# COMPUTER REPAIR PROGRAM FOR AN

# ALL-DIGITAL SCHOOL

A Project Presented to the Faculty

of

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In Partial Fulfillment
of the Requirements for the Degree
of Master of Business Administration

By
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CERTIFICATION OF APPROVAL

COMPUTER REPAIR PROGRAM FOR AN

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# DEDICATION

I would like to dedicate this project and degree to my parents, Arturo and Maria Albor. They have supported and encouraged me in everything I have wanted to do. Both have done a tremendous job raising my siblings and me. I love you for everything you have done for us and would love to pay you back tenfold. A special dedication for all my accomplishments to my father for the hard love and high expectations to attend a university and earning my degree. My efforts to strive for greater heights and never settling is based on his hopes for me as well as a reflection of his lack of opportunities growing up. He has been my role model my whole life and, I learned to always work hard and not complain. Even though, he had limited education, my most important lessons came from his wisdom, knowledge and taking nothing for granted. Words I live by: "Abusadillo desde chiquito. Use la cabeza. Pongase al tiro. Y hechele ganas!"

Secondly, I would like to dedicate this to my siblings. Without them, I would not be where I am today. They are a great support system, always willing to lend a hand and thankful for all they have done for me throughout the years. In addition to my siblings, I dedicate this to all my nieces and nephews. They have no idea, of the motivation they gave me to succeed. Because of them, I push myself in hopes that I

can become a role model or plant the idea to never settle or give up and continue working hard to achieve your goals.

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ABSTRACT

All-digital (K-12) schools provide students with laptops or tablets that help prepare them for a real world environment. At the same time, although providing high rewards, they also come with high risks such as embracement from all teachers, students, and parents, financing to purchase new digital devices every 3-4 years and networking equipment, and even additional technical support for all applications used by the students and teachers. Many all-digital schools running into these risks are abandoning the program due to financial obligations and technical support. After the financial and implementation efforts to go all-digital, districts must find additional means to maintain the success of the program. This project illustrates some opportunities that arise due to the risks of an all-digital school and how it may be beneficial to the district and students alike.

# CHAPTER I

# INTRODUCTION

## Background

As technology continues to grow, it is essential that society adapt to the ever-coming changes. Businesses as a whole are making large strides to invent and implement the newest and greatest when it comes to information technology. Just as businesses continue to embrace these new developments, the public is doing the same. Homeowners are implementing home server to store photos, music, and video with the whole family. A key contributor is the affordability of desktop and laptop computers relative to their capabilities and prices from a decade ago. Tablets, on the other hand, have been increasing in price, mainly due to the portability, additional features, and capabilities of such devices. However, generic tablets are less expensive. It is vital that society continues to build and prepare for the future. One of the preeminent means to accomplish this is through the education system.

School systems have many different programs that prepare students for college, work, and life in general. They provide students with many different opportunities for career preparation from a variety of different job fields. Some schools, for example, offer programs in nursing, child development, criminal justice, agriculture, building construction, and computer programming.

## SWOT Analysis

In recent years, schools have begun shifting away from traditional textbooks and implementing a one-to-one concept where each student in the school has their own laptop, Chromebook, or tablet, which is the substitute for traditional textbooks. This effect and externalities of the new model of education is not fully understood. A SWOT analysis, which looks at strengths, weaknesses, opportunities, and threats, is illustrated for an all-digital school/district as a baseline of information. Figure 1. All Digital school SWOT Analysis.

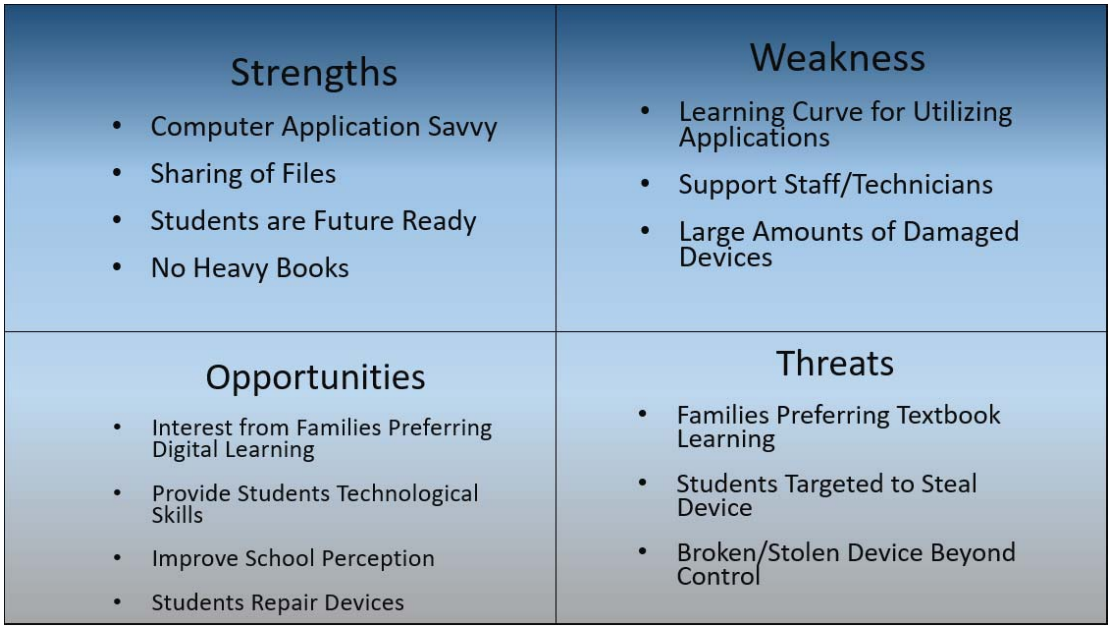


*Figure 1*. All-Digital school SWOT analysis.

In all probability, one of the most important strengths in regards to having an all-digital school is that students develop computer savviness in working with applications and other digital resources. A good example is skill building by working with Word documents, spreadsheets, and presentation slides, regardless of whether the students learn through Google or Microsoft Office platforms, the features are similar. Along with creating the documents, students learn a number of different ways to save and share (flash drives, email, and cloud storage) their files among classmates and teachers. In an article in the Modesto Bee, Director of Innovation Mike Rich said, "Future Ready gives students a chance to build computer and online skills they will need in college and their working lives" (Carlson, 2017). These types of skills help students become future ready by decreasing the learning curve when they reach college and begin working.

One of the weaknesses of an all-digital school is the learning curve for students and teachers. Like any new experience, it takes time to learn how to navigate or operate a computer, especially if the students have never used a computer before. This can be even more challenging for a student who has arrived from another country and is leaning a new language. Another weakness is continuous need for on-site technical support for the school. Regardless of whether the institutions is a small private school or a large public school, onsite technical support is necessary. From a frozen computer to a broken screen, onsite technicians must provide quick technical

support to return the students to their classrooms. The greatest weakness, perhaps, is the large amounts of damaged devices. The likelihood of having damaged devices throughout the school year is high, especially given the amount of utilization time.

One of the opportunities is the families' interest of having their children attend an all-digital school to take advantage of digital learning programs. Specifically, for schools offering English-speaking courses through programs like Rosetta Stone, an all-digital school provides the students with devices to take home in order to continue their learning without having to install, configure, or struggle with setting up on their home computers. In addition, an all-digital school provides the platform for students to expand their skills, knowledge, and/or interests. Having a laptop means students can experiment with programming, music, sketching, and many other applications that will broaden their abilities and, perhaps, even allow discovering a career interest.

An all-digital school gives the perception of higher learning and advancement, which may lead to increased enrollment of students, which may result in higher funding for the schools. The more funds a school has, the more opportunities that arise. An additional opportunity arising from an all-digital school is the learning opportunity that presents itself in the form of computer repair by having students repair the damaged devices. With the amount of students at a school, a chance for them to repair and learn appears to be well suited. Although, depending on the

circumstances, it may not be feasible (for example, if devices are on a lease or owned by the student, the school).

Some families prefer the old fashion textbooks instead of dealing with laptops, tablets, and the extra responsibilities that come along technology, such as affordability of insurance or damages to equipment. Another threat is students being targeted for their devices and becoming victims of theft. Regardless of how careful a student is, accidents are bound to happen. Devices will be broken, lost, or stolen in situations that are beyond the student's control.

After conducting the SWOT analysis, the author focused on the weakness of having a large amount of broken computers and exploring the opportunity to implement a computer repair program for students to resolve this problem. The first section of this project, chapters two through four, will illustrate the purpose, the current state of a program, and the target to decrease the amount of broken computers. The next section, chapters five through seven will explain the causes of the problem along with alternative solutions and an action plan for the most viable solution. Lastly, chapters eight and nine will provide a confirmation and conclusion of the project.

Since there are so many different device variations, devices, laptops, and computers will be used interchangeably when relating to Windows or Chromebook computers, as well as interchanging the terms all-digital school and one-to-one. The

project assumes that the school or district must own the computers. Normally on leased computers, companies will only allow their own certified technician repair the devices.

# CHAPTER II

## THE PURPOSE

The purpose of this project is to show the importance of implementing a computer repair program at an all-digital school. In relation to the SWOT analysis, all-digital schools have a higher probability of success due to the large amounts of broken devices. This project will demonstrate how a computer repair program is the most viable solution for handling damaged devices as well as providing learning opportunities to students. The financial analysis illustrates the benefits to a school or district and even to students' families, if they provide their own device, by presenting a computer repair program as well as other alternatives.

By introducing a computer repair program, students will gain experience, confidence, and most importantly, direction for their future. If the program is offered to juniors and seniors in high school, the program complies with many business requirements of having a minimum of two years of computer related experience. The program helps build students' confidence and expands their technical skills.

The most beneficial aspect is the sense of direction the program provides to a student after high school. Students in high school can experience if a career in computers is a field they would like to pursue. By realizing this at an early stage, it takes away much of the guessing and worrying about what to study in college or what

type of employment to seek out if the student goes straight into the work force. The importance of this paper is to convince schools and districts to implement such programs in order to help students determine what to do after high school.

## The Stakeholders

As with most new programs, stakeholders are affected. The stakeholders for a computer repair program are computer technicians, the school/district, students, and family and friends. Other affected parties could include insurance companies and third-party computer repair companies.

Computer technicians, depending on their role, may not be affected much. Some technicians may have the flexibility to repair some of the damage devices themselves. In this case, their job duties are affected by the change. This results in fewer devices for them to work on than in the past due to the students handling (most) of the repairs. Technicians that do not do the repairs themselves, but rather send devices out for repair to an outsourced repair company are unaffected by a student repair program. On one hand, some technicians will be affected by the amount of computers they repair, and, on the other hand, others will not be affected at all since they do not do the repairs themselves.

The school or district is also affected in a number of ways. First, looking into devices offered by the school or district and from a personnel standpoint, the amount

of labor hours would decrease because claims would not be filed, insurance companies would not be contact, devices would no longer be shipped, and fines on students would not be assessed for damaged devices. From a financial standpoint, funds used to purchase insurance (if provided by the school/district) can be used for other school programs. By eliminating insurance costs and purchasing just the replacement parts, a school can decide if the replacement parts will be paid by the school or pass the costs to the student's family. On the other hand, if a school has a BYOD (bring your own device) policy, not only does the student's family need to provide a device, the school would have recommended purchasing insurance as well. Based on information provided by Worth Ave. Group, insurance ranges from $45-$58 on devices worth $250-$450. Appendix A and Appendix B contain two full insurance quotes for two laptops of differing values (since quotes are for individual device, information collected shows a 50% discount offered to district).

Students benefit from such a program by learning about computer components including how they work and how to repair them. Students also benefit by declining insurance and its related costs and spending only on replacement parts (considering the schools do not cover the costs). In the author's experience in a one-to-one school, about half of the students purchased insurance. From the ones that did not, it is because perceived unimportance of insurance or lack of affordability for students' families.

Family and friends become beneficiaries with respect of having someone in proximity who can repair their personal computers. An additional advantage to family and friends is that the student can guide them into the best computer purchase to fit their needs. With student's increased savviness, they are capable of determining the necessary hardware specifications required to meet the uses of the device. Not all computers are made for the same purpose. For example, if the student, a friend, or family member would like a gaming computer, the student may recommend a computer with a better processor than one with a larger hard drive. In sum, the knowledge provided by the student will help family and friends save money in repairs and purchasing the ideal computer.

Students doing the computer repairs affect external stakeholders, including insurance and repair companies. Since students will do the repairs, these outside companies are no longer needed. Insurance for damaged computers will no longer be required, thus eliminating the need for insurance company services. Since the repairs will be completed by students, external repair shops will also not be needed.

# CHAPTER III

# CURRENT STATE

In order to determine where we want to be, we need to establish the current process of an All-Digital school. We will be using the following information as an example and reference any research to this current state. Along with the assumptions that the devices are owned and provided by the school or district. Table 8 contains a description of assumptions.

As a scenario, an all-digital school with 2,000 students receive a school/district provided laptop (or Chromebook). An additional 500 units are purchased for replenishment purposes totaling 2,500 devices. Based on data gathered by the author while working at an all-digital school, during a school year, there is an average of 25 broken computers per week, leading to 1,000 per school year (this does not account for 250 additional broken computers turned in at the end of the school year). By the end of the school year, approximately 1,250 devices are broken.

## Computer Repair Process

In order to have these computers back in rotation for the students, the devices are shipped to an outside computer repair shop. However, before being shipped, the on-site computer technicians first must check-in the broken computer, provide the student with a non-damaged computer, and file a claim with the insurance company.

Once the claim is processed, the insurance company provides a return merchandise authorization (RMA) to the technicians. Finally, the computer technicians box the device and ship it to the repair company. Appendix C illustrates the process.

On average, the turnover time to receive a computer from the repair company is about five days (from the time shipped). If broken computers are sent at the end of each week (25 at a time), the turnover time may be a week for all 25. However, if waiting until the end of the month to send all 100, then it may take a month to repair all 100. The turnover repair ratio for computers averages about 25 per week. Table 1 shows the time and cost of repairs when using a computer repair company.

Table 1

*School Conditions*

| Description | Units | Quantity | Total |
|---|---|---|---|
| Students | 2000 | | |
| Laptops | 2500 | $250 | $625,000 |
| Insurance | 2500 | $20 | $50,000 |
| Broken Computers | 25 Days/Week | 100 Days/Month | 1000/School Yr |
| Turnover Time at 5 days/device* | 125 Days/Week | 500 Days/Month | 5000/School Yr |
| *Includes Shipping Days | | | |

Based on the ratio of 25 broken computers per week, and an average turnover repair time of five days per computer, there will be about 5,000 days with computers being out of rotation. At this rate, it would take 20 weeks to go through all the

computers for replenishment, if no devices are returned from repair. Meanwhile, about 40% of the computers will be damaged by the end of the school year (50%, if including the extra 250 computers turned in at the end of the year). This leads to the problem of having a large amount of broken computers. The larger the amount of damaged computers, the more funds required to replenish the broken devices.

# CHAPTER IV

# TARGET STATE

By lessening the amount of damaged computers in rotation, the school or district is able to reduce the amount of backup computers used to replenish broken computers. Decreasing the additional investment mitigates the risk of terminating an all-digital curriculum due to unavailable funds. Lack of funding and poor planning are the main reasons contributing to the failure of an all-digital school. "Districts like Los Angeles and Fort Bend, Texas, who jumped on the tech trend without careful planning, have had problems with their programs to distribute a laptop or a tablet to every student, and are scrapping them, too" (Barshay, 2014). Many schools fail to maintain an all-digital school not because of funding, but because of improper planning and vision for the program. With the amount of resources required to implement an all-digital school program, it is a waste to make a run for a couple of years and call it quits.

## Key to Success

In order to improve the odds of success for one-to-one schools, financial cost improvements are imperative. A poorly managed all-digital school can typically survive in strong economic times, but weak economic times test the survivability of this school model. Weak economic times often call for a decrease in funds, a cut in

programs, and terminated or furloughed employees. In order to combat or improve educational funding (private or public), financial stability is key. For an all-digital school, it is vital to avoid unnecessary costs in order to maintain financial solvency.

Based on the current scenario one approach to reducing the financial burden is to alleviate the amount of broken devices out at a time. By decreasing the amount of damaged computers in rotation, the school/district can decrease the investment on initial computers for replenishment and thus improve financial efficiency.

The main goal is to lower the amount of funding on computers from $675,000 ($625,000 for the computers and $50,000 to insure them) to $575,000. As mentioned in the SWOT analysis, by decreasing the weakness of having a large amount of broken computers can contribute to accomplishing this goal.

CHAPTER V

GAP ANALYSIS

In order to identify the best solution, the largest gaps in relation to the current process and target state must be determined. A cause and effect diagram was used for this purpose. This diagram illustrates where most of the issues lie and where the most difference can be made in regards to the surplus of damaged devices. Figure 2 illustrates the major contributors to an increased amount of broken computers.

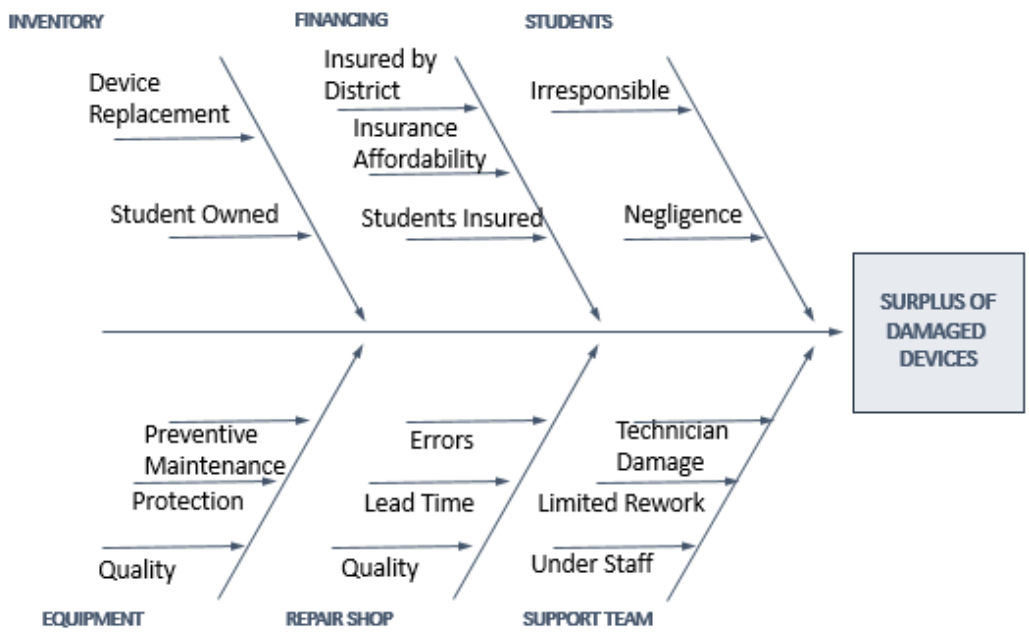


*Figure 2*. Causes of surplus of damaged devices.

## Inventory Causes

In regards to inventory, if the district provides the devices, they are limited to the stock on-hand. It is not enough to have one device for each student. The school or district must invest in additional devices as reserves in order to replace broken computers. When a student brings in a broken device, a new (or used) device is assigned to the student while an outside company repairs the broken computer. Once the broken computer is repaired, it is shipped back to the school and placed back into the available inventory until it is assigned to another student.

If the device is student owned, the student is typically responsible for having a replacement device or wait until his or her device is repaired. In this case, it may take valuable time from schoolwork depending on the severity of the damage. Regardless of who owns the computers, during the time the computers are out for repair, it decreases the number of students having a functional device, which results in a higher repair time turnover. A higher turnover leads to an increase of reserved laptops for replacement purposes.

## Financial and Insurance Causes

The higher the amount of laptop replacements, the higher the financial investment. Going back to the previous example, a school with about 2,000 students provides an additional 25% of computers in order to accommodate broken devices. If at the start of the school year, 500 (the 25%) are set aside as replacements for broken computers, it will take about 20 weeks to go through the 500 surplus computers at a

rate of 25 broken computers per week (500 surplus/25 broken per week = 20 weeks). If, during those 20 weeks, the damaged computers take an average of five days to be repaired at a rate of five per day, then the repair ratio of broken to repaired computers will be 1 (5:5), meaning, for every broken computer, one will be repaired (with a five-day lead time). However, if six computers are broken per day and the repair turnover is still five computers, the rate of broken to repaired computers will be 6:5 (or higher than one), meaning the original mark of 20 weeks decreases to about 16.6 weeks. As the ratio of damaged to repaired computers is higher than one, the more time, money, and investment is allocated to surplus computers.

By a school funding the devices to students, the pressure to maintain consistency and a successful program begins to build. Proper financial planning is important especially when the school or district account for insuring the devices as well. "Despite the potential benefits, however, many districts have run into trouble when attempting to implement one-to-one computing initiatives. Paying for the devices can be a challenge, especially as the strategy of issuing long-term bonds for short-term technology purchases has come into question. Many districts have also run into problems with infrastructure [bandwidth]" (Herold, 2015). By deciding to go - digital, schools are envisioning long term commitment, however, if financial planning is not up to par with the vision, the program may suffer and may result in termination of an all-digital school.

Whether a school covers device insurance or the costs are passed on to the students' families, the affordability and peace of mind of insurance coverage leads to student carelessness. A prime example is the same student walking into the tech room with a broken computer every other month with no worries because the device is insured. Based on information gathered from Worth Ave. Group, a Chromebook, which is a lower valued device, is priced at $250 and costs about $43 per year (based on the quote with $0 deductible) to insure. Using that quote, it costs $107,500 per year to insure 2,500 Chromebooks. Appendix A and Appendix B are sample quotes from the Worth Ave. Group webpage. The security of having insurance coverage leads to negligence of devices adding to the quantity of broken computers referring back to the same students having multiple broken devices.

## Equipment Causes

Defective equipment is another leading cause of the increased amount of broken computers. For example, defects in the form of keyboards, touchpads, wireless cards, speakers, and other hardware may be defective right from the start. Based on the author's experience, out of the 2,500 computers received, approximately twenty to fifty computers are defective. Out of the box. In addition, the absence of any type of equipment protection increases the chances of damaging a device, whether it is a missing sleeve, case, or even a bag to carry the computer.

## Technical Support Causes

Proper technical support is the key to a successful one-to-one program. It is essential for technicians to be on-site to examine the devices brought in by the students. On-site technicians must first determine if the problem is hardware or software related. Installing, updating, or re-installing drivers typically resolve software issues. However, hardware issues can be more difficult to resolve because of a lack of on-hand replacement parts. Therefore, the devices need to be shipped to an outsourced repair shop for restoration. This is an example of limited capabilities in terms of technical support. Even if the problem is a damaged hard drive and a technician can replace it in ten minutes, the device would still need to be shipped out for repair.

At the same time, in the process of troubleshooting a hardware problem, a technician may cause additional damage to the computer. An example may be breaking a cable connection while repairing a speaker problem. In the process repairing an issue, technicians may inadvertently cause a larger problem that requires sending the device for repairs and adding it to the count of already damaged computers.

## External Causes

So far, most of the reasons for the abundance of broken devices are related to factors within the school/district. However, one of the external factors accounting for the number of damaged devices is the repair companies. One of the ways they

contribute to the load of damaged devices is by the lead-time for repairing the devices and returning them to the school's inventory. The quickest turnaround would be three days, considering one day to ship, one day to repair, and one day to return shipment; however, it is unlikely repairs would consistently be this fast. A primary factor affecting repair turn-around is the availability of replacement parts, which may require purchase or be on back order. Additionally, setback errors among the insurance or repair companies contribute to the number of unavailable devices. Any problems related to RMA requests, shipping errors, and computer mix-ups delay the repair process. Quality of work by the repair company is also a contributing factor in the availability of devices. There are times when computers are received from repair and the problem persists because the wrong component was replaced or repaired, the work was not sealed properly causing problems for the students, or the connections were not secured thus preventing the computer to work properly.

## Student Causes

The greatest contributing factor to broken computers is the students. One of the reasons for the high number of broken devices is because of the irresponsibility of the students. This was experienced firsthand with students walking into the tech room mentioning the screen broke by closing the lid while a pencil was in between the screen and keyboard, dropping their backpack, walking with laptop screen open then bumping into someone, dropping the device from their desk, and even getting upset to the point they punch the screen. Students saying, "I'm not worried, I have

insurance", proved it throughout the school year. Second, some students are negligent by not realizing how fragile a computer is and before they realize what happened, the computer is already broken.

It can be difficult for a high school student to go a complete school year without breaking a digital device, much less go four years without breaking a digital device. If the district provides the devices, it is financially straining to afford to maintain such a program, especially during economic struggles and the inevitable number of broken computers. In order to combat the issue, discovering solutions to the causes will likely decrease the number of broken computers.

# CHAPTER VI

# SOLUTIONS

Using the cause-and-effect diagram and the issues leading to the amount of broken devices, solutions for reducing the amount of damaged computers can be considered. In respect to the inventory on-hand, it was determined in the previous chapter how 25% of additional devices would be purchased in order to replenish the broken devices from students. The additional computers cost the district approximately $100,000 (considering the extra 500 Chromebooks at $250 each). Chromebooks are near the lower end in costs, while Windows computers such as Lenovo, HP, and Dell cost over $500 depending on the models.

One approach to decrease the amount of broken computers is investing in computer screen protectors. During the 2016, school year at XYZ high school, seventy-six percent of damaged computers were a result of broken screens. Table 2 breaks down the issues and their respective percentages.

Table 2

*Computer Damages Amount*

| Issue | Monthly | Yearly | Percent |
|---|---|---|---|
| Broken Screens | 76 | 760 | 76% |
| Keyboards | 4 | 40 | 4% |
| Housing/Hinge | 8 | 80 | 8% |
| Battery | 4 | 40 | 4% |
| Other (Vol., Power) | 8 | 80 | 8% |
| Total | 100 | 1000 | 100% |

## Equipment Protection

The purchasing and use of a screen protector mitigates the amount of broken screens. This would in turn, allow the district to lower the computer replenishment inventory. The average costs of screen protectors is about $20 for a 15" tempered glass products currently available from Amazon.com. Based on collected data from XYZ School, there were about 1000 broken screens during the 2016 school year. By adding tempered glass screen protector, it is possible to decrease the total to 500 broken computers screens. Table 3 compares the costs if screen protectors were used while eliminating insurance on 60% of the replenishment computers.

Table 3

*Screen Protection Approach*

| Description | Scenario A Current State | Scenario B Screen Protection | Difference |
|---|---|---|---|
| Number of Devices | 2500 | 2200 | 300 |
| Costs of Devices at $250 | $250 | $250 | |
| **Total Cost of Devices** | $625,000 | $550,000 | $75,000 |
| Insurance per Device at $20 | $20 | $0 | |
| **Total Insurance Costs** | $50,000 | $0 | $50,000 |
| Tempered Glass Investment at $20 | $0 | $20 | |
| Tempered Glass Total Cost | $0 | $44,000 | |
| **Total Costs** | $50,000 | $44,000 | $6,000 |
| Grand Total of Costs | $675,000 | $594,000 | $81,000 |

Based on the table above, despite the fact that the price of insurance equals the price of the tempered glass screen protector, the difference in grand total costs is the additional 300 units purchased for replenishment of $81,000. Nevertheless, by investing in the tempered glass, it does not mean it will protect every computer screen from being broken and it does not resolve the problem in regards to other damaged components. Therefore, the costs may still outweigh the benefits.

## Technician Repair

A second approach is to have computer technicians repair the devices. Table 4 compares the current state to a technician repair scenario. Estimates are based on 1,000 broken computers per school year with a technician salary of $26 per hour. Appendix D provides detailed information on replacement part costs (LCD screen, digitizers, keyboards, batteries, etc.).

Table 4

*Technician Repair Approach*

| Description | Scenario A Current State | Scenario C Technician Repair | Difference |
|---|---|---|---|
| Number of Devices | 2500 | 2200 | 300 |
| Costs of Devices at $250 | $250 | $250 | |
| **Total Cost of Devices** | $625,000 | $550,000 | $75,000 |
| Insurance per Device at $20 | $20 | $0 | |
| **Total Insurance Costs** | $50,000 | $0 | $50,000 |
| # of Damaged Devices at 30 min/repair* | 1000 | 1000 | |
| Technician Salary per Half Hour* | $0 | $13 | |
| **Total Labor Costs** | $0 | $13,000 | -$13,000 |
| Replacement Parts Average. | $0 | $25 | |
| **Total Cost Replacement Parts** | $0 | $25,000 | -$25,000 |
| **Subtotal Labor and Parts** | $0 | $38,000 | -$38,000 |
| **Grand Total Costs** | $675,000 | $588,000 | $87,000 |
| *Estimates | | | 0 |

*Note*. Cost estimates from Appendix D and cited in Reference section.

Table 4 shows that using technicians for repairs can offer a savings to the district of approximately $87,000. The advantage to scenario C, technician repair, unlike scenario B, screen protection only, is that technicians are capable of repairing all damages done to the device (while scenario B only focuses on broken screens). The technician repair solution decreases costs by allowing a district to purchase fewer devices and eliminates the need for insurance. On the other hand, the disadvantages require technicians to spend about 500 hours completing the repairs, which equates to about twelve and a half weeks of work. The amount of time allocated to the broken computers may put a strain on other work technicians must do or it may create an under staffing issue.

## Computer Repair Program

A third approach to decreasing the amount of damaged devices is to offer a computer repair program to the students. The repair program will allow students to repair the damaged computers without the district having to purchase insurance or send the damaged computers for repair. Table 5 compares the current state to a computer repair program.

Table 5

*Computer Repair Program*

| Description | Scenario A Current State | Scenario D Computer Repair Program | Difference |
|---|---|---|---|
| Number of Devices | 2500 | 2200 | 300 |
| Costs of Devices at $250 | $250 | $250 | |
| **Total Cost of Devices** | $625,000 | $550,000 | $75,000 |
| Insurance per Device at $20 | $20 | $0 | |
| **Total Insurance Costs** | $50,000 | $0 | $50,000 |
| Number of Damaged Devices at 1 Hour/Repair* | 1000 | 1000 | |
| Student Salary (not applicable) | $0 | $0 | |
| **Total Labor Costs** | $0 | $0 | $0 |
| Replacement Part/Computer Avg. | $0 | $25 | |
| **Total Cost Replacement Parts** | $0 | $25,000 | $25,000 |
| **Subtotal Labor and Parts** | $0 | $25,000 | $25,000 |
| **Grand Total Costs** | $675,000 | $575,000 | $100,000 |

*Note*. Cost estimates from Appendix D.

Based on the information in Table 5, the computer repair program provides an increased savings of $100,000 to the school district. This scenario also provides additional savings of $15,000 by not paying a computer technician. Another advantage includes the reduced number of replenishment devices purchased (2,200 total devices instead of 2,500), no insurance costs, no shipments to an outside repair

company, and no additional protective accessories. An additional advantage is the experience students' gain by doing the repairs themselves. Overall, the student repair program is the most appealing solution as it offers the most cost savings and provides hands-on training to students.

# CHAPTER VII

# ACTION PLAN

In order to implement a computer repair program for students at a school, there needs to be a number of things in place, including storage space for the broken computers, workstations, and tools. However, before jumping straight into the repairs, students will need some classroom instruction to understand the components, processes, and safety measures required when working with electronics. There are other educational procedures that must be followed to implement such a program, but that is beyond the scope of this project.

## Program Material

Once the storage and workspace is established, the primary objective is to train the students. The CompTIA A+ curriculum and study materials can prepare students for computer repair as well as a professional certification that is valued in business and industry. The CompTIA A+ certification curriculum could be implemented in tandem with the hands-on training, which will produce a job-ready student upon graduation. The CompTIA A+ course is composed of two sections, 220-901 and 220-902. Table 6 breaks down the major objectives of each section. Section 220-901 deals with hardware, whereas section 220-902 focuses on the software side.

Table 6

*CompTIA A+ Objectives*

| 220-901 Objectives | 220-902 Objectives |
|---|---|
| 1.0 Hardware | 1.0 Windows Operating System |
| 2.0 Networking | 2.0 Other Operating Systems & Technologies |
| 3.0 Mobile Devices | 3.0 Security |
| 4.0 Hardware & Network Troubleshooting | 4.0 Software Troubleshooting |
| | 5.0 Operational Procedures |

Ideally, the first three to six months of a student's training would be allocated to in-class instruction. This gives students time to master the concepts covered in both sections of the CompTIA A+ curriculum. When estimating the amount of hours in a six-month semester, there are about sixty-four hours, which provides enough time for students to complete coursework for the both sections of the CompTIA A+ curriculum. Since the school is all-digital, it is likely an eBook or online course be utilized along with lecture and quizzes so students get accustomed to test taking should they decide to take the CompTIA A+ exam. One of the available materials for this program is the CompTIA A+ Certification All-in-One Exam Guide, Ninth Edition (Exams 220-901 & 220-902) by Mike Meyers and published by McGraw Hill Education. This textbook also comes in an eBook format, perfect for an all-digital school and includes some practice exams. The practice test results will highlight for students the areas for improvement should the student pursue the CompTIA A+ credential.

The CompTIA A+ program is more than a student would need to prepare for computer repair. A beginner's book to computer components could also be used for the classroom instruction to prepare students for computer repair. An example of the type of material that could be used is the text *Upgrading and Repairing PCs 22nd Edition.* This text provides students the general concepts for upgrading components, understanding component function, troubleshooting skills, and repairing skills need for replacing components. However, many other texts could be used to teach students the concepts of computers. In addition to the instructional materials, the computer manual will also guide students on the use of proper part numbers as well as on how to replace computer components for specific computers.

## Computer Repair Tasks

When working on computer repairs, there will be a vast array of computer problems. Either computer issues will be software (operating system, applications, driver, etc.) or hardware related (physical components). Students will be dealing with the hardware repairs while computer technicians deal with software related problems. Table 7 lists a few of the hardware related issues, while Table 8 lists the most common replacement parts.

Table 7

*Computer Tasks*

| Computer Tasks | | |
|---|---|---|
| Broken/Missing Keyboard keys | Wi-Fi not Detected | Audio Jack not Working |
| Battery not Charging | Internet not Loading | Speakers not Working |
| Computer not Powering | Broken Housing | Liquid Damage |
| No Boot Device Found | Broken Power Button | Broken USB Ports |
| Black Screen (Does Power On) | Broken Digitizer | Power Port not Working |
| Keyboards/Keys | Power Button Broken | Lid Housing Cover Broken |
| Battery Not Connected | Wireless Card Replacement | Bottom Housing Cover |
| Unresponsive Digitizer | LCD Display Replacement | RAM (Random Access Memory) |

Table 8

*Replacement Parts*

| Replacement Parts | | |
|---|---|---|
| Keyboards/Keys | Power Button | Lid Housing Cover |
| Battery | Wireless Card | Bottom Housing Cover |
| Digitizer | LCD Display | RAM (Random Access Memory) |
| Camera | Audio Jack | External Speakers |

All these projects can be assigned to students depending on the student's comfort and skill level. Some of the repairs may take a few minutes, while others are more complicated and may take some students a few hours or even a couple days to complete. Appendix E, F, and G contain examples of repair components for a Chromebook.

Aside from purchasing replacement parts, specialized tools are also required to do the work. Tool provision can be managed in a couple of different ways. Each student can be provided with their own tool kit or a class set can be checked out to the student during each class or work session. The latter of the two options is more cost effective, but if a district can finance it, then a tool kit for each student is ideal as it allows students to work beyond the time spent in the classroom or doing repairs.

There are many different options for toolkits, but a practical choice is the ORIA 76-in-1 Precision Screwdriver Set. The toolkit includes a 60 in 1 magnetic screwdriver set, update 2 set for iPhone7, utility knife, anti-static tweezers, SIM card ejector pin and LCD suction cup, triangle plectrum, plastic spudgers, metal spudger, stainless steel ruler, and an anti-static wrist strap. A toolkit like this costs about $30 [Computer tool kit product advertisement] (2017n.d.). (As of 09/14/17). Appendix H is an illustration of the toolkit contents. Along with the toolkit, other needed tools are a magnetic mat and screw driver holder to keep all the parts and screws together.

By implementing a student-run computer repair program, the district will save money on inventory, insurance, and repair turnover, and it will engage students in active learning. Students will gain an understanding of the terminology, components that comprise a computer, the purpose of each component, and the proper parts needed to upgrade a computer. In the latter stages of the program, students will apply their classroom learning to real-world computer repair.

# CHAPTER VIII

## CONFIRM STATE

All projections derived from this study show a student-run computer repair program will be cost effective with the added benefit of promoting real-world active student learning. Tables 9 shows the financial and time investments involved in running an all-digital school using a third-party computer repair company to maintain devices. Table 10 show the financial and time investments involved in running and all-digital school using a student-run computer repair program.

Table 9

*Time and Financial Investment Using Third –Party Computer Repair Company (Current Condition)*

| Description | Units | Quantity | Total |
|---|---|---|---|
| Students | 2000 | | |
| Laptops | 2500 | $250 | $625,000 |
| Insurance | 2500 | $20 | $50,000 |
| Broken Computers | 25/Week | 100/Month | 1,000/School Year |
| Turnover Time at 5 days/device* | 125 Days/Week | 500 Days/Month | 5,000/School Year |
| *Includes Shipping Days | | | |

Table 10

*Time and Financial Investment Using a Student-run Computer Repair Program (Proposed Condition)*

| Description | Units | Quantity | Total |
|---|---|---|---|
| Students | 2000 | | |
| Laptops | 2200 | $250 | $550,000 |
| Insurance | 2400 | $0 | $0 |
| Broken Computers | 25/Week | 100/month | 1,000/School Year |
| Turnover Time at 2 days/device** | 50/Week | 200/month | 2,000/School Year |
| **No Longer Requires Shipping | | | |

## Financial Results

By saving an additional $100,000 per year ($125,000 if students pay for the damaged parts), during a three-year span, the school or district will be saving $300,000 ($375,000 if students pay for the damaged parts). The savings is about 47% the cost to purchase a new set of devices at the beginning of the fourth year (since laptops tend to have a life span of about three to four years). In a span of eight years, the new set would pay for itself through the implementation of the student-run computer repair program.

Financial results favor the continuation of an all-digital curriculum. In addition, by implementing a computer repair program, device repair turnover time decreases to two days. The main reason for the decrease in repair turnover is the

elimination of shipping time to and from the repair company. The elimination of shipping results in a savings of 5,000 to 2,000 days within a year. Such a decrease allows the school to maintain a smaller replacement inventory, which, in turn, decreases the amount of money spent on the one-to-one program.

## Opportunity Results

More importantly, the opportunity a computer repair program provides to the students is more difficult to measure in this nascent stage of the all-digital education model. How many students will participate? How many will pursue a career in computers? Although these questions may not be answered right now, with additional choices or opportunities provided to the students by a school, more possibilities students have to explore and evaluate which interests are worth pursuing and which are not. Even if students take part in the computer repair program and realize it is not a career for them, they apprehend it at an early time where they can still pursue other interests without spending as much time and/or money as if they did in college.

# CHAPTER IX

# CONCLUSION

## Advantages

In respect to schools or districts, as demonstrated in Chapters VII and VIII, financial costs would decline in the all-digital model when a student-run computer repair program is implemented. The student-run computer repair program provides a cost savings of $75,000 by purchasing 300 fewer devices as oppose to the original 500 needed to ensure an adequate supply of replenishment devises. In addition, the student-run computer repair program eliminates the need for insurance that allows for an additional savings of $25,000. A student-run computer repair program provides a school or district with a total savings of $100,000. Financially, the computer repair program makes sense.

According to the Public Policy Institute of California, "California's public schools receive funding from three sources: the state (57%), property taxes and other local sources (29%), and the federal government (14%). The proportion of funding from each source varies across school districts. The majority of revenue (almost 70%) is unrestricted general purpose funding. The remainder is restricted categorical state and federal funding earmarked for special programs and purposes such as special education, class size reduction, and the National School Lunch Program" (Weston, 2011). Therefore, it is possible to increase funding for the school by increasing school attendance as well as new program implementation.

As for the students, if the insurance that came out of their pockets, or that of their families, will no longer need to be purchased. The flipside is that instead of purchasing insurance, they may be required to purchase replacement parts (depending on implementation by the schools). This, however, may promote students being responsible for their property as opposed to students being careless and letting the school or insurance pick up the costs.

Many high school students do not know what to pursue when they graduate from high school. A computer repair program may provide some with a career interest to pursue. One student from Buhach High School stated, "I took two computer classes my senior year and fell in love with computers. I think it's so important to get a head start on these things and have real-world experience. This is what I want to do for the rest of my life" (Calix, 2017). A computer repair program also provides students with a couple of years of experience, which is what most organizations require when hiring new individuals. At the same time, the early exposure to computers provides students the opportunity to determine if a career in the computer industry is right for them. Even if a student decides their future is not in the computer industry, they have made a decision early in the career trajectory, which allows them to change course with minimal time and financial investment.

## Disadvantages

A disadvantage for the school or district may be the amount of errors committed by students while repairing a computer. When repairing a broken screen

for example, it is possible that the new screen is broken during the attempted repair or that not all cable connections are connected properly. In this case, the financial gains would not be as large as previously estimated. To mitigate student error, a school or district should encourage students to take their time and pay attention to detail. Student error can also be minimized by assigning repair tasks to students based on the individual skill or comfort level of the student. If at any point a job is too complicated for the students, the task can be handed off to the computer technicians to complete.

Concerning students, the biggest disadvantage is maintaining discipline. Whether it is staying on task or trying to hack a system, some students will try to push the envelope. The author has experienced students at an all-digital school hack, modify, and make other efforts to go around built-in securities on the machines. However, the same students that hack the machines generally have an interest in expanding their skills. Another disadvantage to students may be the inconsistency in the amount of hands-on repairs. At times, student may be under pressure to increase their productivity, while at other times they will experience a lull in repair activity.

## Concerns

The biggest concern of implementing a student repair program is the job security of the computer technicians. If students are doing all the computer repairs, what will the technicians have left to do? It is important to note that in this project, the current state of the all-digital model, computer technicians were not doing the

computer repairs anyway. An outside repair company was doing the repairs. Secondly, computer technicians are still needed to do all the other support duties. For example, computer technicians not only support the students with computer issues (mainly software related), they also support the teachers and administrators. The only changes in the repair process is having students handling them in-house as oppose to shipping the devices to an outside company.

## Conclusion

The SWOT analysis broke down some of the key aspects to an all-digital school, and made it clear where a weakness could turn into an opportunity. The cause-and-effect diagram helped narrow the leading contributors to the amount of broken computers. Based on the causes, three possible solutions were introduced; increasing protection to devices (by installing a tempered glass on the screen), have technicians handle the computer repair, and providing a computer repair program for students.

Out of the three possible solutions, the one with the largest financial gains and faster repair time is the computer repair program. The program can save a school/district about $100,000 per year by decreasing the amount of computers purchased and eliminating insurance costs. Over a four year period (i.e. the life span of a computer), the financial savings of a computer repair program allows the program itself to fund about 73% of the cost of a new set of computers (55% for three years).

A computer repair program can be implemented in many different forms. For example, aside from just repairing the school computers and saving costs on insurance or additional computers, the program can take it a step further and even raise funds for the school. Burlington High School in Massachusetts did just that and some student technicians repair computers for local residents. The profits from the student computer repair program are used to support the continued technology needs of the school (Sheehy, 2012). Any student computer repair program has the potential to grow a branch of the program into a business environment where profits are put back into the technology program and help the program and the school become self-funded. Although the program is supported financially, the opportunity students receive may be more beneficial.

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# REFERENCES

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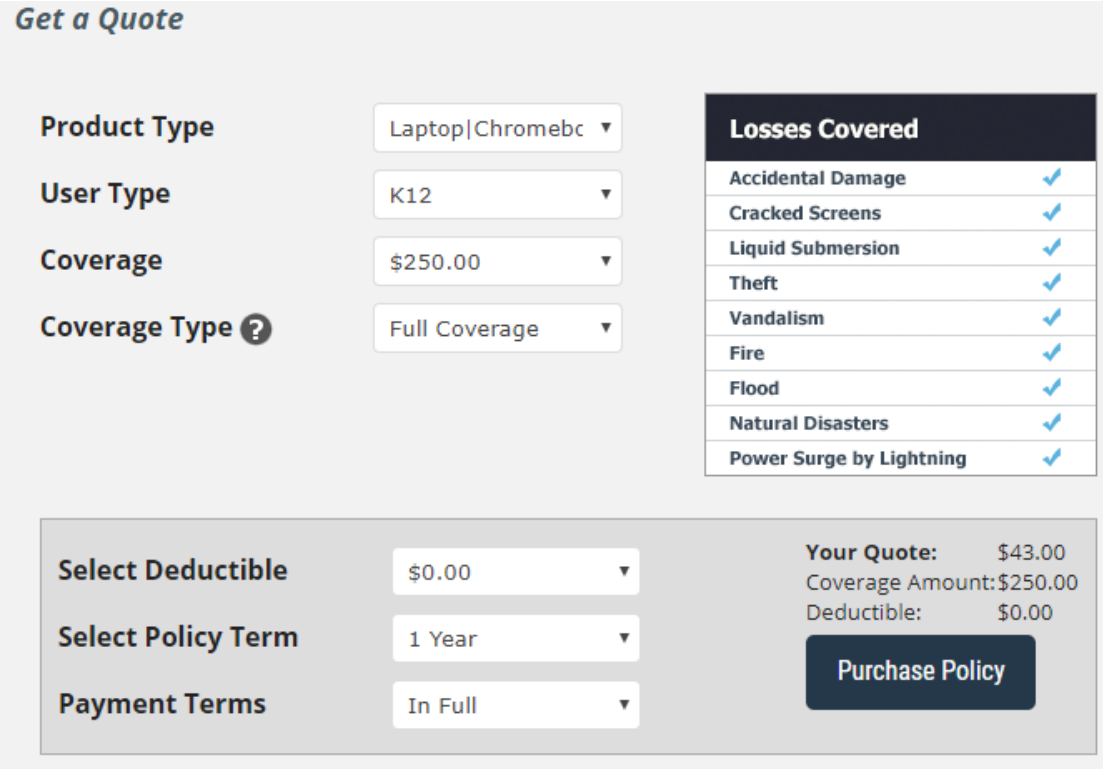
# APPENDICES

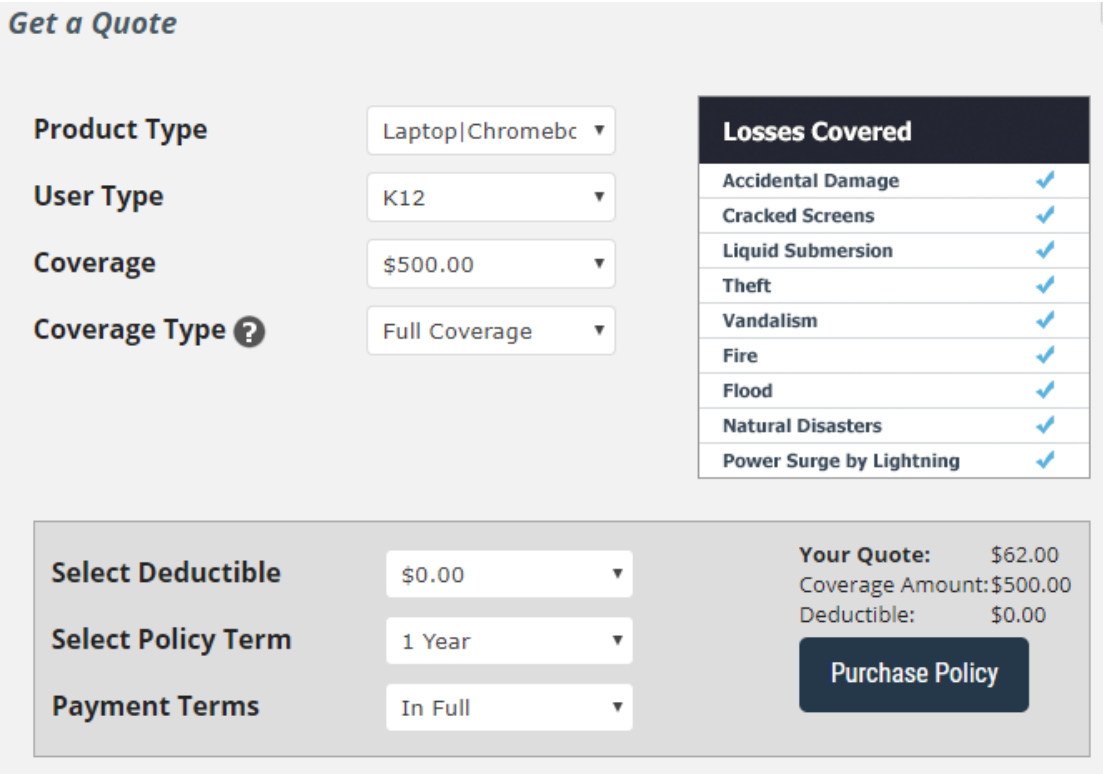
# APPENDIX A

## INSURANCE QUOTE FOR $250 LAPTOP



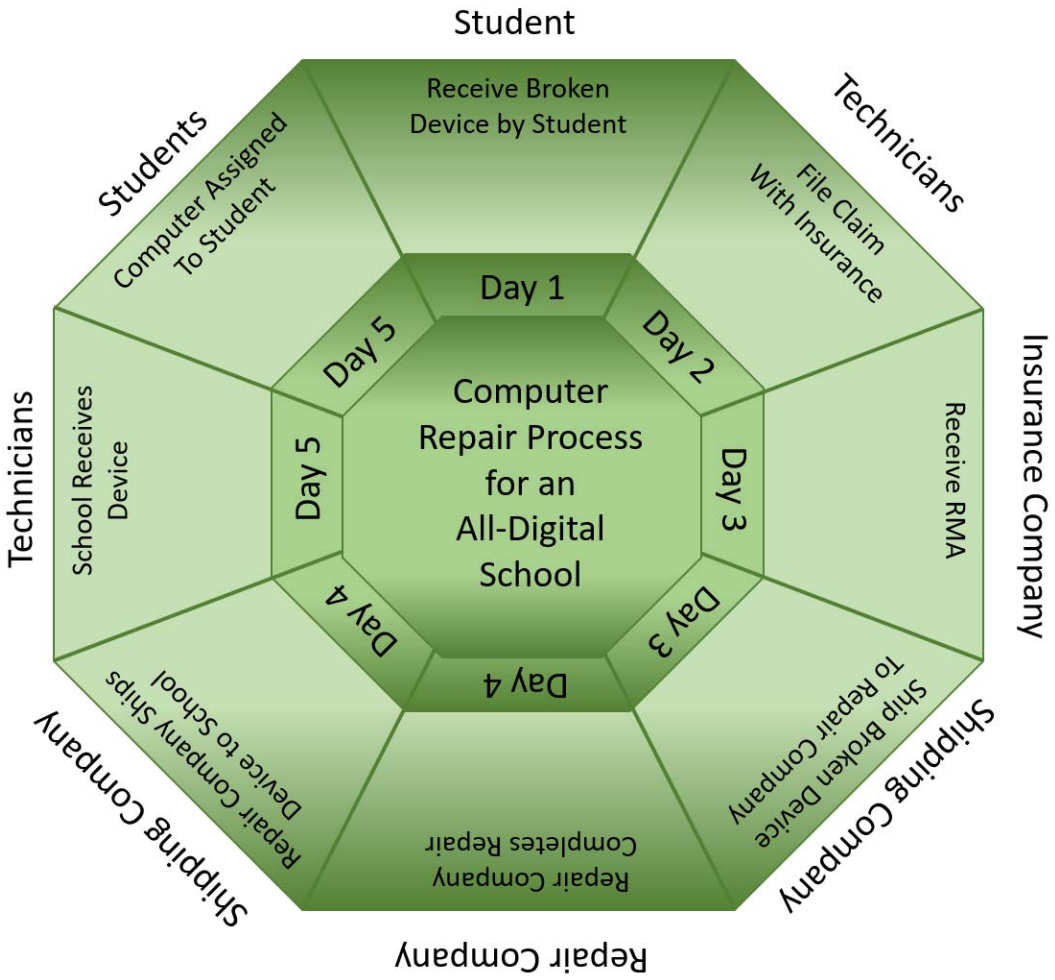
# APPENDIX B

## INSURANCE QUOTE FOR $500 LAPTOP



APPENDIX C

COMPUTER REPAIR PROCESS FOR ALL-DIGITAL SCHOOL



# APPENDIX D

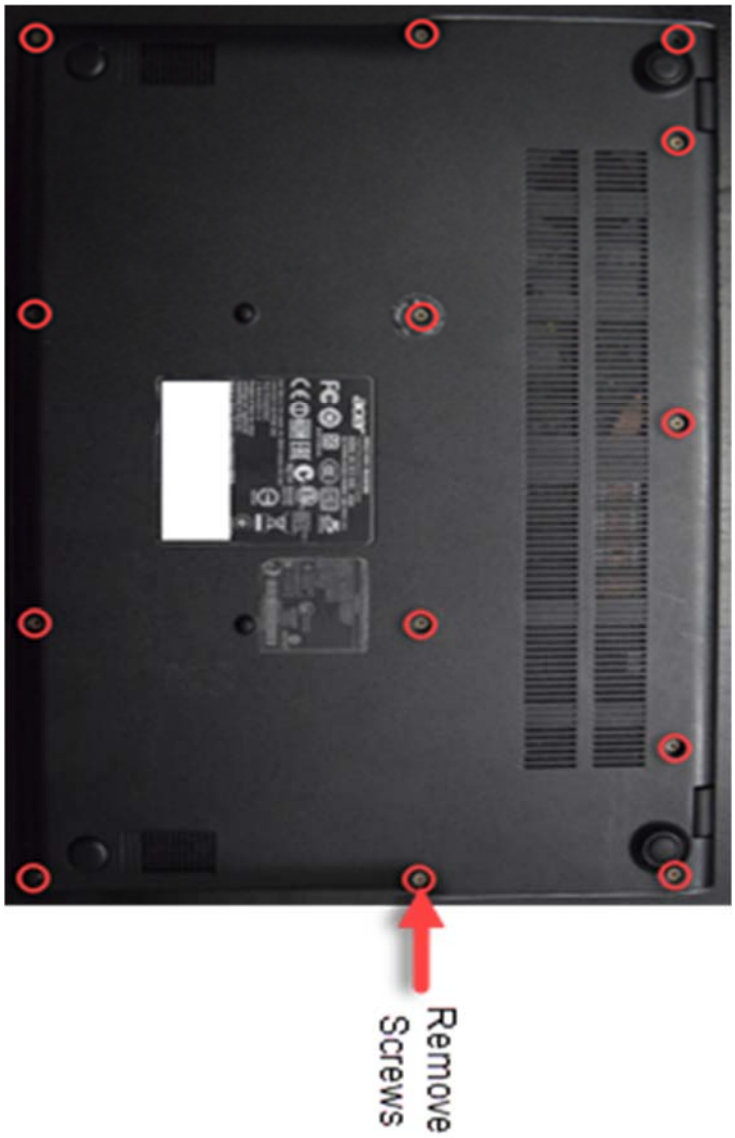
## COST OF REPLACEMENT PARTS

| Part | Price | Broken/Year | Total Costs |
|---|---|---|---|
| Digitizer | $15 | 760 | $11,400.00 |
| LCD Screen | $30 | 5 | $150.00 |
| Keyboard | $20 | 50 | $1,000.00 |
| Battery | $30 | 40 | $1,200.00 |
| Hard Drive | $20 | 70 | $1,400.00 |
| Top/Bottom Cover | $35 | 80 | $2,800.00 |
| Total Costs | $150 | 1,005 | $17,950.00 |
| Average | $25 | | |
| **Based on 1000/Year | | | |

*Prices are as of October 24, 2017 and cited in Reference section.

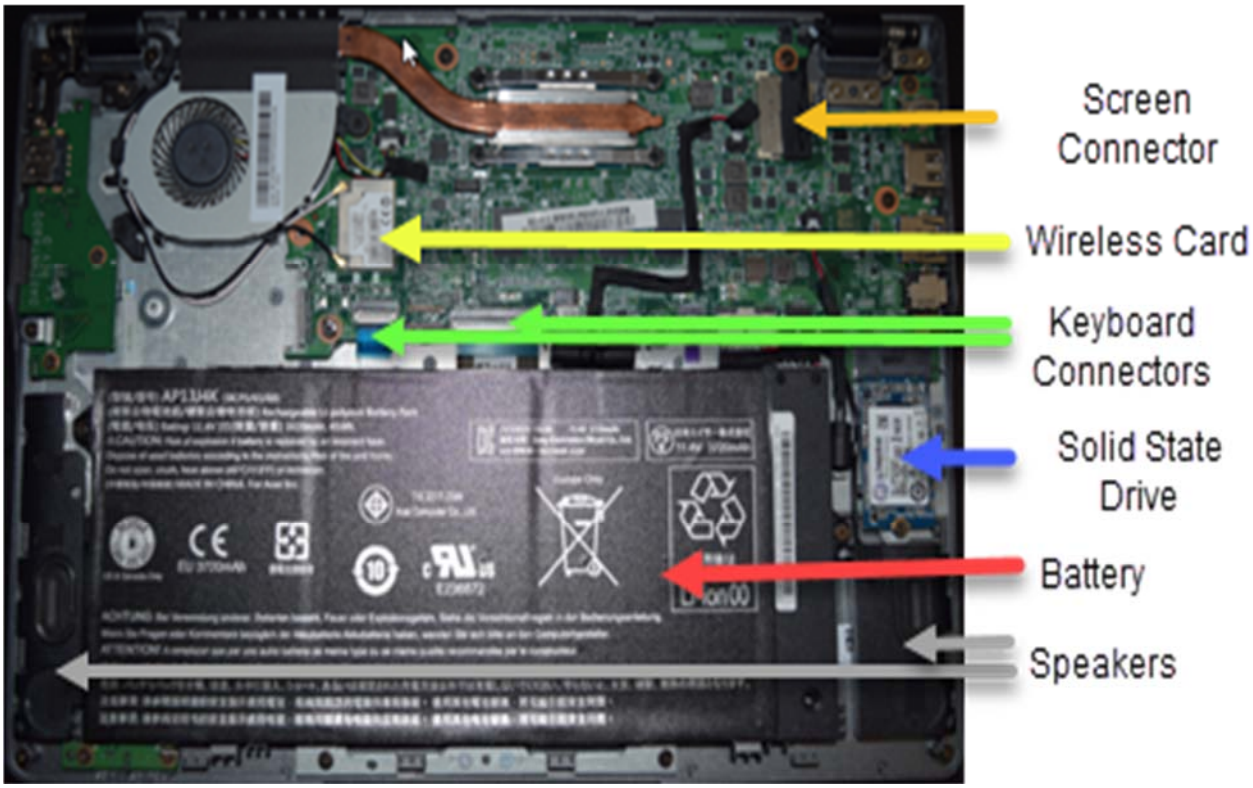
APPENDIX E

BOTTOM HOUSING



APPENDIX F

MOTHERBOARD




APPENDIX G

SCREEN REPLACEMENT


APPENDIX H

COMPUTER REPAIR TOOL KIT

ORIA

ORIA 76-in-1 Precision Screwdriver Set with Magnetic Driver Kit, Repair Tool Kits With Portable Box For iPad, iPhone, Laptops, PC, Smartphones, Watches and Other Devices

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Size: **76-in-1 Screwdriver Set**

| 54 in 1 52 Screwdriver Set | **76-in-1 Screwdriver Set** | 86 in 1 Screwdriver Set |
|---|---|---|
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| ✓prime | ✓prime | ✓prime |