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In this issue:

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INFORMATION SYSTEMS EDUCATION JOURNAL

Teaching Case

Ethics and Data Manipulation

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Abstract

According to the cliché, it's not what one says so much as how one says it. In the business world, those words ring particularly true. How one presents information can influence all forms of business decisions, from level of investment to expansion to downsizing and everything in between. This brings up significant questions relating to the manipulation of data and data integrity in general – particularly since the presentation of data is, in effect, the creation of knowledge. It is therefore vital to be able to look at data, its analysis, and its presentation, using an ethical framework. This article presents the students with two scenarios, one focusing on how data is presented and the other focusing on the credibility of the data. In both cases, the "clear" answer is to present the information honestly, but the looming question is "how?" Due to extenuating factors in both cases, students are forced to think about how a seemingly simple decision can have a significant impact on not only a business and its employees, but also the clients, customers, suppliers, and other stakeholders.

Keywords: Ethical Dilemmas, Ethics, Decision-Making, Research, Data

1. INTRODUCTION

When it comes to ethics and ethical dilemmas, only the major issues seem to hit the news – cover-ups, fraud, embezzlement, abuse of power, etc. As a result, other instances, ones that don't make the news, may not always be recognized for the dilemmas that they are.

Ethics is not simply what is *right* or *wrong,* nor is it *good vs. evil.* Binary choices such as those actually cloud the discussion because they risk adding judgment rather than simply seeking the best solution possible. In the cases that follow, the actors are asked to make decisions that relate to the creation of knowledge, where lines should be drawn, and what consequences one has to be willing to accept.

Regardless of the field one is in, how one presents information determines how it is understood by the audience. What is shared, or not shared, impacts the final interpretation. As Mathies (2018, p. 90) notes, "there are multiple contexts and reasons" for how one uses data, and while in one instance the approach is ethical, in another, that same approach would be unethical.

While Mathies' article focused on data use in higher education, the concepts remain the same: those who provide information have a responsibility to provide it clearly, coherently, and completely. Without reliable data, the audience lacks the information to make fully informed decisions or draw accurate conclusions.

In the field of data science, the question on clear information does not just relate to what is written but also to what is shown. In the first case, data visualization is the issue. What happens when the information is presented honestly, but is drawn in such a way that affects the way the audience perceives it?

This leads to the second case, and the second issue: the question of reliable data. How much can one trust studies and their results, and how do deadlines, profits, and reputation affect the decisions one makes regarding the quality of data used?

2. SITUATION 1: GOOD DATA, BAD NEWS

On Monday morning, Lark Lawson, barged into her boss's office without knocking. Edie DeLuca glanced up, saw the stress on Lark's face, and motioned for her to sit down.

"Just tell me what's going on," Edie said. Lark shook her head and handed Edie a stack of printouts.

"I keep running the numbers and nothing is coming out the way that it should. Sales are down but customer satisfaction is up, and production costs are up… everything is wrong. The board is not going to be happy with any of this."

Edie held up a hand. "Let's start over again. What do you mean that everything is wrong?"

As Lark explained, Edie began to understand the new hire's panic.

Lark was looking at everything over the last four quarters, which were less than impressive (figures 1-3). If owners saw these numbers, Edie thought, things could get ugly – layoffs, canceled bonuses, smaller raises. Worse, if investors knew… she smiled at Lark.

"Let me think about this. Did you tell anyone else about the data?" Lark shook her head no. "Good. Keep it that way. If anyone asks, you're still crunching numbers. Got it? Email me everything that you have. I want to look at it."

Edie got to work the minute she received the email. Quarter 2 showed a definite loss in sales, but Quarter 3 had a small uptick, and Quarter 4 had another small improvement. The problem was that the losses outweighed the gains significantly.

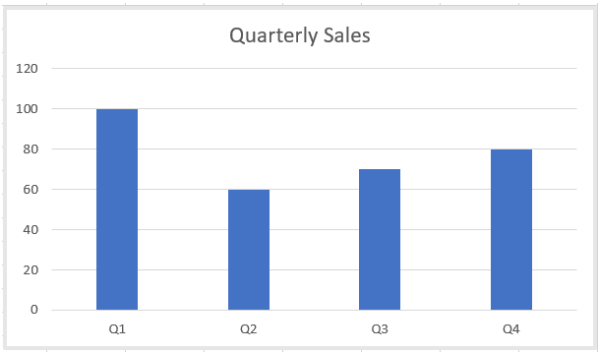

Figure 1: Quarterly Sales

Customer satisfaction, meanwhile, was slowly and steadily increasing. That was definitely a plus because it meant that they were doing something right. It was just a matter of pinpointing what it was and keeping on that track.

Figure 2: Quarterly Customer Satisfaction

Thanks to tariffs that were put in place during Quarter 1, production costs went up significantly. It wasn't pretty, but Edie was relieved to see that they dropped and leveled out by Quarter 3.

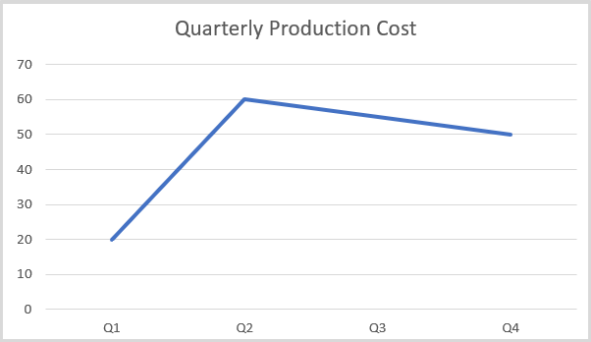

Figure 3: Quarterly Production Costs

If one took the time to think about the data, the numbers really weren't *that* bad, but at first glance, it did appear that the company could be in trouble.

Lark was right to worry, Edie thought. Presenting data from all four quarters would make upper management nervous about the current and the coming year. Hiding it wasn't an option, that would be illegal, but perhaps there was a way to spin it that would make things look better than they actually did.

Presenting the data

Using the data that Lark had provided, Edie created new graphs for the report. She knew that upper management had some initiatives to boost sales in place, and current data from the current quarter suggested that those initiatives were working. She also knew that they were negotiating with new suppliers in effort to bring production costs back down.

She decided that she would present the data in a way that focused on the positive, which would – ideally – keep the owners and the investors happy.

The next day, she sent Lark her changes with a note:

Present all of the data in writing, add the attached information on initiatives to boost sales and reduce production costs that I attached. Be sure to use these new charts in your final report.

When Lark reviewed Edie's charts (figures 4-6), she saw data that presented a moderately successful company that was growing, gaining points in terms of consumer confidence, continually increasing sales, and cleverly reducing production costs.

But when she looked at how Edie manipulated the data, she got more than a little nervous. While the numbers were accurate, they played to the short term and failed to provide a complete story.

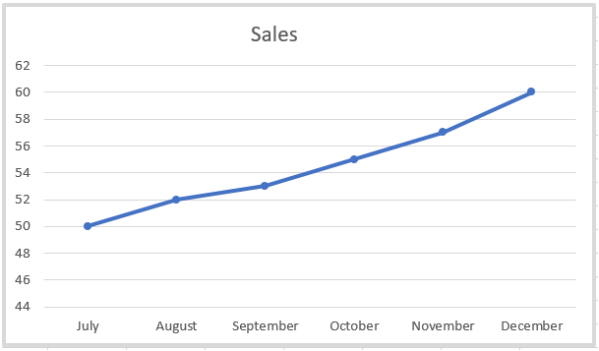

Figure 4: July-August Sales

Figure 5: Q1-Q4 Customer Satisfaction

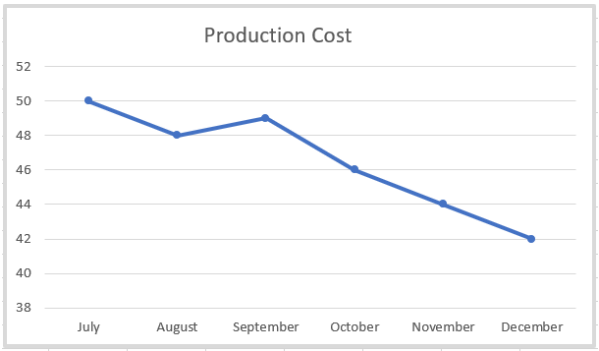

Figure 6: July -August Production Costs

In addition, the only visuals that would be used were ones that painted a rosy picture. Lark knew that most people would look at the charts and graphs and just skim over the written explanation.

She ran up to Edie's office. "We can't use these. The data isn't complete," she blurted out.

"Lark, have a seat and relax. It's not like we're lying about anything. We're providing them with

everything they need to know. It's not our responsibility to make sure that they read it."

Lark shook her head. It had been a while since her intro to management class as an undergrad, but she remembered the chapter on ethics and doing what was right. One didn't have to lie about something to be unethical. To her, these charts omitted significant historical information that management and investors had the right to know.

"I know that the onus is ultimately on the reader, but you have to remember that the reader trusts us to provide all of the pertinent information…"

"I am providing pertinent information," Edie replied, more than a little annoyed at being questioned by someone who was just hired a few months ago. How could someone so new to the company understand what this data meant?

The managers in the C-suite wanted to know that they would make money. They didn't care about the details. If she sent Lark's graphs upstairs, everyone would focus on the first two quarters and how profits were down. No one would read them and say "yes, but things are looking up." No one would ask what was already being done to remedy the downturn. Nope. They would just ask how to cut expenses further – and that usually translated to cutting wages, bonuses, overtime, and jobs.

"We are creating knowledge here, Edie," Lark said. "We are responsible for how people understand these numbers."
Edie shook her head. "Nonsense. We present it. They interpret it. Nothing more. I've been here for fifteen years and, trust me, upper management doesn't want to know what's going wrong. All they want is what's going right. It's our job down here to solve the problems – and we are. As you know, we're changing suppliers, so production costs will continue to go down. We have a few new promotions to boost sales, and even though it's slow, we're going to be fine.

"*But*," she said, leveling her gaze on the young woman before her, "we will *not* be fine if you send them your version of the data. They will want to cut costs – that means jobs, raises, everything. We are on track to get a cost-of-living increase this year, which is the first one in two years. But we might not if they think we can't afford it. If you want to be responsible for that, just let me know."

Lark just sat there, letting Edie's words sink in. She hadn't thought about what the repercussions might be. "Would they really do that?"

"It's hard to say. From my experience, they aren't the type of managers who ask questions and have open dialogues with us. They just make decisions based on what they read."

"So we don't really know what they'll do."

Edie had to concede that point. "We don't. It's wholly possible that they will be okay with the data. But, at the same time, it's impossible to tell."

The decision
That evening, Lark pondered the situation as a whole. She had agreed to use Edie's graphs, but mostly because she was new, and Edie had seniority. The other reason, if she wanted to be honest with herself, was that she was still new and did not want to lose her job due to a bad review when they did her 90-day evaluation. The thought of finding a new job, again, was more than a little disheartening. This was her first "real" job since graduating with her bachelor's degree a year ago, and she was determined to keep it.

Edie's argument made sense – for Lark, the thought of being responsible for cutbacks of any sort was awful. She had made a few friends and knew from some of their remarks that raises had been either minuscule or non-existent these last few years. The fact that everyone was slated to receive at least 3% was welcome news.

What was nagging at Lark was the question as to whether or not the company could afford the raises. What if the low sales and high production costs made raises fiscally irresponsible? Surely Edie took that into consideration. Right?

The questions kept coming. What if the company couldn't afford the raises? While it would be horrible, wouldn't it be better in the long run? Or what if they kept the raises and laid people off instead? But Edie admitted that she didn't know what might happen. What if their worries were for nothing?

Then, just when Lark thought that she had enough to worry about, another idea popped to mind: what if she got in trouble for using Edie's graphs? What if she was blamed for manipulating the data, and they thought that she was trying to cover something up?

The whole thing was a mess, and if she didn't figure out what she believed and act on it, she would end up letting other people make decisions for her.

3. SITUATION 2: BAD DATA, GOOD NEWS

Meanwhile, across town at Research, Inc., Julie Hamilton was dealing with her own issues.

Six months ago, MultiCorp contracted with Research, Inc., to conduct extensive studies that would be used to guide a massive re-imaging starting next year. It was the largest undertaking the small research company had ever attempted, meaning that the pressure was on to not only succeed but to surpass all expectations.

The owner, Gil Hart, put Julie in charge and gave her more freedom than ever. "You're the expert when it comes to surveys," he said. "You have that knack for asking just the right questions, and your analysis is always spot on. Get a team of two or three together and work directly with Pat from MultiCorp. I'm going to step back and let you run with it. Just keep me in the loop."

And now it was Monday and MultiCorp expected a presentation on Wednesday, but thanks to this morning, it was wholly possible that the presentation would be the worst moment of her career.

For whatever reason, as she gave everything a final review, Julie decided to check the survey one last time. Rather than log in through her desktop, where she had several windows open already, she grabbed her phone and opened the survey.

It opened with no problem, but as Julie clicked through the questions, she realized that half of the images were missing from the options the respondents were to choose from. Trying not to panic, she pulled the survey up on her desktop, where it opened without issue. Relieved, she decided that it was her phone and that the issue was probably slow load time. Sighing in relief, she returned to the presentation.

When she reached a discussion on methodology, it clicked. Her phone defaulted to Chrome. Her desktop used Firefox. Hoping that she was wrong, she opened Chrome on her desktop. Then she opened the survey.

Half of the images were missing.

An hour later, Julie was sure that her career was over. Though she wasn't sure how, she'd certainly never forgotten before, she had neglected to verify the survey's compatibility with Chrome. As a result, she had no idea how many of the 4,573 responses were valid because she had no idea how many respondents had taken the survey using Chrome.

While she was tried to figure out how to manage the situation, Gil came in. "Working on the final presentation?"

Julie nodded. "Just making sure everything is in order." She would have to tell him, but right now wasn't the time. She needed to come up with solutions first.

"You said that the last survey just reinforced everything we already knew, right?"

She nodded again, wishing he'd leave so that she wouldn't have to discuss what she'd said or how fantastic the response rates were. She just wanted to close the door and hide from the world while she figured a way out of this debacle. Perhaps if she looked busy… Julie began shuffling papers on her desk. "I need to make sure that everything is, um, perfect."

Gil took the hint. "I'll let you get back to work."

She flashed him a smile that, she hoped, radiated confidence. "Okay. Hey, can you shut the door on your way out? Thanks!"

As soon as the door clicked shut, she buried her head in her hands, dreading the moment where she would have to tell him the truth – the last survey didn't reinforce anything. All it did was prove that his trust in her was misplaced and that the last three months had been a complete waste of time. She didn't even want to think about how much money had been spent developing and deploying the now-useless study.

Then again, who said he needed to know? She studied the numbers again. The results were

overwhelmingly in support of everything that they already knew. It was possible, she reasoned as she flipped through the other studies and their results, that the glitch didn't have a significant impact on the results at all.

Perhaps the participants would have answered the same way regardless. If that was the case, why bother telling Gil or Pat or anyone? After all, she was the only person who knew. No one on her team had discovered the problem, and had it not been for her using her phone this morning, she would never know either.

Then again, what if the missing images did skew the results and people chose answers that they would not have chosen otherwise?

Julie remembered how one of her colleagues would always stress dependability and validity. "We need to make sure that our methods are consistent. We need to make sure that we get the truth. You can't get good data if you have sloppy methods."

There was nothing dependable or valid about a survey that was missing questions. But, again, Julie reasoned, if the results are the same, it doesn't matter. The client wanted results, not methods.

Gil wanted results, too. He wanted a satisfied customer. More specifically, he wanted MultiCorp as a permanent customer. A company that large would need studies done on a regular basis, which would make it far easier for Gil to continue to keep Research, Inc., out of the red. This contract, he had said more than once, was the company's golden ticket. Once other companies knew that MultiCorp used Research, Inc., it wouldn't be long until they, too, signed on.

Then again, things were just fine before MultiCorp. Gil was showing a steady profit. It wasn't like they were on the verge of closing down.

Maybe this would be easier if Gil wasn't such a nice guy. He didn't deserve to be lied to or let down. She wanted to talk to him, to get his perspective, but still wasn't quite ready to actually talk about the problem. Besides, she wasn't sure what would be worse – his firing her or his telling her to do something unethical.

If she didn't admit to anything, and presented everything as legitimate, she would be lying. That didn't sit well with her. But given the consequences of telling the truth, would it be worth it in the long run?

4. POST-CASE DISCUSSION

According to Valasquez, Andre, Shanks, Meyer, and Meyer (2010), *ethics* can be defined a "well-founded standards of right and wrong that prescribe what humans ought to do, usually in terms of rights, obligations, benefits to society, fairness, or specific virtues."

This is a fairly basic definition, and it hits on all of the main points of the concept. Using this definition as a starting point, one wants to look at the cases presented and consider what standards are coming into question. For those just learning about ethics or who simply need a refresher, consider viewing the two *Crash Course* videos listed in the Further Reading section of this paper.

Utilitarianism looks at the consequences of one's actions and is often summed up as choosing the greatest good for the greatest amount of people; meanwhile, deontology is about universal rights and intention, and can sometimes be summarized with the Golden Rule: do unto others as you would have done unto you.

A caution though: the "greater good" needs to go beyond what is best financially. Simply looking at the "greater good" can actually create "conflicts with the direct obligation to not harm the person" (Fairfield & Shtein, 2014).

With deontology, one might argue that the intentions of the actor are most important, but the decision makes needs to consider universal rights as well. These rights are similar to those espoused by the Josephson Institute (Appendix A) for ethical business behavior. Rights such as *loyalty, fairness,* and *accountability* are important in these two cases. The challenge here is determining which right to value.

With both theories, it is vital that the one considers the stakeholders – and that means thinking beyond the company and the customers. Primary stakeholders are those immediately affected, e.g. employees, customers, vendors, and management. Secondary stakeholders are also affected, but

the impact is either less or not as immediate, e.g. employees' families and businesses in the immediate vicinity that profit from the company's presence. While it is impossible to take all stakeholders into consideration, one wants to think about as many as possible prior to making the final decision.

In the two cases, the actors are faced with decisions regarding data and how they will use it. On one hand, one can argue that these are almost non-issues because the actors need to just do whatever is considered the "right thing" by whatever standards of behavior already exist. Most companies have codes of ethics or standards of behavior. Depending on what is in place, these issues may actually be non-issues, as existing policies will guide ethical behavior and eliminate the need for discussion (Hudson, 2017).

On the other hand, one can look at the potential fallout from the assumed "right thing" and wonder if there might be more than one way to approach a decision. When it comes to data, there is a myriad of ways to report it, many of which are wholly ethical.

Erroneous results are more common than we might think. According to *The STM Report*, in 2014 "around 1-2% of scientists admit to having fabricated, falsified or modified data or results at least once" (Ware & Mabe, 2015, p. 73). If there were four million authors in 2014, over 40,000+ have, at least once, used faulty data (Dunie, 2017). While there are differences in terms of the types of research and their purposes, the one constant that remains is the need to produce; and it is this need that can drive someone to falsify, manipulate, or outright lie about data.

It is important to remember that one is not just the gathering and providing information. It is the actual creation of knowledge. As a result, reporters of data are "unconditionally responsible" for the resulting knowledge (O'Leary, 2004, p. 50). How one understands data can, and is, influenced by how it is presented. In both cases, how the actors chose to move forward will impact the businesses they work for, their careers, their colleagues, and a number of other stakeholders.

This is not hyperbole. How one presents data, regardless of whether it relates to financial performance, consumer preference, or any other topic on which information is collected and analyzed, determines the way in which the receiver understands it.

The questions below will help guide your analysis and strengthen your critical thinking skills.

5. DISCUSSION QUESTIONS

1. When it comes to ethical dilemmas, one of the first steps we need to take is to identify the actual dilemma. What is the ethical dilemma faced Lark? By Julie? Why are these dilemmas?
2. The most logical response to both cases would be "just tell the truth." The problem is that neither case is black and white. What new problems will be created by telling the truth?
3. When making a decision, you want to keep stakeholders in mind. Who are the stakeholders in each case? Who will be affected by the decisions that each person makes and how does that affect your decision-making process?
4. When it comes to making decisions, one of the final steps is the "gut check," where you ask yourself exactly how you feel about the decision you are about to make. What does your gut tell you for each case?
5. Consider the theory of utilitarianism.
    a. How would a utilitarian, which looks at maximizing benefits for the whole, approach the situation from Lark's point of view? What about from Edie's point of view?
    b. In Julie's case, what is the greater good and would not mentioning the glitch ever be an option? Why or why not?
6. Deontology is the ethical theory that looks at universal rights such as *justice, fairness,* and *honesty.* Is Edie violating these rights when she provides visuals that highlight the company's successes and downplays its setbacks?
7. Part of deontology is Kant's *Categorical Imperative* which advises that we should act as if our actions were to become law, meaning that if we can do something, so can everyone else. How would this imperative affect Lark's and Julie's decisions? Why?

8. Consider the field that you are studying to enter. When might you find yourself facing situations such as these? What would you do? What are the possible consequences of such a decision?
9. Consider each case using Rawl's Veil of Ignorance. How does not knowing who is involved affect your decision?
10. For this last question, consider the opposite point of view – why might it be a *good* idea to manipulate data or hide the fact that the results may be corrupt?

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Editor's Note:

This paper was selected for inclusion in the journal as the EDSIGCON 2019 Best Teaching Case This is based on blind reviews from six or more peers including three or more former best papers authors who did not submit a paper in 2019.

Appendix A

12 Ethical Principles for Business Executives from the Josephson Institute

1. HONESTY. Ethical executives are honest and truthful in all their dealings and they do not deliberately mislead or deceive others by misrepresentations, overstatements, partial truths, selective omissions, or any other means.

2. INTEGRITY. Ethical executives demonstrate personal integrity and the courage of their convictions by doing what they think is right even when there is great pressure to do otherwise; they are principled, honorable and upright; they will fight for their beliefs. They will not sacrifice principle for expediency, be hypocritical, or unscrupulous.

3. PROMISE-KEEPING & TRUSTWORTHINESS. Ethical executives are worthy of trust. They are candid and forthcoming in supplying relevant information and correcting misapprehensions of fact, and they make every reasonable effort to fulfill the letter and spirit of their promises and commitments. They do not interpret agreements in an unreasonably technical or legalistic manner in order to rationalize non-compliance or create justifications for escaping their commitments.

4. LOYALTY. Ethical executives are worthy of trust, demonstrate fidelity and loyalty to persons and institutions by friendship in adversity, support and devotion to duty; they do not use or disclose information learned in confidence for personal advantage. They safeguard the ability to make independent professional judgments by scrupulously avoiding undue influences and conflicts of interest. They are loyal to their companies and colleagues and if they decide to accept other employment, they provide reasonable notice, respect the proprietary information of their former employer, and refuse to engage in any activities that take undue advantage of their previous positions.

5. FAIRNESS. Ethical executives and fair and just in all dealings; they do not exercise power arbitrarily, and do not use overreaching nor indecent means to gain or maintain any advantage nor take undue advantage of another's mistakes or difficulties. Fair persons manifest a commitment to justice, the equal treatment of individuals, tolerance for and acceptance of diversity, the they are open-minded; they are willing to admit they are wrong and, where appropriate, change their positions and beliefs.

6. CONCERN FOR OTHERS. Ethical executives are caring, compassionate, benevolent and kind; they like the Golden Rule, help those in need, and seek to accomplish their business objectives in a manner that causes the least harm and the greatest positive good.

7. RESPECT FOR OTHERS. Ethical executives demonstrate respect for the human dignity, autonomy, privacy, rights, and interests of all those who have a stake in their decisions; they are courteous and treat all people with equal respect and dignity regardless of sex, race or national origin.

8. LAW ABIDING. Ethical executives abide by laws, rules and regulations relating to their business activities.

9. COMMITMENT TO EXCELLENCE. Ethical executives pursue excellence in performing their duties, are well informed and prepared, and constantly endeavor to increase their proficiency in all areas of responsibility.

10. LEADERSHIP. Ethical executives are conscious of the responsibilities and opportunities of their position of leadership and seek to be positive ethical role models by their own conduct and by helping to create an environment in which principled reasoning and ethical decision making are highly prized.

11. REPUTATION AND MORALE. Ethical executives seek to protect and build the company's good reputation and the morale of its employees by engaging in no conduct that might undermine respect and by taking whatever actions are necessary to correct or prevent inappropriate conduct of others.

12. ACCOUNTABILITY. Ethical executives acknowledge and accept personal accountability for the ethical quality of their decisions and omissions to themselves, their colleagues, their companies, and their communities.

Teaching Case

Styles by Ashley: A System Design and Development Case

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Abstract

Ashley Baker was fed up and ready to strike out on her own and cut her own path. New salon policies aimed to eat away at her profits were forcing her to start her own business. As Ashley and her husband refurbished a downtown storefront to house her shop, she starts planning for the operational side of her new venture. Ashley is in search of an affordable salon customer management system. She solicits the help of one of her clients in exchange for hair services. The case provides a realistic scenario that can be used in a systems analysis and design, database development or graduate level management information systems course. The case focuses upon the development of a hair salon customer management system to sell products and services. Multiple assignment options are provided allowing instructors to select an assignment based upon course material coverage. Suggested assignments include the development of process modeling diagrams such as data flow and swim lane diagrams, a request for proposal for an existing system and a response to the request for proposal, and database design and development artifacts.

Keywords: Teaching Case, Process Design, Swimlane Diagrams, Database Design, RFP

1. INTRODUCTION

Over the past ten years, Ashley Baker had developed quite the reputation in her small town of Whispering Hills, Missouri for her ability to style hair. She was an accomplished hair stylist at Lavish Locks Hair Salon and had developed an extensive following of loyal clients. Ashley's appointment book rarely had an opening and she occasionally lost prospective clients to other stylists due to her fully booked schedule.

A rumor had been floating around the salon that Bev, the salon owner, wanted to deduct another usage fee from the stylists' commission percentage. Another rumor indicated that an additional fee would be charged to stylists unable to accept walk-in customers, as such a problem stifled growth. Ashley felt that the commission rate was already pretty low and hated the thought of being penalized for building her business. Her husband, Steve, had suggested that she strike out on her own; but she had quickly dismissed the idea as "crazy." With each passing day, the idea looked a little less crazy.

With Steve's support, Ashley found a small storefront in the trendy downtown area of Whispering Hills and set about opening her own shop. Together, they renovated the building at night so she could maintain her steady income during the day and keep her clientele. It would soon be time to strike out on her own. Thus, she needed to start focusing her attention on the business side of operations.

Lavish Locks had a fairly extensive system in place for managing customer data, setting up appointments, sending out appointment

reminders and handling payments. However, she knew she couldn't afford such an elaborate set-up. She had heard that there were affordable programs available for small businesses like hers; but she wasn't sure which one would provide "the biggest bang for her buck." She now had a new issue to keep her up at night.

2. HELP IS ON THE WAY

Monday morning rolled around and Ashley had a five-minute break between customers at Lavish Locks. Her mind wandered to the nagging prospect of finding an acceptable system and getting her client data transferred into it. A friend had told her to download the data as a csv file, but she wasn't really sure what to do from there.

A soft ding from her phone brought her thoughts back to the present. Her next appointment, Connie, had just sent her a text to let her know she would be a few minutes late. That was enough time to pull up Connie's client profile and review her notes.

The profile screen was fairly detailed. Connie's profile included a picture of her hair from the last appointment, a description of what she wanted done during her current appointment, a detailed description of how her hair had been most recently cut and styled, a link to a history of the descriptions of her previous appointments and a brief biographical sketch. The notes in Connie's biography indicated that she was employed as a systems analyst and was working part-time on getting her MBA. Ashley wondered if Connie might have some ideas for finding an affordable appointment system to help her business get started.

3. THE APPOINTMENT

After Connie had caught Ashley up on the latest developments in her life, Ashley brought up the subject of her future business endeavors and the need for an affordable customer management system. "Connie, in your business courses at the university, have you heard of any software that can be used as an appointment scheduling system?"

"I know that there are some programs out there to make the process easier, but the only one with which I am familiar is the one that Square offers. Unfortunately, I have not personally used it. I am sure there are other choices available, but I don't know what features they offer or their prices," Connie noted.

"I honestly don't know where to start or how to compare programs. I should have started looking months ago, but I let other things take priority. Connie, I know that you work with new systems all of the time. Do you have any recommendations for getting started? Or, better yet, would you have time soon to come over and help me find the best program? I could add free highlights to your hair while we worked." Ashley added.

"I know you are pretty busy putting the finishing touches on your new business. What if I see what I can find for you when I get home and you can highlight my hair when I bring you the results?" Connie offered.

"That would be great! Thank you so much, Connie! Do you think there might be an affordable system that also offers the ability to monitor inventory?" Ashley asked.

"I'm guessing that a scheduling system like that might manage storefront inventory; but it may not manage back office products that you would use during client visits. It may also be somewhat limited to the amount of information that it collects regarding individual client preferences and history; but I'm not sure. I'll have to look into that for you too. If an affordable off-the-shelf system does not, I could create an additional small database for you to monitor inventory and to maintain information on your clients. We're supposed to come up with a project for my information systems class at the university. We could kill two birds with one stone," Connie suggested.

"Connie, that would be outstanding. Thank you for the offer! I don't have the time right now to look into the software, nor the finances to buy an elaborate system. Steve and I have been investing all of our excess cash into renovating the new shop, 'Styles by Ashley'," Ashley beamed. "But, we could work out a payment plan in haircuts, colorings and other salon services. What do you think?"

"I'm all for that!" Connie exclaimed. "Why don't you give me a description of the processes associated with a hair salon business and what your dream front and back office systems would be able to do. That will give me some ideas of what you would like for me to try to find for you," Connie offered.

"Steve and I will work on it over the next few days. Can you come in Saturday morning for a color refresh and a chat?" Ashley asked.
"Perfect! Connie exclaimed. "I'll see you then."

4. SALON PROCESSES

When Saturday rolled around and Connie arrived for her appointment, Ashley was ready. "Hi Connie. Thanks again for helping me. Let's get you settled in a chair and I'll tell you my line of thinking. Steve and I have put a lot of thought into what processes we would like the system to support and what we would like it to do. If you could find something affordable that offers similar capabilities to what Lavish Locks' system has, that would be fantastic! Let me tell you about their system.

The system contains information about clients, stylists, appointment schedules, products and inventory. When a new client makes an initial appointment, she completes a form providing a little background about herself as well as her phone number, address, email address and preferred mode of contact. Each time the client visits, history is recorded in the system about that client's visit.

Stylists enter their schedules each week into the Lavish Locks' system. This allows the receptionist to schedule appointments as well as the clients to log in through the web site to schedule their own appointments. Two days before the date of the appointment, the system sends out a text or an email to the client to remind her of the upcoming appointment and to give the client an opportunity to reschedule if plans have changed. On the morning of the appointment, another text or email is sent to the client to serve as a reminder of the upcoming appointment.

At the beginning of the workday, the hair stylist receives a summary report of the appointments she has scheduled for the day. This report gives the clients' names, appointment times, latest haircut pictures, brief description of what clients' want done and a brief bio of the clients. About five minutes before the client arrives, the stylist receives a reminder on her phone about the client coming for the next appointment.

Once the appointment is finished, the stylist updates the customer's record, on her phone, with a description of the services that were performed. If the client allows, a picture of their hair is taken to upload for future reference.

The customer pays the receptionist as she leaves and receives a receipt for the services performed. At that time, the client is asked about scheduling another appointment and reminded that she can do that online if she prefers.

The web site is also connected to an online database of inventory that is offered for sale in the store. Customers are able to purchase those items during their visit to the store or online. The online system accepts debit/credit and PayPal payments.

Stylists operate as independent contractors and purchase store products at cost for use during customer visits. However, an inventory is maintained of products that are not for sale over the counter such as hair color, permanent solutions, curl activators, straightening products, wax, etc. These items are charged to the stylist along with the in-store products that are purchased. The system bills each stylist at the end of the month for booth rental as well as for the products that they used. The total cost of items used comes directly out of the stylists' income each month.

The receptionist uses the system to print reports each month such as inventory levels and purchases, total sales generated in the salon, income earned by each stylist, total products purchased by stylists and customers, and total appointments provided by each stylist. Bev, the owner, receives all of the reports, but copies of the individual stylists' reports are shared with each stylist. The company books are kept in a separate accounting software, I think, QuickBooks. I plan to do the same thing."

"That sounds like a good plan. Do you think it would be possible to see some of the reports that the system generates so I can see what kind of data is collected? Also, can any of the data in the system be downloaded in a file?" Connie asked. "Also, what kind of computer hardware will you be using in the shop to access the system?"

"Sure. I can get copies of reports for you. I also have a csv file of my customer list that I can show you too," Ashley added. "I'm not really sure what all I can do with that file. I don't have any technology purchased yet. All that I need right now is a point-of-sale system and a laptop or tablet that can connect to the Internet. My dream is to rent out booth space to multiple stylists and to provide each of them with a tablet

as well. The shop has space for three more booths."

"Let me see what systems are currently available and how much they will cost. I can also give you a cost estimate on the hardware you will need to purchase as well. I'll try to get that for you next week," Connie remarked.

"Why don't you come in next Saturday and I'll add some highlights to your hair. We can discuss it then," Ashley said as she handed Connie a mirror to inspect her new hair color.

"I started looking at salon management systems this week," Connie offered. "From what you have described, I think I can find some online systems to suggest. We can look at them next week. I'll also have some suggestions for hardware to use. The reports the Lavish Locks system produces will come in handy as we discuss my suggestions as well."

"I can't wait to see what you have for me next week!" Ashley exclaimed as she walked Connie to the door and picked up her phone to enter next week's appointment.

APPENDICES

Customer Profile Example

PROFILE

Amber has a natural curl to her hair. She likes to keep her hair about shoulder length.

She usually runs a bit late as she often comes from taking her children to school.

CONTACT

PHONE:
573-555-1212

EMAIL:
Amber@emailexample.com

PERSONAL

Husband: Robert
Son: Bobby
Daughter: Alley

AMBER Smith

Appt: 6/2/19 @ 9:00 a.m.

LAST APPOINTMENT

Wash, cut and style
Had a little cut off the ends

Would like to try something new at next appointment; but does not know what. Need to find style examples to show her.

APPOINTMENT HISTORY

6/2/2019: Wash, cut and style
5/2/2019: Highlight, wash, cut and style
4/2/2019: Wash, cut and style
3/3/2019: Dry cut

HOBBIES

Photography
Cycling

Client Invoice Example

Invoice No. 19510 6/2/2019

Amber Smith
100 Pine Bluff
Whispering Hills, MO 63101

Quantity	Resource Description	Unit Price	Total
1	Wash, cut and style	$45	$45
1	Organic shampoo	$15	15
1	Organic conditioner	$12	12
	Subtotal		$72.00
	Taxes (8%)		5.76
	Total		$77.76
	Tip		
	Total		

Thank you for your business. We look forward to seeing you again.

Hair Stylist Daily Appointment List

Ashley Baker's Daily Appointments

Date: 6/01/2019

	Client ID #	Time	Name	Appt. Description	Price
1	AB18151	9:00 a.m.	Amber Smith	Wash, haircut, style	$45
2	AB18025	10:00 a.m.	James Adams	Wash & haircut	$35
3	AB18152	10:30 a.m.	Betty Smith	Wash, haircut, color, style	$155
4	AB18056	1:00 p.m.	Lisa Martin	Wash, cut & highlights	$85
5	AB18098	2:00 p.m.	Susie Martin	Wash, cut and perm	$145
6	AB18024	3:00 p.m.	Tony Adams	Dry cut	$25
7	AB18066	4:00 p.m.	Jane Wilson	Wash, cut, color	$135
8					

Lavish Locks Monthly Stylist Income/Expense Report Example

Styliest Income/Expense Report May 2019

Ashley Baker

Quantity	Resource Description	Unit Price	Subtotal	Cost	Total
Income					
30	Wash, cut and style	$45	$1,350		$1,350
25	Wash and haircut	$35	$875		875
20	Dry Cuts	$25	$500		500
15	Highlights	$50	$750		750
20	Coloring	$110	$2,200		2,200
7	Organic shampoo sold	$15	$105		105
5	Organic conditioner sold	$12	$60		60
	Tips		$750		750
...	...	...	...		
Expenses					
3	Organic shampoo	$8		$24	$24
2	Organic conditioner	7		$14	14
1	Monthly booth rental	$250		$250	250
	No new customer generation	$25		25	25
5	Hair Spray	$8		40	40
	Income				$6590
	Expenses				353
	Subtotal				$6237
	Total Revenue				**$6237**

Teaching Case

Software Business Models

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Abstract

This case describes a classroom activity that explores a fictional software product company to help students learn about ways that businesses make money from software, including Free & Open Source Software (FOSS). The activity shows how a company might evolve through different business models, but does not imply that some models are always better than others. Each section of the activity develops specific concepts, so an instructor could choose desired sections. The activity is designed for Process Oriented Guided Inquiry Learning (POGIL), an evidence-based approach to teaching and learning in which student work together in teams to understand key concepts and develop skills such as teamwork, communication, and critical thinking. This case includes relevant background on software business models, FOSS, and POGIL; teaching notes for the case; and the student version in an appendix.

Keywords: business models, case study, open source, POGIL, Process Oriented Guided Inquiry Learning

1. INTRODUCTION

This case describes a classroom activity that explores a case study of a (fictional) software product company to learn about ways to make money from software, including *Free & Open Source Software (FOSS)*. The case study shows how a company might evolve through different business models, but it does not try to imply that some models are always better than others.

This activity is designed for *Process Oriented Guided Inquiry Learning (POGIL)*, and thus the structure differs from a traditional case. As described below, in a POGIL classroom, student teams work together with active facilitation by an instructor. Thus, this case might be less effective if used in other ways, including as an individual activity or homework.

The rest of this paper is organized as follows. Section 2 presents background on software business models, FOSS, and POGIL. Section 3 describes the case in more detail. Section 4 presents conclusions and future directions. Appendix A contains the full student version; an expanded teacher version is available on request.

2. BACKGROUND

Software Business Models

Students might have personal experience with a few business models, but a much broader range of models are possible and might be viable in different contexts. Thus, this activity also seeks to help students understand a variety of models.

Conceptually, every business model has three components (Popp, 2011): first, the type of product or service, such as physical goods, intangible goods, or human services; second, the pattern of business, such as creation, distribution, or leasing; and third, how the business gets income, such as payments from users or advertisers.

Cusumano (2008) describes how businesses often shift between product models and service models, and some of the associated challenges. Popp (2011) describes models that are common

and emerging in software, using a 4x4 grid based on four patterns of doing business (e.g., creator, broker) and four types of goods or services (e.g., financial, physical).

Free & Open Source Software

FOSS is freely available for anyone to use, modify, and share with others. Popular examples include Audacity (audio editing), Drupal (web site content management), Firefox, GIMP (image editing), LibreOffice, Linux, and WordPress.

FOSS might seem incompatible with a for-profit business, but in fact many people and companies use, contribute to, and make money from FOSS. Researchers have studied the motivations for using and contributing to FOSS by developers and businesses (e.g., Benkler, 2005; Ghosh, 2005; Roberts, Hann, & Slaughter, 2006; Gonzalez-Barahona, Izquierdo-Cortazar, Maffulli, & Robles, 2013). Hecker (1999) describes some of the motivations and challenges for businesses focused on FOSS. Lindman, Rossi, & Puustell (2011) discuss issues when matching software licenses to business models. Riepula (2011) describes *client-shared source*, which combines elements of FOSS and proprietary software.

FOSS also provide opportunities for students to learn about large-scale software development practices and develop skills by participating in and contributing to FOSS communities. An active community develops and shared resources to support such work (e.g., http://foss2serve.org, http://teachingopensource.org).

Process Oriented Guided Inquiry Learning

POGIL is an evidence-based approach to teaching and learning in which collaborative student teams work in the classroom on activities that are specifically designed to help them develop their own understanding of key concepts and to develop skills such as teamwork, communication, information process, critical thinking, and problem solving. Much more detail is available (e.g., Moog & Spencer, 2008; Simonson, 2019).

A POGIL activity contains a series of *models* (e.g., graphs, diagrams, pictures) with *critical thinking questions* that guide teams through *explore-invent-apply learning cycles* to *explore* the model, *invent* their own understanding of key concepts, and then *apply* that understanding in other contexts. Some questions quickly direct student attention and build confidence, some guide student thinking, and some are open-ended to promote discussion (Kussmaul & Sullivan, 2019).

For example, in this case, the POGIL models include short descriptions of the business, reports from the three directors, and lists of options for key decisions. In other POGIL activities for business topics, models could include balance sheets or other financial statements, data tables or graphs, business process flowcharts, etc.

In POGIL, teams usually stay together for weeks or longer. Each member has an assigned role that rotates daily so all students have all roles. For example, the *manager* tracks time and helps all team members to participate; the *recorder* takes notes for the team, and the *presenter* interacts with other teams and the instructor.

The instructor is not a lecturer, but an active facilitator, who observes and listens as teams work, offers suggestions, addresses problems, and moderates class discussions. For example, the instructor might ask a few teams to have their presenter report their answer to a question, to highlight key concepts and ensure that all teams are on the right track; this is called *reporting out*. If the instructor notices that multiple teams are struggling, she or he might stop the class to answer questions or clarify misconceptions.

POGIL was first developed around 20 years ago in college chemistry, and is now used in high schools and colleges, across STEM disciplines, and even in non-STEM disciplines. POGIL has been used in computing disciplines for around 10 years, and a variety of materials are available (see http://cspogil.org). Management faculty have used elements of POGIL with traditional cases (Kode & Cherukuri, 2014).

Numerous research studies have shown that POGIL enhances student outcomes, including engagement and content knowledge (e.g., Hanson, 2006; Hu, Kussmaul, Knaeble, Mayfield, & Yadav, 2016; Lo & Mendez, 2019). This is consistent with the *ICAP framework* (Chi & Wylie, 2014) which describes how student outcomes improve as learning progresses from *passive* to *active* to *constructive* to *interactive*.

The POGIL Project (http://pogil.org) promotes POGIL, offers faculty development workshops, and reviews and distributes POGIL activities. It is recognized as an exemplar *community of transformation* for STEM education (Kezar, Gehrke, & Bernstein-Sierra, 2018).

3. TEACHING CASE

This case could be used or adapted in a variety of settings, since it has minimal prerequisites and defines most unfamiliar terms as they are used. It was originally designed for intermediate to advanced courses on software engineering or FOSS development, offered in computer science (CS) or software engineering (SE) programs. However, since the case focuses on general concepts, not specific technical details, it could be used for courses in information systems, information technology, business, management, or entrepreneurship.

Structure
The activity follows *ABLE Software, LLC*, a fictional software company that develops and sells the *Advanced Business Logistics System*. ABLE is run by three directors, each overseeing part of the business. The activity is divided into sections; most describe a situation and options for the directors to consider.

The activity begins with a general overview, and a table to assign a POGIL role to each student. In most sections, one model describes recent events, and each director's key concerns. Questions prompt the students to explore each model, notice useful information, and start to develop key ideas. Typically, another model describes a set of options for the business. Questions prompt the students to explore and evaluate these options to develop (invent) understanding of key concepts, and then choose the one option they would recommend. Often, a section ends with optional, open-ended questions to apply new ideas and explore other options.

For example, section A focuses on the basic structure of the business. In questions 1 and 5, students explore models and notice specific facts. In questions 2, 3, 6, 8, and 9, students build on the models to invent new ideas. In questions 4, 7, and 10, students express these ideas in their own words. In questions 11 and 12, students apply these ideas to develop recommendations. Thus, section A uses the *explore-invent-apply* learning cycles that are a key feature of POGIL.

Learning Objectives
After this activity, students should be able to:

- Explain and give examples of different software business models (see below).
- Describe & compare the pros & cons of each model.
- Evaluate a business opportunity or FOSS project to identify and evaluate potential business models.

After each section (e.g., A, B, …), students should be able to:

A. Describe one-time license models and their pros and cons.
B. Describe yearly or upgrade-based license models and their pros and cons.
C. Define & contrast internationalization and localization.
D. Describe cooperative competition (coopetition) and its pros and cons.
E. Describe Free and Open Source Software (FOSS) and dual or multi-license models, and their pros and cons.
F. Describe dual or multi-license models and their pros and cons.

Before Class
Before using this activity, the instructor should read through it, review the learning objectives for each section, and decide how much class time to allocate, which sections to complete, and what changes (if any) to make to the activity. Note that omitting "easy" questions can actually take more time, since these questions are often designed to help students notice things that will help them answer later, more difficult questions.

The instructor should identify any terms used in the activity that are likely to be unfamiliar to most students, and decide how to clarify them – perhaps at the start of the activity, or just before teams start to work on that section. The instructor should also decide how to introduce the case and each section; for example, she or he might give a mini-lecture at the start of the activity, and only say a few words before each section. Finally, the instructor should decide when and how to have students report out. To save time, most instructors only report out questions where teams disagree or that involve key concepts.

If the class has never used POGIL, the instructor also needs to decide if and how to introduce POGIL concepts and practices such as teams, roles, and reporting out. For example, the instructor might choose to ignore roles since it often takes multiple activities before students really appreciate the roles and their value.

Note that most POGIL activities are designed to be students' first introduction to new ideas, and do not expect students to do reading or other preparation, which can lead to misperceptions. Instead, most POGIL instructors assign reading

after the activity, to reinforce and expand what students learned in class.

During Class

The activity includes several icons that act as cues for students and teachers; these or similar icons are common in POGIL activities. For a *key question* (), students should take particularly care with their answer, e.g., to define a term or explain a concept; these are often questions where the class will report out. For an *optional question* (), the instructor might decide in advance which students should answer, or might instruct students to answer if they are ahead of schedule and skip it if they are behind. A *pause* () prompts teams to check with the instructor, who might check their answers. A *stop* () prompts teams to stop work and wait for instructions from the instructor.

After Class

The instructor also needs to decide what should happen after the activity. Options include:

- Give a short quiz in the next class to encourage all students to engage in the activity and review key ideas.
- Have teams or individual students answer some optional questions that weren't answered during class.
- Have each recorder submit a final version of the team's answers.
- Have some or all team members submit short reflections on the experience.
- Assign related readings from a textbook or the literature. (An expanded set of references are in the teacher's version of the activity, available on request). Students often find readings easier and more informative when they have already developed key concepts in the activity.
- Assign homework or projects that expand on the activity or apply key concepts. For example, an assignment might describe a different company and ask students to explain which models are most relevant.

4. CONCLUSIONS

This paper has described a non-traditional case study activity designed for POGIL, and suggested ways that the activity could be used and adapted depending on the instructor and course.

In the future, this activity could be enhanced in a variety of ways, such as:

- Sets of sample quiz questions, homework assignments, and projects that build on this activity and the concepts it develops.
- Questions and assignments based on specific supplemental readings.
- Longer, more detailed descriptions of the case, and the situations and options in individual sections; students could read these materials before the classroom activity, or review them afterwards.

The activity is already too long to finish in a typical class period, but it could be expanded with sections that the instructor could select from, or spread over multiple class periods. Additional sections might explore:

- Multiple customer segments with varied needs and constraints.
- A system architecture diagram where ABLE must decide when to use FOSS, commercial software, or their own code.
- Other business models, such as ad-supported software, software-as-a-service (SaaS), and crowd funding.
- Other scenarios (e.g., for a different business) and prompt students to apply when they are learning.
- The research literature on business models, FOSS, and related topics. For example, fit the case into the frameworks from Cusumano (2008) or Popp (2011).

Note: Instructors interested in using this case should contact the author (clif@kussmaul.org) for a teacher version of the activity, with sample answers, typical timings, suggesting discussion prompts, and other information.

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Appendix A: Student Activity

Software Business Models	start time:

This activity explores a case study of a (fictional) software product company to learn about ways to make money from software, including Free & Open Source Software (FOSS). The case study shows how a company might evolve through different models, it does not try to imply that some models are always better than others.

Before you start, complete the form below to assign a role to each member.
If you have 3 people, combine Speaker & Reflector.

Team	**Date**
Team Roles	**Team Member**
Recorder: records all answers & questions, and provides copies to team & facilitator.	
Speaker: talks to facilitator and other teams.	
Manager: keeps track of time and makes sure everyone contributes appropriately.	
Reflector: considers how the team could work and learn more effectively.	

This activity uses several icons to highlight key places:

- is a **key** question; you should have a good answer that everyone understands.
- is an **optional** question; you may safely skip it if you are behind schedule.
- is a **pause**; check with the instructor before you continue.
- is a **stop**; wait for other teams to catch up before you continue.

Reminders:

- *Recorder: Note the time whenever your team starts a new section or question.*
- *Write legibly & neatly so that everyone can read & understand your responses.*

A. ABLE Software, LLC	start time:

After over a year of development, **ABLE Software, LLC**, releases version 1.0 of the **Advanced Business Logistics Environment (ABLE)**, a software system that provides one central view of many parts of a business. To do this, ABLE has modules that connects to other business systems, such as accounting, customer relationship management (CRM), and human resources (HR). Customers pay a **one-time license fee** of $2000 for ABLE, and get free updates. The company plans to release **minor** versions (1.2, 1.3, 1.4) every few months, and **major** versions (2.0, 3.0) every 2 years or so.

1. Use the information above to answer these questions:

a.	Is an update from 2.1 to 2.8 **major** or **minor**?	
b.	Is an update from 2.9 to 3.0 **major** or **minor**?	

2. What is the total cost for a customer who:

a.	Uses ABLE for 1 year?	
b.	Uses ABLE for 5 years?	
c.	Uses ABLE tech support twice a week?	
d.	Uses ABLE tech support twice a year?	

3. At ABLE Software, most expenses are in one of three broad categories:
sales & marketing software development technical support

a.	Which category(s) come mostly **before** a purchase?	
b.	Which category(s) come mostly **after** a purchase?	
c.	Which category(s) seem **hardest** to estimate?	

4. In complete sentences, summarize the key pros & cons of a one-time license fee.

Check with the instructor before you continue.

ABLE Software was founded and is run by 3 directors, listed below.

Name	Title	Responsibilities
Fiona	Finance & Operations Director	accounting, HR, internal operations
Sal	Sales & Marketing Director	competitive analysis, sales & marketing
Tara	Technology Director	software development & support

5. Use the information above to answer these questions:

a.	Who is in charge of sales & marketing?	
b.	Who is in charge of support?	

Six months after releasing ABLE 1.0, the directors meet and give their reports:

Sal (Sales)	Potential customers want to know how well ABLE will work for them, before they buy it. We would sell more licenses if we lowered the price, or if we offered a free or reduced trial license. To increase sales, I want to advertise more and hire more sales staff.
Tara (Tech)	Some customers need a great deal of support to start using ABLE, and others need very little support; this seems unfair since they pay the same amount. We try to add features that will help many customers, not just a few. I want to hire more staff to support customers and develop new features.
Fiona (Fin & Ops)	Over time, revenue must be greater than expenses. With less revenue, we need to spend less on sales, development, and/or support. To spend more, we need more revenue - e.g., higher price for similar sales, more sales at a similar price, or many more sales at a lower price.

6. In which area (sales, development, or support) should ABLE spend more to:

a.	Get more revenue as soon as possible?	
b.	Get happier customers in the short term?	
c.	Get a better product in the long term?	

7. Explain what can go wrong if a company doesn't spend enough on:

a.	sales	
b.	development	
c.	support	

After their reports, the directors evaluate several options:

U. $2500 for a one-time license (25% more).
V. $1500 for a one-time license (25% less).
W. $1000 for a one-time license (50% less), plus $500 for each major update (every 2 years or so). Minor updates are free.
X. $500 for a 1-year license, which must be renewed each year.

8. Use the information above to answer the questions below:

a.	For option V, should the number of **customers** go up or down?	
b.	For option W, how many **major updates** must a customer buy for their total cost to equal the original price?	
c.	For option X, how many **1-year licenses** must a customer buy for their total cost to equal the original price?	

9. Which option(s) (U, V, W, or X) will cost a customer:

a.	The **most** in the first year?	
b.	The **least** in the first year?	
c.	The **most** over 5 years?	
d.	The **least** over 5 years?	
e.	More if there are more "major updates"?	

10. Price changes can have unexpected effects. How might:

a.	Option U **decrease** total revenue?	
b.	Option V **increase** total revenue?	
c.	Option U **increase** sales?	
d.	Option V **decrease** sales?	

11. Consider all options (U, V, W, & X), and decide which is **best** and which is **worst**. Justify your answers using information provided above.

 Check with the instructor before you continue.

12. At the end of their meeting, the directors discuss options for the future. For each option, identify at least one **pro** (advantage) and **con** (disadvantage). Which option seems best?

a.	Limit the number of support calls for each customer.	
b.	Cancel a customer license and refund their money.	
c.	Release a free version of ABLE with all features that only works for a short time (e.g., 1 month).	
d.	Release a free version of ABLE with limited features that never stops working.	
e.	Offer hourly consulting to help install & setup ABLE or add new features.	

 Wait for the rest of the class to catch up before you continue.

B. Competing Products	start time:

Two years later, ABLE Software has changed features and pricing several times. Customers now pay $500/year for a license. The company also offers consulting services (at $100/hour) to help customers install and configure ABLE, and to add custom features. At their next meeting, the directors report:

Sal (Sales)	Companies often take a year or more to choose ABLE. Two other companies have similar products. Product P is $2000/year, and does more than ABLE, but customers really like the support, which is better than ours. Product Q is $100/year, but does less than ABLE.
Tara (Tech)	I want a bigger support team, to give better support. I want the dev team to fix more defects and add more features. We mostly add new features that help many customers, but we lose some customers who need specific features.
Fiona (Fin & Ops)	Remember that over time, revenue must be greater than expenses. This year, our revenue is 20% from new (first-year) licenses, 50% from yearly license renewals, and 30% from consulting services.

1. Use the information above to answer these questions:

a.	How much will a customer pay for ABLE over 5 years?	
b.	How many hours of consulting equal the cost of a yearly license?	
c.	Could some customers pay more for consulting than for a yearly license?	

2. Which competing product (P or Q):

a.	Is least expensive?	
b.	Has the best support?	
c.	Appeals to customers who need lots of support?	
d.	Appeals to customers who will pay for consulting?	
e.	Will customers likely try before they try ABLE?	

After their reports, the directors evaluate several pricing options:

U. $500/year, with the current support.
V. $1000/year, with more & better support (e.g., faster response and access to experts).
W. $200/year, with less support (e.g., limit the number and length of support calls).

3. Explain which option (U, V, W) best reacts to the threat from:

a.	Product P	
b.	Product Q	

4. Consider all options (U, V, & W), and decide which is **best** and which is **worst**. Justify your answers using information provided above.

Check with the instructor before you continue.

5. At the end of their meeting, the directors discuss options for the future. For each option, identify a **pro** (advantage) and a **con** (disadvantage). Which option(s) seems best?

a.	Offer all 3 options (U, V, & W) described above.	
b.	Offer the first year license for free.	
c.	Expand efforts to sell ABLE internationally.	

Wait for the rest of the class to catch up before you continue.

C. International Customers	start time:

At their next meeting, each director reports:	
Sal (Sales)	We have more and more customers in other countries, time zones, and languages.
Tara (Tech)	International customers complain about our support, so I need more people on the support team, maybe based in other countries.
Fiona (Fin & Ops)	We can't afford to hire many dev or support people in other countries.

1. Use the information above to answer these questions:

a.	What is good about international customers?	
b.	What is bad about international customers?	

Different parts of the world use different terms, languages, types of money, date and time formats, etc. Each different region is a **locale**. The work to adapt a product to another locale is **localization**. Work to make localization easier is **internationalization**.

Invent:

2. The word "internationalization" has 18 letters and is sometimes written "i18n". The word "localization" has 12 letters, and is sometimes written "l10n". These are called **numeronyms**. What is a likely numeronym for "globalization"? For "customization"? Explain your answer.

3. Which type of work (l10n or i18n):

d.	Requires more knowledge of a specific **locale**?	
e.	Requires more knowledge of the **product**?	
f.	Should the ABLE Software dev team focus on?	
g.	Could be done by other companies or customers?	

4. Describe the relationship and differences between **internationalization** and **localization**.

D. Competing Services	start time:

A year later, ABLE Software is still making money, but facing new challenges. Customers pay $200, $500, or $1000 per year based on how much support they want. Some customers also pay $100/hour for consulting services. Each director reports:	
Sal (Sales)	Some customers buy our $200/year license, and then hire another company (R or S) to help them install and configure the software. Company R is small, and was started by ABLE Software employees, who quit, moved overseas, and started their own consulting company. Company S is a big customer, and uses ABLE at several sites in advanced ways. R and S take money that should be ours. Should we sue them?
Tara (Tech)	Company R has some of the people who developed ABLE, and sometimes we need their help to fix problems and add new features. Company S has some of our most experienced users, and sometimes they help us figure out how to help other users. R and S both help some customers that are hard for us to support.
Fiona (Fin & Ops)	This year, our revenue is 10% from new (first-year) licenses, 50% from repeating licenses, and 40% from consulting services.

1. Use the information above to answer these questions:

a.	How many levels of support does ABLE Software provide?	

2. Which company (R, S, or both):

a.	Is best able to help develop ABLE?	
b.	Is most likely to pay for consulting from ABLE Software?	
c.	Best understands customer needs, and how to help them?	
d.	Seems most likely to help basic customers?	
e.	Seems most likely to help advanced customers?	

After their reports, the directors evaluate several options:

U. Sue companies that support ABLE without permission.
V. Develop formal partnerships with R or S for support and/or development.
W. Buy or merge with P, Q, R, and/or S.

3. Use the information above to answer these questions:

a.	Which option(s) would require ABLE Software to share source code with other companies?	
b.	Which company(s) are likely easiest to buy?	
c.	Which option(s) would likely reduce competition?	
d.	Should ABLE Software charge partners a **fixed fee**, or a **sliding fee** based on the number of customers?	

4. What are the main benefits & risks of:

		Benefits	**Risks**
a.	Suing other companies.		
b.	Sharing source code with R or S.		

5. Consider all options (U, V, or W), and decide which is **best** and which is **worst**. Justify your answers using information provided above.

Check with the instructor before you continue.

6. In what ways does ABLE:

a.	**Compete** with companies R & S?	
b.	**Cooperate** with companies R & S?	

7. Describe what is meant by **cooperative competition**, or **coopetition** (combining two or more words is called a **portmanteau**).

8. Describe at least one other example of coopetition, from a different context.

9. At the end of their meeting, the directors discuss options for the future. For each option, identify a **pro** (advantage) and a **con** (disadvantage). Which option(s) seem best?

a.	Limit the number of locales supported in ABLE.	
b.	Invest more time and money in i18n to make l10n easier.	
c.	Share source code with some or all customers (not just partners).	
d.	Work with companies P & Q to develop standards so that all products can work together.	

Wait for the rest of the class to catch up before you continue.

E. Free & Open Source Software	start time:

With **Free & Open Source Software (FOSS)**, anyone can download, use, and modify the software, without any restrictions and without being **required** to pay for it. Thus, some people describe FOSS as "free as in free speech, not free beer".
However, people could choose to pay for a variety of services, such as:

- Expert help to install, set up, and maintain the software.
- Training for users, administrators, and/or developers.
- Support contracts to find and resolve problems.
- Custom development to fix defects or add features.
- Hosted installations (so someone else handles all hardware issues).

FOSS is sometimes called **Free/Libre Open Source Software (FLOSS)** or simply **open source**. Non-FOSS software is called **closed source** or **proprietary software**.

1. With FOSS, could a **user**:

a.	Install and set up the software themselves?	
b.	Pay someone else to install and set up the software?	
c.	Modify the software themselves?	
d.	Pay someone else to modify the software?	

2. With FOSS, could a **company**:

a.	Sell the source code?	
b.	Be paid to help people use the software?	
c.	Be paid to modify the software?	
d.	Sell other software that works with FOSS?	

3. 🔑 If a company is losing money and about to fail, why might it release software as FOSS?

4. 🔑 If a company is making plenty of money, why might it release its software as FOSS?

F. Opening Up	start time:

A year later, ABLE Software, LLC is still making money, but facing new challenges.
I18n is mostly finished, but l10n continues for an ever-expanding set of locales.
Companies R and S are now "ABLE Certified Partners" - they can edit parts of the ABLE source code, and they pay ABLE a percentage of their consulting income.
ABLE also lets customers do their own localization and some other customizations.
Each director reports:

Sal (Sales)	I hear rumors that product Q (the small competitor) will go out of business, and release their source code as **Free & Open Source Software (FOSS)**.
Tara (Tech)	It's great that customers can do some l10n and other customizations, and that partners can help fix defects and add minor changes. This helps the dev team focus on major improvements to stay ahead of competitors.
Fiona (Fin & Ops)	We still can't afford to hire many dev or support people in other countries. This year, our revenue is 10% from new (first-year) licenses, 30% from repeating licenses, and 60% from consulting services and partners.

1. Use the information above to answer these questions:

a.	Which competitor might go out of business?	
b.	What does the dev team spend more time on?	
c.	What does the dev team spend less time on?	

2. Which of these four categories (**dev team, partners, customers, competitors**) can:

a.	Can edit **all** of the source code?	
b.	Can edit **parts of** the source code?	
c.	Cannot edit any of the source code?	
d.	Do most of the i18n?	
e.	Do most of the l10n?	
f.	Can customize parts of ABLE?	
g.	Can fix defects and add minor changes?	
h.	Can make major improvements?	

After their reports, the directors evaluate several options:

U. Continue with current model (share some code with partners).
V. Split ABLE source code into two (or more) components with different licenses - closed source, open source, maybe some shared only with partners.
W. Release all of ABLE as free & open source software.

3. What are the main benefits & risks of sharing code with:

		Benefits	**Risks**
a.	No one		
b.	Partners		
c.	Customers		
d.	Anyone		

4. Consider all options (U, V, or W), and decide which is **best** and which is **worst**.
Justify your answers using information provided above.

Check with the instructor before you continue.

5. At the end of their meeting, the directors discuss options for the future.
For each option, identify a **pro** (advantage) and a **con** (disadvantage).

a.	Release a free version of ABLE that never stops working with embedded advertisements.	
b.	Propose your own option(s).	

Wait for the rest of the class to catch up before

Teaching Case

Broadband Connectivity In "Flyover Country"

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Abstract

Every professor (who teaches online or uses online submissions) has probably heard that story about not having internet access at a crucial time. It is kind of like that story about the "dog eating the homework…", but in rural areas, the dog may be lack of internet connectivity.

Broadband commonly refers to high-speed internet access that is always on and faster than the traditional dial-up access. Most urban areas in the United States have broadband and cellular internet services abundantly provided, but adequate broadband in rural areas of the country still do not have enough internet service needed to perform and compete in modern markets. In the 21st Century, the Internet is necessary to complete necessary tasks in communications for education, businesses, health care, and farming communities. This case provides a conversation for a Computer Information Systems undergraduate course, or an introduction to Management Information Systems course, in which this topic is part of the curriculum. The case could be used in other courses to discuss the impact of legislation on business, public/private collaborations, and ethics. It has application for various economics classes or courses bearing on the Internet and connectivity. The case was written to generate discussion and to help students contend with the trade-offs of social and economic realities of business and governmental policies. The emphasis of the case is to provide an opportunity for students to learn about the topics and become knowledgeable about the problems that are presented.

Keywords: 5G Wi-Fi, Broadband, Cellular Connectivity, Digital Divide, Net Neutrality, Internet Service Providers (ISPs), Federal Communication Commission (FCC).

1. INTRODUCTION

Over two decades ago, in 1999, country music artist Keith Urban debuted his hit song "Where the Blacktop Ends", and the song continues to remain popular. The lyrics of the song express the joys of escape to rural life, away from urban grind. The song describes the drive through many counties in Kentucky and other states that are filled with scenic croplands, rolling green pastures, and livestock. Such a drive leaves little doubt that agriculture is king in rural sections of these regions. An American phrase used to describe these areas is "Flyover Country." The term is also used synonymously with "Flyover States," and both are terms that refer to the interior regions of the country passed over during transcontinental flights. "Fly Over States" is a song by American country music artist Jason Aldean. In May 2012, it became a number one hit, and the song (like Keith Urban's "Where the Blacktop Ends") remains popular.

In the modern world of technology, connectivity is essential to compete. In 2019, rural areas throughout the United States still did not have enough consistent service to adequately operate things like sophisticated GPS (Global Positioning Systems) and fail-proof cell service. Some GPS systems use mobile internet through cellular connections, and modern farming equipment uses technology that needs sufficient broadband in order to work properly allowing periodic software updates to take place. Having consistent internet service also provides marketing information for crops and livestock that could be time-critical for profitable sales and activities to be competitive.

2. THE DOUGLAS FARM

Kylen and Beth Douglas understand all too well about the advantages and disadvantages of living "where the blacktop ends". They own and operate a family farm in Henry County, Kentucky, and they also know all too well how much internet connectivity plays in their family's life on the farm where Kylen grew up. Their only option for connectivity is cell service. They readily admit that there is no other place on Earth they would rather be, but modern farming needs technology, and, on their farm, that does not always happen.

Many farmers need to work off-farm jobs to supplement their income, and in many cases, they need connectivity for that employment. Many who live in rural areas remember listening to their parents and grandparents talk about the advantages electricity and city water made when coming to their part of the world. It would only make sense that sufficient broadband service should be next.

"A lot of times it depends on which hill you're standing on and which way the wind blows as to whether or not I can get service out here," Kylen said, "And that can get frustrating at times, especially when you are really depending on it [cellular connection]." In addition to seeing this issue from a farmer's viewpoint, Kylen also sees it as it related to his second job and career, as an agriculture teacher and FFA (Future Farmers of America) advisor at Franklin County High School. The need for adequate broadband makes that job a little more challenging when trying to work from home, which is something teachers often do.

"I've lived on this farm my whole life except for a few years while I attended college. It is a very traditional farm that includes tobacco, hay, some of which is organic hay, a smaller feeder cattle operation, and a couple of beef cattle herds along with corn and soybeans," he said, "But even the most traditional of farms rely on good broadband service and once you get away from the interstates, the (mobile cellular) service out here gets pretty sparse."

Beth Douglas, Kylen's wife, takes care of most of the business needs, paper work, and records for the farm while also taking care of their three children. She points out that although the farm is located in an area just outside of the triangle that includes metro areas of Louisville, Lexington, and Cincinnati, the service they need is just not available. "We can get service here but it's not the quality of service you get when closer to bigger cities," she said. "As we use the internet more and more for things like taking online classes, ordering goods for the farm and family, and even working some jobs from home, the need for adequate service grows, as well."

As poor as the service can be at times, it gets even worse if both Beth and Kylen are online at the same time. "It becomes really slow around 6:30 at night when more people are home and using their computers," he said. From a teacher's perspective, Kylen can sympathize with his students who live in the more rural areas and have a difficult time using the internet for school homework. Students in his county have individual access to Chromebooks, and much of their schoolwork is now done via the computer and the internet. "I do have many students that live in rural areas, like I do, so I understand that sometimes, in giving a certain assignment, those students may not be able to do it," he said. "And a lot of our assignments are internet-based nowadays and you have to adapt. But for myself and rural students you have to keep in mind that that service may not be available." Often Kylen has to make the trip into town to be able to complete a task for school or the farm utilizing broadband service and states that it could be just the price for living where he does.

His neighbor and local advocate to improve the rural broadband service in Henry County does not see Kylen's view of the price he pays for where he lives. Janet Grissom had worked for 30 years in Washington D.C. in many public service jobs, including having served as Chief of Staff for Senator Mitch McConnell and in the Whitehouse under the George H.W. Bush administration. She says the lack of broadband service in rural areas is appalling and limits the

opportunities for the businesses and people in those communities.

3. RURAL SOUTH ALABAMA

As one of Alabama's youngest senators and the state legislature's only full-time farmer, Senator Clay Scofield, age 37, has separate careers. His careers have helped him overlap the increasingly wide divide of modernity and traditionalism that exist in Alabama. He starts his day tending to his near 25,000 chickens before putting on a suit to talk to constituents, work out deals in Alabama's halls of power, and in recent years, advocating for high-speed internet that still elude large parts of the state. For Scofield, lack of quality broadband internet connectivity is one of the biggest threats to life in rural Alabama.

"It's something I see as being a growing concern and it's going to continue to put rural Alabama at greater disadvantages as we move into the 21st century even further," said Scofield. "We're seeing that high speed internet is important in the 21st century just as electricity and water are … So if we expect rural Alabama to be able to compete to be able to educate a 21st century work force, if we want rural Alabama to recruit 21st century jobs, if we want rural Alabama to recruit people to move there instead of moving away, then high speed internet has to be in the mix of utilities and amenities that is offered there."

Around 39 percent of the country's rural population is without access to fast broadband access, defined by the Federal Communications Commission (FCC), as having a download speed of about 25 megabits per second. However, the closer you get to Alabama and Mississippi, the number of those without access increases substantially, according to FCC data. That lack of internet access compounds the poorly functioning education and health systems that exist in some rural communities around the state, and ensures that rural businesses are excluded from the economy, according to state legislators and experts.

"Broadband has emerged as being as important to rural life as the phone service and power," said Dr. Darrell West, the founding director of the Center for Technology Innovation at the Washington D.C.-based Brookings Institute, one of the country's leading think tanks. "And [the] digital divide is widening, where we see that lack of having access to high speed internet is leaving rural students and schools further behind."

As rural populations continue to migrate toward big cities, attracted by the lure of better work and opportunity, rural Alabama is losing its population, according to U.S. census resulting data. Scofield says, "Quality teachers are less inclined to take rural jobs, as are doctors, nurses and other professionals that are key to the success of a small, rural town". (Harriss, 2019).

"The internet has become as basic of a utility as water or electric. Students have to be able to access the internet to do their homework; small business people need it for marketing purposes, farmers need it for their businesses…" Janet Grissom (of Kentucky) said, "But it's a complicated issue and it's not all going to come from the government or the private sector, but it has to be a partnership." Grissom noted that in order for broadband to get to that last mile, it has to remain a priority, noting the sectors that are affected by connectivity include economic development, health care, agriculture, and education (Thornberry, 2018).

4. NET NEUTRALITY

You may have heard the phrase "net neutrality" before, but some people may not know parts of the background and challenges that have led the conversation and how it may affect rural broadband due to some content possibly being blocked. Net neutrality is a set of rules introduced in 2014 that demand equality for all Internet content. To understand the background, one first has to look at the basic history of legislation, and then look at how the outcomes will affect rural broadband in the future.

Net neutrality is the idea that all internet traffic should be treated equally – with no internet service provider (ISP) having the power to favor one source over another.

An open internet helps people everywhere, from doctors in developing communities who need vital medical information to treat patients, to small startups looking to build global businesses, to established Fortune 500 companies providing services to millions of customers. Without a level playing field, certain people will have access to the world of knowledge and opportunity while others will not. This may not be fair to some.

Legislative History in Brief

In 2014, the United States Court of Appeals for the District of Columbia struck down the Federal Communication Commission (FCC) Open Internet rules that required equal treatment of Internet traffic and prevented broadband

providers from blocking traffic that would provide more service to certain sites or charging special fees to companies that account for most of broadband streaming of traffic. The court ruled that the FCC had given service providers the same types of requirements as common carrier telephone services, even though the commission had decided not to classify broadband as a telecommunications service. On February 26, 2015, the FCC decided to reclassify high-speed Internet as a telecommunications service, which prohibits the blocking of content, creation of faster connectivity, or making connectivity slower for some users. The rules applied to mobile and wireless services for phones and other devices, as well as wired lines. The changes also included provisions to ensure services would be available to people in remote areas. The new rules were then endorsed by a decision by the United States Court of Appeals for the District of Columbia on June 14, 2016 (Kang, 2016 & Selyukh, 2016).

In December 2017, the Federal Communications Commission, in a 3-2 vote repealed the legislation deeming broadband internet a Title II utility. In short, the FCC voted to relinquish the ability to regulate Internet Service Providers (ISPs). Congress tried to repeal via the Congressional Review Act in 2018. A vote to overrule the FCC's decision passed the Senate and moved on to the House; however, in the meantime, several ISPs filed lawsuits in an attempt to fight the FCC's net neutrality rollback, as well as a number of state attorneys general. On November 5, 2018, the United States Supreme Court denied an appeal of a lower court's ruling requested by the telecommunications industry. The Supreme Court's decision would not make a huge difference to an ongoing federal overhaul of net neutrality regulations in the short term, but it could set a precedent for future court cases (Corbett, 2018 & Price, 2018).

Outcomes for Rural Broadband

As noted in the opening of this case, rural areas in the United States experience a disadvantage when it comes to broadband infrastructure. This is often termed as a "digital divide issue". As of 2016, 39 percent of rural communities lacked access to true broadband – defined as a minimum download speed of 25 Mbps (Megabits per second) – despite the availability in urban areas. Over ten million U.S. households did not have access to broadband at all, and 46 million rural households had only one provider offering wired 25 Mbps speeds. Internet Service Providers insist that network congestion is a serious problem and that expanding their services would require higher costs to consumers (Dunne, 2017). Given that the infrastructure needs to be in place for broadband, and those people in the rural areas have to find ways to acquire the backbone media to gain that connectivity, the case for net neutrality is a problem. The need is there, but without telecommunications ISPs on board, there lies a problem that legislation alone might not be able answer. Lack of infrastructure is a separate issue that needs to be solved by local and state governments, but if ISPs can decide content, there could be issues that need to be addressed later. (See Appendix 1 at the end of the case.)

For example, video streaming has accounted for most bandwidth use during peak times of use, where broadband is available. Combined with Netflix, Google YouTube, online gaming, and other access such as Hulu or Amazon Prime, cable providers (such as Comcast, or AT&T/DIRECTV) might block online streaming from other companies to force customers to use the cable company's on-demand movie rental services. Some companies believe government regulations might discourage competitiveness by preventing capital expenditures to grow the demand for Internet and Wireless traffic that needs the infrastructure to provide those services. However, equal treatment of access and prevention from blocking certain traffic to sites might need some regulation. That is the crux of "net neutrality."

Access and streaming issues are already an issue for rural Americans and getting rid of net neutrality may have affected them the most. Rural communities with broadband have potential to experience growth in entrepreneurship. This type of success can help local communities along with the national economy. With gigabit connections, rural software developers can use massive data center capacity anywhere in the country as if it was in their basement. Health-care entrepreneurs can overcome the challenges of rural medicine by connecting patients with specialists in other geographies. Farmers could get products to market using real-time supply chain management. Overall, the country and the citizens could benefit with a better infrastructure.

Kylen and Beth Douglas in the state of Kentucky, and State Senator Clay Scofield of Alabama, are not alone. Kate Vickery and her husband live in Colorado and are horse people.

They also work in technology by developing and designing software. When they moved to Colorado in 2017, they were looking for two things in a new home: wide-open space and a solid internet connection. They finally found a place in Westcliffe, Colorado, a town of around six hundred people nestled in a pastoral valley between two snow-capped mountain ranges.

Kate pondered about where she lives now, "You know you may still have a hard work day, life is still life, but at the end of the day you walk out your front door and you've got mountains and horses and pasture and life is okay." Life is all right for Vickery because, in part, her internet is mostly good. From her home office, she can see through the window to some hills that have a wireless tower on them. That cell tower is Vickery's connection to the internet, but, she said, "If you're on the wrong side of the mountain where you've got the shadow of a hill in the way then you don't have broadband access."

Caroline Fry, advocacy and media manager for Colorado Common Cause, is in the camp for net neutrality. She stated, "What net neutrality protects is for content to operate freely online." She also added that people living in rural communities like Westcliffe were already at a disadvantage when it comes to internet and that made them especially vulnerable. She said they relied more on the web for running their businesses, accessing education, news, health care, entertainment – you name it - but they often had fewer options when it comes to providers. Fry continued, "So there's more of a risk for internet service providers (ISPs) such as Comcast or Verizon to come in and ask them to pay for accessing content." On the other hand, the ISPs could slow down or block website content altogether if no one is willing to pay extra. Fry stated that their daily lives rely so heavily on the internet now that access was an important issue. She said it's a big deal. "It's more than just about do I watch Netflix or Hulu? This is about how do I get the resources I need to be able to participate in our society." Could this be a monopoly issue?

On the other side of the argument of "net neutrality" sits Montana Public Service Commissioner (MPSC) Travis Kavulla. He is on the panel that oversees telecommunications for the state of Montana. He believes that the internet relies far too much on federal subsidies and that content providers like Netflix, Google and Apple were getting a free ride. He would like to see those companies picking up the tab. He called it a "content sponsorship model of the deployment of broadband." He suggested that net neutrality prohibited sponsorship, which means there is less money for innovation and expanding rural access. He believes that getting rid of net neutrality changes that, and would be good for everyone, urban and rural alike. Some may ask if these content providers are already paying their fair share.

Kavulla is less concerned about preserving an egalitarian world wide web, and he wonders if that would really be a bad thing, "I mean, wouldn't your average rural consumer prefer a high speed broadband network where certain content albeit was preferred over a crappy broadband network where everything is equally slow?" Maybe the answer is already in on that. According to a number of surveys, the vast majority of Americans support keeping net neutrality in place. In addition, states are already taking action. Earlier in 2018, Montana Governor Steve Bullock issued an executive order to keep net neutrality in his state. Idaho and Colorado both have legislative efforts underway to accomplish a similar goal (Budner, 2018).

Meanwhile, back in rural Kentucky, Alabama, Colorado, Montana, and across rural America many are still hoping that maybe soon they will get enough internet reception to get a little work done.

5. CONCLUSIONS

Most undergraduate students are familiar with broadband connectivity, as most college campuses provide superb internet access. However, some may relate to the situations presented in the case, as many students are provided a platform for online classes, and they may have experienced similar connectivity issues. This case presents a situation from which students may learn and analyze broadband platforms, and the issues associated with how the infrastructure is needed and made available. It also provides legal and ethical issues for discussion that may help students to understand how the ability to access internet connectivity through broadband infrastructures affects the economy and businesses. The best course to present the case is in an information systems course that provides content for a more in-depth understanding of net neutrality.

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Appendix 1

BROADBAND

Wide Area Networks (WANs) vary in some types; however, the one we all are familiar with is the **Internet**. Keep in mind that although there are different technologies to compare, either the connection is shared among many customers, or it is dedicated to one customer.

TYPES OF BROADBAND CONNECTIONS
According to the FCC, Federal Communications Commission, the term broadband commonly referred to high-speed Internet access that is always on and faster than the traditional dial-up access (FCC, 2014) Broadband includes several high-speed transmission technologies such as:

- **Digital Subscriber Line (DSL)**
- **Cable Modem**
- **Fiber**
- **Wireless and Wireless Fidelity (Wi-Fi)**
- **Satellite**
- **Broadband over Powerlines (BPL)**

***For definitions of each of these types of connectivity please visit the FCC site:**
"Types of Broadband Connections."
https://www.fcc.gov/general/types-broadband-connections

Table 1

Broadband Type	Download Speed Range
Digital Subscriber Line (DSL)	.5 – 15 Mbps
Cable Modem	3 – 15 Mbps
Fiber	up to 1 Gbps
Wireless	up to 128 Mbps
Satellite	varies to 25 Mbps
Broadband over Power Lines (BPL)	Up to 10 Mbps (still limited and experimental)

Types of Broadband and **Table 1** are from ("Types of Broadband Connections," 2014) & (Dilley, 2019).

DIA (Dedicated Internet Access)

If the cable itself or a portion of its available bandwidth is dedicated to a single customer, this is more common for business customers, and comes with a Service-Level Agreement (SLA) guarantee of minimum uptime percentages and maximum recovery times if the service goes down. Bandwidth is symmetrical or synchronous meaning download and upload speeds are the same. This is important for businesses that back up large amounts of data online. The subscription also often includes a number of static addresses to allow for separate hosts of servers to dedicate to resources.

5G (Cellular technology with WiFi access)

One promise for rural communities to access broadband has been for the next generation of technology. 5G (or Fifth Generation) is the next generation following 4G (or Fourth Generation) of networking technology. Similar to how some access Wi-Fi, either through an existing wireless service like satellite, or a direct-wired connection like cable, DSL, or fiber, 5G is able to deliver Internet services via a direct wireless connection. 5G-based Wi-Fi in the context of a 5G network is not the same as the 5 GHz Wi-Fi supported by some routers.

One way this works is through Fixed Wireless Access (FWA), which is a base station that wirelessly connects directly to an end user's location, specifically to a Fixed Wireless Terminal (FWT) on the premises, like a home or business. Another way this works is through mobile devices, like cellular telephones, that are part of an Internet Service Provider (ISP) subscription. You can also use a 5G hotspot to turn your mobile network connection into Wi-Fi for your local devices like a tablet, laptop, or workstation with wireless connectivity.

The technology is not available everywhere yet, but could potentially help bridge the gap for some rural areas in the near future. The promise of 5G-based Wi-Fi is to access fiber-like speeds without the cost of high-speed wired internet in an area that does not currently provide it. A minimum theoretical speed of 20 Gbps (2.5 GBs) per cell means that it is over 10 times faster than 4G, and most likely faster than many types of wired home connections. Another aspect is the extremely low latency standard that 5G networks are required to abide by. This means that everything you currently do on the internet is a lot faster with 5G-based Wi-Fi, like when downloading files, sharing data, uploading videos, playing online games, streaming movies, etc.

Not all companies have upgraded their infrastructure to support 5G technology. Verizon is currently the only major carrier that offers 5G-based Wi-Fi in the United States, but it is only available in a few cities. Its release date depends on many factors, including your location and service provider, but most are looking at 2020 to be the year 5G really emerges as the next big mobile networking technology. (Fisher, 2019)

Many factors including regulations from the government, rural fiber, and logistical strategies are all components in ensuring successful rollout of 5G throughout the U.S., which has the most mobile broadband connections among western nations. At the same time, the enormous geographic size and wildly uneven population density between the coasts has made universal and uniform high-speed adoption difficult. According to FCC data, low-population areas of the U.S. still lag in both access and speed.

Some focus on the promise of accelerated government support for 5G rollout, and for subsidies to build rural backbone networks. Some, however, debate over how best to manage 5G development that has shown potential.
Some people want government to take over construction of a nationalized 5G network, following the model of the interstate highway system in the 1950's. The idea is to build a single, 5G network that mobile operators would lease instead of building their own, competing infrastructure. A single private company, not one of the existing carriers, would have the job of building and operating it under government supervision. Others have strongly rejected the idea of nationalized 5G, as it could create unwanted regulations and tax burdens on citizens who may not have access for several years to come. The debate will continue, and everyone should analyze the benefits as well as the problems associated before deciding. (Downes, 2019).

The industry of specifications has settled on 5G NR ("new radio") as the standard technology to fulfill those specifications. 5G NR is a new way of encoding data through the air which is more efficient than previous generations. It can use wider channels, communicate more responsively with remote servers (lower latency), pack more data into one radio cycle, and address more devices per square mile than 4G can. It does this by using more advanced computing power in your device and in base stations than was available in 2009, when the 4G standard was set. You will almost certainly need a new devices to be able to access 5G, even on existing radio bands. 5G promises multi-gigabit speeds, but has trouble penetrating walls and traveling long distances. AT&T, T-Mobile, and Verizon will all use at least some coverage for rural areas.

Appendix 2

1. What is your personal experience with internet connectivity, and what area do you relate to (i.e. urban or rural)?

2. What some of the problems presented in the case, and how would you identify with the people it describes?

3. What are the factors that have helped create this problem?

Geographic:

Economic:

Technology:

Social/Cultural

Legal/Political:

4. What problem does Net Neutrality bring to the country as a whole, and how do we go forward?

5. What promises does 5G-based Wi-Fi (or other broadband types) have for rural areas, and should it become a government-owned utility?

6. What areas of telecommunications and the benefits of internet connectivity do you think students who are going into a business career would need to understand?

7. Exercise: Test Your WAN Connection's Speed.

You can test your own WAN connection to see what the current upload and download speeds are using a bandwidth speed tester, or a speed test website. During the test, data will be sent to your computer and then requested from your computer in order to measure download and upload speeds.

1) Go to your browser, then go to speedtest.net, then launch the test. Wait for the test to complete, then write down your results.

2) Go to Verizon.com/speedtest, start the test, then record your results. Compare the results and your findings about the similarities and differences.

Teaching Case

Ethical Coding: Privacy, Ethics & Law in Computing

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Abstract

This case provides an opportunity for classroom discussion of ethical issues addressed by computing technologists and the Association of Computing Machinery (ACM) Code of Ethics as the authors describe a recent lawsuit brought against Sutter Health. Security issues, data breaches and compliance with industry privacy rules are common concerns for all industry professionals, including computing technologists. However, employer work requests—of questionable moral position—place employees in ethical dilemmas that add another layer to job-related stress. This case may be used in a graduate level management information systems course or as part of a capstone class experience. Suggested assignments include discussion questions regarding the ACM Code of Ethics and the right to privacy, and situational ethics scenarios for programmers.

Keywords: Teaching Case, ACM Code of Ethics, Privacy Law

1. INTRODUCTION

As companies increasingly realize the value of data analytics, computing technologists may be asked to enhance their programs and systems with data collection capabilities unassociated with the intended purpose of the resource. While users of the technology tool may assume that their data is being used only for the activity at hand, in reality, their data may actually be collected and used beyond the implied purpose of the system. Computing technologists need to be aware of laws and industry codes of ethics as they develop programs. In addition, future technologists should also be aware that they may be placed in situations where their ethical values may need to guide and direct their decision making. They may also want to be prepared to think about how they would handle a situation in which their employer or co-worker's ethical intentions are questionable.

There is some guidance available to assist computer technologists in applying industry ethical principles. The world's largest computing organization—the Association for Computing Machinery (ACM)—updated their ethics code in 2018 due to the significant advances in technology. The group's ethics standards had last been updated in 1992. The ACM Code of Ethics is regarded as the standard for the computing profession and is designed to guide computer technologists in making ethically responsible decisions to "ensure the public good." (ACM, 2019). This case focuses on the law and ethics of data sharing. The handling of

healthcare data is especially sensitive; and therefore, our study of legal and ethical situations begins with an action filed against a major healthcare provider for sharing confidential information with third parties.

2. THE LAWSUIT

On Monday, June 10, 2019, a class action lawsuit (*Jane Doe I and Jane Doe II v. Sutter Health*) was filed in Sacramento County, California against Sutter Health. Sutter Health is one of California's largest health care providers with 24 hospitals serving more than 100 northern California communities. The lawsuit claims that Sutter secretly shared private information about patients with Facebook, Google, Twitter, LinkedIn, as well as other companies. The claim indicates source code was written into the website that allowed for "cookie synching" and the provision of a "… secret and invisible window through which to spy on the communications that the Defendant exchanges with its patients." (*Jane Doe I and Jane Doe II v. Sutter Health*, 2019). According to the claim, the window was indicated by a third-party logo (i.e. Facebook "share" icon) present on the page or a one-by-one tracking pixel. The claim noted that a GET request would disclose the subject matter of a search. Personally identifiable information was also supposedly disclosed including cookies, the IP address, and device and browser identifiers. Javascript code was indicated as being used in the web page to allow a first-party cookie value stored in a tracking pixel to be shared with third-party partners allowing for "cookie synching." (Cookie synching allows two web sites to share data collected about individual users.) This data was supposedly included in the development of detailed dossiers used to target advertising to both current and potential Sutter patients (Cahill, 2019).

If these allegations are true, then Sutter Health may not only have violated laws intended to protect privacy; but may also have committed ethical transgressions. The next section describes protected health information.

3. PROTECTED HEALTH INFORMATION

Protected health information (PHI) is individually identifiable health information protected by the Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy Rule. HIPAA Journal describes PHI to include such things as "health records, health histories, lab test results, medical bills, demographic information, and common identifiers when they can be linked with health information." However, when PHI is stripped of identifiers that can link individuals to the information, the information is described as being de-identified and PHI HIPAA rules do not apply. The next section provides a summary of the alleged legal violations

4. VIOLATIONS

The class action lawsuit includes complaints for the following issues:

1. Violation of California Confidentiality of Medical Information Act (Cal. Civ. Code §§ 56, et seq.)
2. Violation of California Invasion of Privacy Act (Cal. Penal Code §§ 631, et seq.)
3. Intrusion upon Seclusion
4. Breach of Fiduciary Duty of Confidentiality
5. Violation of California's Unfair Competition Law (Cal. Bus. Prof. Code §§ 17200, et seq.)
6. Conversion
7. Negligence

The following provides a short explanation of each of the complaints included in the lawsuit with the accompanying allegations. Several of the complaints refer to the term "tort" which is defined as an act or omission that causes harm or injury to another.

Violation of California Confidentiality of Medical Information Act (Cal. Civ. Code §§ 56, et seq.): This act indicates that health care providers cannot disclose patient medical information without the patient's consent. According to the law, medical information also includes information that could identify the person as being a patient of the facility. (*Jane Doe I & Jane Doe II v. Sutter Health*, 2019).

Violation of California Invasion of Privacy Act (Cal. Penal Code §§ 631, et seq.): This act protects internal communications from being shared without the consent of the parties involved. The claim indicates that the sharing of communications with third-party entities violates this act (*Jane Doe I & II v. Sutter Health*, 2019).

Intrusion upon Seclusion is a privacy tort associated with intruding upon the private affairs of another person (Duhaime, 2019). The lawsuit alleges that the disclosure of medical communications and personally identifiable information violates this tort (*Jane Doe I & Jane Doe II v. Sutter Health*, 2019).

Breach of Fiduciary Duty of Confidentiality Healthcare providers have a heightened responsibility to protect the personal and medical information of their patients. The lawsuit against Sutter Health alleges that the company breached their fiduciary duty to keep communications between them and their patients confidential by transmitting browsing experiences of users to third parties, without consent (*Jane Doe I & Jane Doe II v. Sutter Health*, 2019).

Violation of California's Unfair Competition Law (Cal. Bus. Prof. Code §§ 17200, et seq.): This law prohibits fraudulent, deceptive or misleading business practices. The complaint alleges that Sutter Health violated this law through "misrepresentations and omissions regarding the disclosures of the personally identifiable information to third-parties…" (*Jane Doe I & Jane Doe II v. Sutter Health*, 2019).

The Conversion tort applies to taking someone's personal property without permission. (DMLP, 2019). The case alleges that Sutter Health "stole" web site users' confidential information.

Negligence laws are intended to protect people from injuries by others who may be careless or reckless. According to the suit filed against Sutter Health, the company had a duty to maintain the confidentiality of their users'/patients' personal and medical information, and not share their data with third parties without permission.

Like almost all companies that collect data from users, Sutter Health has a privacy policy linked to their web site for users to read before using the site. This document contains multiple sections and subsections detailing the collection of personal user information on their site. (Relevant Sections from the privacy document can be found in Appendix 1.) The document also indicates that the collection will occur in multiple ways.

The privacy policy informs users how their data may be collected and how it may be used. When the case goes to court, the content of the privacy policy will be evaluated. The court may find no fault with Sutter's actions. However, even though policies may make some actions legal, that does not necessarily mean that all legal actions are ethical. The next section examines the ethical aspect.

5. LAW AND ETHICS IN COMPUTING

When considering the law and programmer's code of ethics, the Sutter Health case is a good example of the potential risks that may be encountered even in the most seemingly mundane and straight-forward computing work assignments. Computer technologists must consider the intended, and even unintended, consequences of their work in the internet environment, and keep the tenets of privacy (Schwieger & Ladwig, 2016) and ethical programming—such as maintaining transparency and minimizing negative repercussions—at the forefront of every assignment.

Most professional careers have some form of code of ethics (e.g., CPA, physicians, lawyers and computing). For those without a formal written code, moral responsibility, human decency and the Golden Rule (treat others the way you want to be treated), should, at the very least, hold sway. The code of ethics associated with the field of computer technology is the Association of Computing Machinery (ACM) Code of Ethics. This document can provide guidance to programmers professionally beyond their own personal code of ethics. An excerpt from the ACM Code of Ethics can be found in Appendix 2.

Following the right ethical path is not always as easy as one would think. In his article "Ethical Dilemmas Faced by Software Engineers" (July 13, 2019) Princeton University author and computer scientist Arvind Narayanan discusses some real-life examples of ethics situations in computing. One of the contributors to the article mentions that although the issue of privacy has subtle implications for software engineers, the topic doesn't get much attention because there "are not enough dead bodies." Computer programmers must realize that unethical programming is not just a management issue. Students should understand and apply legal and ethical principles to their daily work and projects. (Narayanan, 2019).

6. ASSIGNMENTS

Faculty may use this exercise to address technology-related basic business law issues, familiarize students with the ACM Code of Ethics, and consider examples of circumstances where knowledge and consideration of ethics is vital for computer programmers. Discussion of answers for assignments are provided in the teaching notes.

Questions for Discussion
Courses: Graduate level MIS course or Capstone MIS Course

1. Visit the ACM's Code of Ethics Website and read through the Code (https://www.acm.org/code-of-ethics). After reading the Code, answer the following questions:

    1. Do you think it is ethical to use someone's data for unintended purposes without their consent?
    2. Assume that your supervisor asks you to add code to your project to collect data from unsuspecting users and to transfer that data to third parties (as allegedly occurred in the Sutter Health case). What would you do?
    3. Assume you are a supervisor. What would you do if your employer asked you to have your employees add data collection code to the project on which they were working?
    4. Does your opinion change as your roles change?

2. We do not yet know what the programmers of the Sutter Health site understood about the legal and ethical aspects of the company's website design. In each of the following situations, imagine you are a computer programmer asked to complete the described work assignment by your employer. Study the following scenarios and decide on a course of action. To evaluate the ethics of each situation, you can use the following ethical decision-making model:

    (1) describe the ethical dilemma;
    (2) identify the stakeholders;
    (3) outline your options and how each group of stakeholders will be affected;
    (4) make a decision among the options you've identified.

After you've developed a strategy/made a decision, examine the ACM Code of Ethics. Does your action align with the Code? Why or why not?

a. You are asked by your employer, a pharmaceutical company, to design a website to promote a drug they have developed. Federal law prohibits direct medical marketing to consumers at this time, so the company asks you to design the general information site as an online quiz, where users do not know it relates to the drug company. The target audience is teenaged girls. When taking the quiz, participant answers may vary, but the site always recommends the same drug (your company's target product). Sometimes the drug may be harmful to the user, depending on how they answer the quiz.

b. You are asked by your employer, a company that builds and programs self-driving cars, to design the "object avoidance" feature of the vehicles. You currently need to determine what the car will collide with when sandwiched between a stationary object (which could injure/kill the vehicle occupants) and a human moving target, such as a bicyclist or motorcyclist. All you know is that there is the potential for someone to be injured or killed by the programming, and the car needs to hit one of the two targets.

c. You are asked by your employer, a major clothing brand retailer that focuses on one gender, to program a competition on their website for entrants to win prizes, such as an iPhone. The company also asks you to write code to extract five random winners. Management, however, only wants winners to come from the targeted gender.

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APPENDICES

APPENDIX 1: SUTTER HEALTH'S PRIVACY AGREEMENT

Linked to the homepage of Sutter Health's web site is the address to Sutter's Privacy Policy with multiple sections and subsections. Areas of the document containing content relevant to this article include:

- Collection of Personal Information
- Web Site Visitor Tracking
  - Visitor Tracking Software
  - Web Logs
  - Internet Cookies
- Use and Disclosure of Personal Information

The following subsections provide excerpts from the Privacy Policy document that could be considered relevant to the case.

Collection of Personal Information: In the section entitled "Collection of Personal Information," the page notes:

> *"Sutter collects information about you, and sometimes about your devices, when you visit our Sites. The information we collect and how we collect that information may vary depending on the specific website or application. The information we collect about you through our Sites generally is information that you provide or information that we automatically collect…. We also collect information about you, and sometimes about your computer or device, automatically through cookies and other technology. … In some cases, we may collect location information from you, including your precise location, if you have enabled this functionality for Sites. Most mobile devices allow you to change or disable this functionality by changing the device settings. We also may collect information regarding how you interact with our Sites and on other websites, such as our social media platforms. … In some cases, we may receive information about you from third parties. Once we receive this information, we will use, disclose, and safeguard it as described in this Policy. We may combine information collected through different Sites or portions of Sites. In the event we combine personal information collected through our Sites with your personal health information, we will use and disclose such combined information as described in our Notice of Privacy Practices, which relates to our collection, use, and disclosure of medical information."* *(SutterHealth.org, 2019).*

Visitor Tracking Software: The content, in the Visitor Tracking Software section of the site, notes:

> *"Sutter keeps track of visits to our Sites via an automatic monitoring program that tells us, among other things, how many visits are made to the site; the time of day and date of those visits; and which areas of the Sites individuals visited. The monitoring program does not provide us with any personal information about a visitor. We cannot discern your name or physical address or other personal information about you. This information is used to evaluate the effectiveness of our Sites."*

The paragraph indicates that the physical address cannot be discerned; however, reverse IP lookup software may be able to provide users' locations.

Web Logs: The section of the page entitled "Web Logs" describes the data that is stored regarding site visits:

> *"The visitor tracking software gathers information from standard Web logs and stores it on servers at Sutter. These logs may contain information such as the Internet domain from which you access our Sites; the date and time you visited our Site; the areas of our site that you viewed; your computer's IP address that is automatically assigned when you log onto the*

Internet; the type of browser and operating system you use; and the address of the Web site you linked from, if any.

All Web logs are stored securely and may only be accessed by Sutter employees or designees on a professional need-to-know basis for a specific purpose. Sutter uses Web log information to help us design our Sites; identify popular features; resolve user, hardware and software problems; and make the site more useful to patients and other visitors."

The **Internet Cookies** section describes the types of cookies that are used as well as how cookies are used.

Sutter may place Internet "cookies" on the computer hard drives of visitors to our Sites. Cookies help us obtain information about your use of our Sites; they do not contain information about you or your health history. Sutter uses two types of cookies: "session" cookies and "persistent" cookies

…Some of our Sites may use Google Analytics to better understand usage of our Sites. You may opt out of Google Analytics by following the instructions at: https://tools.google.com/dlpage/gaoptout. Additionally, you may opt out of certain tracking by many third party advertisers, by following the instructions found on the following Web sites: Network Advertising Initiative, http://optout.networkadvertising.org and Digital Advertising Alliance, http://optout.aboutads.info .

The collection, use, and disclosure of your information, as described in this Policy, may continue regardless of whether or not you enable "Do Not Track" functionality on your browser or device.

Use and Disclosure of Personal Information: The final section relating to the case notes:

We may use your information: to contact you … to track and analyze use of our Sites, … and to track and evaluate activity on our Sites; for purposes including enhancing and maintaining our Sites, services, and products; …

We may share information that does not specifically identify you, such as aggregate data, with third parties. Additionally, we may share your information, including your personal information collected through our Sites, under the following circumstances: with our third party service providers who perform certain services or functions on our behalf (for example, we may share your information with a hosting service provider who hosts one of our Sites that you have visited);…

APPENDIX 2: ACM CODE OF ETHICS

The Association of Computing Machinery's (ACM) Code of Ethics and Professional Conduct should serve as a guide for current, and future, computing practitioners. The Code, found at https://www.acm.org/code-of-ethics, is divided into four main sections: (1) General Ethical Principles, (2) Professional Responsibilities, (3) Professional Leadership Principles, and (4) Compliance with the Code (ACM, 2019).

Although upholding privacy and data security are woven throughout the document, the section entitled "General Ethical Principles" most obviously addresses the issue of privacy with five of its seven subsections related to the topic.

1.1 Contribute to society and to human well-being, acknowledging that all people are stakeholders in computing: The focus of this subsection centers upon looking out for others. The subsection notes, "This principle, which concerns the quality of life of all people, affirms an obligation of computing professionals, both individually and collectively, to use their skills for the benefit of society, its members, and the environment surrounding them. This obligation includes promoting fundamental human rights and protecting each individual's right to autonomy. An essential aim of computing professionals is to minimize negative consequences of computing, including threats to health, safety, personal security, and privacy. When the interests of multiple groups conflict, the needs of those less advantaged should be given increased attention and priority." (ACM, 2019).

1.2 Avoid Harm: This subsection of ACM's Code of Ethics addresses user privacy, and the responsibility of a computing professional, most substantially. "In this document, "harm" means negative consequences, especially when those consequences are significant and unjust. Examples of harm include unjustified physical or mental injury, unjustified destruction or disclosure of information, and unjustified damage to property, reputation, and the environment. This list is not exhaustive. Well-intended actions, including those that accomplish assigned duties, may lead to harm" (ACM, 2019).

1.3 Be honest and trustworthy: The focus of this subsection centers upon the disclosure of system and personal capabilities to employers. Although this subsection does not address user privacy directly, the subsection emphasizes the importance of being honest and trustworthy in action and deed. "Honesty is an essential component of trustworthiness. A computing professional should be transparent and provide full disclosure of all pertinent system capabilities, limitations, and potential problems to the appropriate parties. Making deliberately false or misleading claims, fabricating or falsifying data, offering or accepting bribes, and other dishonest conduct are violations of the Code" (ACM, 2019).

1.6 Respect privacy: This subsection of the document reminds professionals that "Technology enables the collection, monitoring, and exchange of personal information quickly, inexpensively, and often without the knowledge of the people affected." and encourages professionals to become familiar with the "…various definitions and forms of privacy and should understand the rights and responsibilities associated with the collection and use of personal information (ACM, 2019)."

1.7 Honor confidentiality: The General Ethics Principles section wraps up with this subsection that reinforces the importance of privacy. "Computing professionals are often entrusted with confidential information such as trade secrets, client data,… Computing professionals should protect confidentiality…"

Teaching Case

Encouraging Analytics Skills Development in All Undergraduates: A Taste of Microsoft Data Analytics

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Abstract

During the past decade, digital transformation enabled by big data and analytics emerged as a key theme in the business world. It promises to continue be a theme of major importance in the 2020s. Digital transformation comes at the cost of grappling with and analyzing the ever-growing volume of data. Data visualization techniques are seen as a main solution for dealing with this immense data growth. Finding talent with the skills and knowledge to glean analytics insights is one of the critical issues in organizations. Given the talent gap, there is a growing call for most employees in organizations to adopt self-service analytics and enforce a data driven culture. In addition to meeting industry demands for analytics skills, institutions of higher education must strive to expose all students to analytics. This would enable organizations to operate as data driven decision making entities by making analytics pervasive through the organization. Educators tasked with teaching the introductory IS course have an opportunity to help in this organizations in this mission by exposing all undergraduate students to analytics curriculum early in their educational career. The addition of data visual analytics curriculum to the introductory information systems course would give all students an interesting hands-on experience with analytics that would help them appreciate analytics and also potentially prompt them to incorporate analytics into their program of study.

Keywords: Analytics Experiential Learning, Data visualization, Power BI, Real world data sets

1. INTRODUCTION

We live in a data driven era where the acquisition and analysis of the almost inestimable amounts of data for decision making dominates the success of organizations (Pappas et al 2018). The increase in the collection of data, characterized by high volume, velocity (i.e., the frequency of incoming data that needs to be processed such as a stock ticker tape), and variability (e.g., twitter feed, images, transaction data, social media), is creating new challenges for organizations to survive but more importantly to succeed. IT teams are burdened with ever-growing requests for data, ad hoc analyses and one-off reports. Decision makers are frustrated as it takes hours or days to get answers to questions. Every industry is faced with the challenges of acquiring, manipulating and making sense of data, that typically has a short life span as a valuable input, for timely decision making.

The adoption of data analytics is seen as the golden ticket to overcoming competitive pressures. In 2019, the business analytics market was assessed at 67.92 billion dollars and is expected to reach 103.65 billion by 2025 at a compound annual growth rate of 7.3 percent (Mordor Intelligence 2019). This growth proves that data driven decision making and achieving digital transformation by adopting business analytics has become mission critical for companies.

While big data analytics has a lot of potential to gain valuable insights, it can also be a burden. Finding skilled professionals to conduct complex big data analyses is near impossible as there is a global shortage of analytics skills. Wallen (2019) states that there will be an extra 250,000 job offerings for data scientists by 2024 in the United States alone. There appears to be a seemingly insatiable demand for data analysts and scientists with little evidence of a resolution to this issue in the near future (Violino 2019).

With limited options, organizations are looking for alternatives and creative solutions to meet demands for analytics professionals. Some are retraining existing decision support staff and partnering with institutions of higher education to get first dibs on analytics graduates (Harper 2019). Others are pushing for a self-service analytics environment within the organization that would encourage employees to develop citizen data scientist skills (Tapadinhas and Idoine 2016). Citizen data scientists are individuals capable of performing simple to moderate analytical tasks (i.e., descriptive, predictive analytics) on data such as exploration using techniques such as visualization.

Data visualization can have a significant impact on how organizations can gain insight from its data. "A picture is worth a thousand data points (Noble 2016)." This is the mantra among organizations that are collecting, storing, and analyzing massive amounts of data to effectively compete in the marketplace (Hardy 2019). Data visualization is a quick, easy way to convey concepts in a universal manner. With interactive visualization, decision makers can take the concept a step further by using technology to drill down into charts and graphs for more detail. Kumar and Goyal (2016, p121) describes the importance of visualization to analytics as follows. "Almost all fields of study and practice sooner or later will confront the big-data problem. Visualization has proven effective for not only presenting essential information in vast amounts of data but also driving complex analyses." The data analytics field presents new opportunities to the computer graphics and visualization community to enhance data comprehension and help glean insights. Data visualization is becoming a crucial component of advanced analytics in the age of big data.

The data visualization project described in this paper proposes to give freshman and sophomore students in the required introduction to information systems course an opportunity to experience data analytics using a data visualization tool. This would enable students to get a 'taste' for data analytics and consider further exploring data analytics as a subject of interest as well as a future career option during their college career. The exposure will also enable students to become more aware of and more easily acculturated to the data driven work environment in organizations.

First, this paper presents potential instructors with more information on the importance of visual analytics to education as motivation to consider using this curriculum in the classroom. Next, it describes the data visualization project and the lesson plan that was used in an introductory MIS course along with other resources that would be beneficial to help an instructor adopt this project, such as a grading rubric and sample student presentations. Finally, the paper discusses feedback and results. The author had success in encouraging students, who had not previously considered analytics as an option to add analytics as a major or minor in to their program of study as well as to pursue more analytics related course work. This work is described with hope that other faculty will have the necessary information to be able to replicate this success in the class room.

2. VISUAL ANALYTICS

Data visualization is the presentation of data in a pictorial or graphical format. Using charts or graphs to visualize large amounts of complex data is easier than pouring over spreadsheets or reports because of the way the human brain processes information (Fiaz et al 2016). The human brain is incapable of processing large quantities of numbers of text at once. Almost 50 percent of brain activity is focused on visual processing (Jerath et al 2015). The brain is able to process visuals 60,000 times faster than numbers or text (Shafipoor et al 2016). Almost always, the brain needs a visual representation of data to make sense of massive amounts of data available and translate it to tangible ideas and concepts.

By increasing visualizations, organizations can make data driven decisions more effectively and efficiently. The use of visualizations increases the functionality of decision makers as they are able to ask better questions from the data (Runkler 2016). It creates linkages between data points that seemingly do not have links. It creates higher data quality as analysts can identify clean versus dirty data. This leads organizations to maximize their productivity as well as increase the value of the information they collected.

As a result, as the demand for big data continues to grow, the need for expertise in data visualization has begun to increase (Bhatia 2019, Hale 2018). Data visualization skills are one of the top ten technical skills with the highest increase in demand according to a study commissioned by Baylor University (Kauflin 2017). Data analysts who are able to utilize various data visualization analytics techniques to analyze data have become extremely highly sought after professionals in the industry.

3. THE IMPORTANCE OF AND PERCEPTION OF ANALYTICS

Globally the shortage of people with analytical skills is continuing to grow (Holak 2019, LinkedIn Workforce Report 2018). According to the Bureau of Labor Statistics (2018), the job market for Computer and Information Research Scientists, (i.e., the closest equivalent to data analytics experts) is positioned to grow by nearly 20 percent by 2026. As described in the introduction, organizations are exploring various alternatives as a means of addressing the skills shortage. Pushing for employees to adopt a self-service analytics environment where they gain citizen data scientist skills such as data visualization is at the fore front of some of the alternatives currently entertained by industry (Harper 2019).

Both nationally and locally, employers as well as students (especially MBA students) who are aware of the importance of analytics are requesting more content and programs on analytics, big data and data visualization skills from institutions of higher education. In response to these requests, universities are creating courses in advanced analytics, using real world data sets for course projects, and developing programs in analytics for graduate and undergraduate students (Clayton and Clopton 2019). Concentrations and certifications in analytics have also gained traction as a means of encouraging citizen data scientist skills.

However, the majority of students in liberal arts higher education institutions often do not comprehend the meaning of 'analytics.' As most analytics curriculum is offered through IS/IT related departments, they equate it with programming. It is often difficult to dispel this myth (Gandomi 2015). Equally, parents of incoming students hesitate to direct students to undergraduate programs that have an analytics focus in fear of heavy statistics and mathematical programming in the curriculum (Holsapple, Lee-Post & Pakath 2014). Many students fear and lack confidence in their math abilities and see analytics solely as a field akin to statistics.

Dispelling these misnomers are challenging. Attracting students to get exposure in analytics and explore analytics as an educational option is difficult. Enabling students to see the broad spectrum of possibilities in analytics roles from citizen data scientist to specialist data scientist with a wide range in skills and knowledge needed ranging from data visualization to machine learning, advanced statistics and artificial intelligence can be a daunting task. Existing courses in IS programs provide little room for the addition of new content.

4. MICROSOFT ANALYTICS PROJECT IN THE INTRODUCTORY MIS COURSE

The introductory MIS course exposes all undergraduate students to a broad array of topics in information systems. Typically, the course plays an important role in the overall IS curriculum as a vehicle to recruit IS majors and minors. Modaresnezhad and Schell (2019) argue that this role played by the introductory IS course has two flaws: "(1) focusing too much on recruiting IS majors and not enough on educating non-IS majors and (2) too much emphasis on technology itself and not enough on how technology enhances decision making" pp. 40. Given the current challenges faced by organizations described in section 3, Modaresnezhad and Schell's statements are specifically potent in suggesting that a fresh perspective of the introductory MIS course is needed to expose all students to analytics content that help them be better citizen data scientists in self-service analytics environments.

Additionally, given the multidisciplinary nature of analytics, Wymbs (2016) and Wright (2016) suggest that it is important for all students to be exposed to analytics skills and be able to apply them to real world problems regardless of the student's chosen field of study. The visualization project described in this paper proposes learning analytic skills in line with the ideas mentioned by Modaresnezhad and Schell (2019) as well as Wymbs (2016) and Wright (2016). This project can be a first step in helping organizations create successful data driven decision making environments.

Data visualization skills are one of the latest high demand skill requirement in the big data and analytics space (Bhatia 2019, Hale 2018). To introduce the concepts of data analytics early to college students, a data visualization based real world data project is introduced to freshman

and sophomore students who take the required Introduction to Management Information Systems course. The project was designed with the following overall goals in mind: (1) Give students a taste of data analytics, (2) Help them understand that there is a full spectrum of analytics roles and tasks in this field, (3) Help them dispel myths that one needs heavy statistics and math skills to be working in this field, (4) Enable them to realize that manipulating data and decision making through visualization should be a skill in their arsenal irrespective of if they are a analytics major/minor or not, (5) Create excitement around working with real world data related to the major or course work that they are passionate about, (6) Give them exposure to an experiential learning activity that would help them consider analytics as a career option.

The project was incorporated during the mid-point of the introductory MIS course. Typically this course focuses on Microsoft Office applications as well as giving students an overview of information systems concepts. While teaching hands-on skills with MS Access and MS Excel, the students are exposed to Excel Pivoting, integrating different data sets and then finally introduced to Microsoft Power BI. Students are given the choice of either using the Power BI cloud service or the desktop version to conduct more visual analyses on a data set. Finally over the course of the semester, students are asked to complete milestones towards the accomplishment of a final project. They used MS Excel, MS Access as well as MS Power BI to complete the project. A detailed lesson plan that involves project milestones is described next.

5. LESSON PLAN

When possible, all relevant teaching content has been provided in the Appendix (Please note, the number item described below is used to locate content included in the Appendix). Others are attached with this submission.

1. Present the Final Project description on the first day of the course at the beginning of the semester as something students need to work on as part of the course (Included in Appendix). Emphasize the value of the project as helping them better navigate and succeed in a data driven business environment.

2. Teach existing course lessons on introducing and working with Excel Pivoting (Content not included here)

3. Assign the Article on Data Visualization ahead of class. Review examples of data visualization in class with students - https://blog.hubspot.com/marketing/great-data-visualization-examples#sm.0000j2cg9qcqhehjx7m24aw8fgzf3

(This article very simply explains what data visualization is as well as provides some interesting and fun visualizations related to sports, current affairs, famous people, etc… that would be interesting to students)

4. Assign students to complete the Power BI tutorial – (Included in Appendix).

5. Suggest and help students identify a good data set for analysis. Students are encouraged and given individualized attention to identify a data set that is relevant to their major or chosen career. This enhances their interest in completing the project with greater enthusiasm and interest. It also helps them incorporate the project accomplishments to their internship and fulltime employment interviews.

6. Final project presentations (Presentation guide – slides and Rubric – included in Appendix).

7. Sample presentation slides that you can share with students to give them ideas of what they could do.

At every stage of the lesson plan presented here, students are reminded of the value of data analytics to business and its ability to glean insights that drive impactful decision making. Whenever possible, efforts were made to find and give students articles or other resources relevant to the data set and the questions a student was interested in exploring. This helped the student become more invested in their project work. For example, a couple of articles on how sustainability dashboards are being used for farming and irrigation was shared with a student who worked on a European dataset focused on effective agricultural techniques and crop productivity. The student later interned in Spain on a sustainability project and indicated that her experience with the analytics project helped her with the work on the internship.

6. RESULTS

Results upon completing the data visualization project was overwhelmingly positive. Students were pleasantly surprised at how they could visualize and chart data to get a general overview of the data. Then most of them drilled deeper into the data to understand nuances. Their explanations were often well thought out

for the results that they gained and some spent painstaking time to prepare the data, analyze the data and develop visuals that were pleasing and effective. Many walked away with confidence and a feeling that "data analytics is not so bad (quote from one student)." Another student, a human resources major, approached me after class to state that she had shared her experience at an interview and the employer had been very interested in her final project. There have been multiple such stories recounted to the instructor in the six iteration of the course. Students in fields as diverse as healthcare administration, nursing, criminal justice, in addition to business majors, have recounted the positive feedback and interest they received from potential employers that heard about the analytics project they completed in the introductory MIS course.

No negative student feedback has been recorded either in person or through anonymous survey during the six semesters in which this project was incorporated to the course. Many students have since started taking other analytics courses leading to the addition of Analytics as a double major or minor. Members organizations of the IS Advisory Board have provided positive validation and feedback for the efforts made with the project. Several recruiters have also shown interest in recruiting students for internships with exposure to an analytics tools and worked with real world data early in their academic career. Overall feedback received from students suggested that they felt working on the analytics project gave them a sense of what self-service analytics and knowledge work in the future may look like.

Integrating Microsoft Power BI and data visualization through a real world project into the introductory information systems course has been a successful venture so far. The total class time and prep work required has been minimal. Through the project students have been exposed to data visualization techniques and the principles for visualization. Students gained hands-on exposure to a data visualization application that gave them a taste of what analytics may involve. By engaging in the project, students are exposed to analytics through data visualization based experiential learning that can become a great means of attracting students to analytics programs.

7. CONCLUSION

Analytics continues to grow as an area of major importance to industry that has a significant skills shortage. This paper describes a project that could help student self-select themselves to analytics based programs and curriculums by giving them an opportunity to experience analytics hands-on in one of the first information systems courses they take as undergraduates. Data visualization skills are the latest high demand skill requirement in the big data and analytics space (Bhatia 2019, Hale 2018). Irrespective of their field of study, students can gain a small appreciation for analytics, become more amenable to engaging in data analytics without fear or anxiety and can potentially become more data savvy employees in organizations by engaging in this analytics project.

By creating an opportunity to engage in a data analytics project where students work with real world data, students gain an understanding of what a role in data analytics might entail. In so doing, the project gives instructors the ability to engage students in analytics early in their college career. Use of the project described in the paper in courses six times have proven that it can have an impact on student perception of data analytics.

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Appendix

1. Final Project Description

The ability to collect a data set, analyze, gain insights and communicate results in a manner that is powerful to a business client requesting business insights are a key set of skills that employers are currently demanding. Through this individual project, each of you will practice these skills by taking a real world data set and taking it through the different steps listed below. Your grade will be based on the complexity of the analysis provided, the discoveries you make and the story you develop to communicate your analysis
In this project, first you will choose a real world data set (Excel based) and analyze it to find interesting links and trends. Here are a couple of possible sources: data set list 1 (https://sqlbelle.wordpress.com/2015/01/16/data-sets-for-bianalyticsvisualization-projects/), data set list 2 (https://public.tableau.com/s/resources). You are free to use another source if you wish.

IMPORTANT - CHOOSE your data set wisely:
1. Make sure the Excel data set has at least 300 rows.

2. Examine and make sure you have interesting columns provided that can be used for analysis.(i.e., 5-8 descriptive variables/dimensions such as gender, product categories, location AND 2 or more numeric measures such as income, sales revenue). Make sure that 'time' is one of the variables you have in the data set. List the descriptive and numeric variables in your dataset. Selections will be awarded on a first come basis.

3. Identify 3-5 major questions you plan to investigate using the data set. I realize these may change as you analyze. However, make sure that you have 3-5 broad questions. Submit your questions along with your dataset.

4. Analyze the data using MS Excel, MS Access, Power BI and any other tools you choose. NOTE - Choosing a good data set is critical as it will drive the analysis you can do. Your grade will be based on the complexity of the analysis provided, the discoveries you make and the story you develop to communicate your analysis.

5. Present your findings at the end of the semester to the entire class.

The Three Major Milestones of the Project are:
Part One
In this first milestone, identify the questions you would like to address with the data set as well as the different types of variables in your dataset. The deliverables for Part One: (1) The 3 to 5 major questions, (2) List of descriptive variables and numeric variables submitted to the TEXT BOX on Canvas, (3) An Excel file with the data set you picked.

Part Two
In this project, first you will chose an existing data set, identify 3-5 main questions to investigate. Now you will analyze it to find interesting links and trends.
Provide analysis of data using techniques learned in class. This may include the use of pivot tables and charts, or spreadsheets with averages, formatted as tables, charts, etc. In addition, you will also use a BI tool - Power BI to visualize and further analyze the data.

Part Three (Presentation Slides)
Present your project to the class according to the details and rubric described by the instructor
Some guidelines on how to structure the presentation are provided to you as PowerPoint slides by the instructor. Make note that this is a FIVE MINUTE presentation.
Submit your presentation to this assignment. Please note that instead of a word document that provides a narrative of your analysis and discoveries with screen shots of analysis that explain your narrative, you can include more slides and other information to your presentation slides to give the instructor more insight into the overall analyses that you conducted.

4. **Power BI Tutorial**

In order to learn the basics on Power BI, please do the following:

1. Read the section on Building Blocks of Power BI (external link - https://docs.microsoft.com/en-us/learn/modules/get-started-with-power-bi/#step-3) to become familiar with the basic areas of this analysis tool.

2. Use the data set on financial data and follow this very short video (external link - https://www.youtube.com/watch?v=e2wDqspleNk) to create a two paged report using
Power BI desktop (available the lab). Note that the presenter goes through the video at a fast pace. You may need to slow it down to create the two page report. You can try to use the Power BI online version if you like.
Save your report with your name on it and submit to Canvas.

3. Watch the following tutorials found in this guided learning link (external link - https://docs.microsoft.com/en-us/learn/modules/visuals-in-power-bi/#step-1) to become familiar with various types of visualization which you can use to analyze data. This is help you better analyze your final individual project data set.

1. Visualizations 2m
2. Create and Customize Simple Visualizations 8m
3. How to Use Combination Charts 5m
4. Create and format slicers 7m
5. How to Use Map Visualizations 11m
6. How to Use Tables and Matrixes 8m
7. How to Use Scatter Charts 9m
8. How to Use Waterfall and Funnel Charts 5m
9. How to Use Gauges and Single Number Cards 7m
10. How to modify colors in charts and visuals 5m

6. **Final Project Presentation Guide**

Project Presentation Guidelines

Focus on the Story

- Stories have a beginning, middle, and end
- Describe the current situation, provide an analysis, lay out the options, make a recommendation, describe the likely outcomes
- Include specific examples

Establish the Setting

- Describe the setting in a way that is relevant to the listener
- Identify the business issues and challenges
- Support the description with data and let listeners know its source, accuracy, and relevance
- Try to take a unique and interesting perspective

Define the Characters

- Identify who is being affected – company's bottom line, customers, management, or employees
- This is where a personal experience can be effectively used

Define the Problem/Conflict

- Be strategic and keep the presentation simple, uncluttered, and tasteful
- Highlight the critical parts
- The more interesting the data analysis/visualization, the more time and attention the audience will give it

Show the Resolution and Future

- Use data analysis/visualizations to make predictions, layout alternatives, identify a recommended course of action, and show likely outcomes

Final Project Presentation Guide Rubric

Name _____

Presentation_____/50 Total Points

The presentation is a critical part of this project. It should be conducted professionally and should present a story surrounding the data context and the analysis.

The presentation should be 5 minutes long. You need to address why you chose the project, the need for data analysis, the analysis conducted & discoveries made and conclude by making recommendations, discussing unique insights or future direction. Make sure you tie it back to business, society or individuals that the data impacts.

	Strongly Disagree				Strongly Agree
The presentation was well organized.	1	2	3	4	5
Visual aids were well designed and used effectively.	1	2	3	4	5
The speaker had good presentation skills.	1	2	3	4	5
The presentation effectively described the background and relevant research questions for analysis	1	2	3	4	5
Effectively described the data analysis using techniques discussed in class	1	3	5	8	10
Effectively communicated the story behind the data analysis project	1	3	5	8	10
Concluded with recommendations, unique insights gained and/or future analysis options for your project.	1	3	5	8	10