An Investigation into the Pharmaceutical Sciences Media Wall

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ABSTRACT

The purpose of this investigation was to research alternative technologies that can be used as a replacement for the current Pharmaceutical Sciences Media Wall. The Media Wall is part of the exhibit, "The Story Medicines", in the UBC Pharmacy building and is used to display pharmaceutical information. There are four main problems associated with the current media wall. There is high maintenance costs associated with bulb replacements each year. The spacing of the rear throw projectors causes an uneven light distribution which creates large shadows on the screen. The projectors consume a large amount of power to operate and due the software being proprietary; there are problems with updating software and flexibility in displaying content. A preliminary analysis was performed on four different technologies, one of being the current setup. This includes projectors, LCD, LED, and MicroTile screens; it was found that MicroTiles would be the most reasonable in the long run due to its low maintenance costs. It also provides flexibility in the design of a media wall. After performing a triple bottom line analysis, the effects of MicroTiles on a social aspect was mostly beneficial as it would solve the issues regarding the shadows in between screens and the use of proprietary software. On the other hand, MicroTiles were not the best economic choice due to the very expensive capital cost. Savings could only be made from the reduced maintenance cost. MicroTiles were the environmental choice as they do not include materials such as mercury, phosphorus, or toxic coolants; thus; they comply with the Restriction of Hazardous Substances (RoHS) Directive. MicroTiles consist of a solid metal housing and removable internal components that are 80% recyclable and 90% recoverable. After evaluating the triple bottom line, Christie MicroTile is recommended for use.

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GLOSSARY

Bezel - The outer rim surrounding the display.

Edge Blending - Technical solution used to deal with overlapping edges between different produced images in attempt to create a seamless image.

Digital Light Processing (DLP) - A reflective image processing technology used in projectors.

Restriction of Hazardous Substances (RoHS) - This is a directive that places a limitation on the use of six hazardous materials in electrical equipment. This includes lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, and polybrominated diphenyl ether.

Christie - Christie Digital group, part of Ushio group of companies, manufactures and sells DLP, DLP projectors and various other digital cinema devices.

MicroTile - Product of Christie Digital group, modular DLP display units that uses LED light sources.

LIST OF ABBREVIATIONS

DLP - Digital Light Processing

LCD - Liquid Crystal Display

LED - Light Emitting Diode

RoHS - Restriction of Hazardous Substances

UBC - University of British Columbia

1.0 INTRODUCTION

The University of British Columbia (UBC) Pharmacy building which officially opened on 18th of September, 2012 contains an interactive exhibit entitled "The Story of Medicines" which communicates pharmaceutical contributions to interested individuals and parties. The Media Wall is the largest exhibition zone by size; it displays pharmaceutical and human health information in short sentence form. A year into operation, several problems were noted.

Firstly, the maintenance cost of the current system is high; the replacement of the projector lamps mounts up to tens of thousands of dollars in itself, adding onto the labour cost. Furthermore, the projectors require a significant amount of power to run which not only increases the cost of operation but also affects the environment in a negative way.
The current setup causes shadows to appear between each projected image, disrupting the aesthetics of the Media Wall and takes away from the desired effect. Another issue of concern comes from the fact that the software is proprietary, resulting in extremely inconvenient software updates and technical support.

Drawing upon these issues, this report will compare different display technologies available, evaluate them, then propose and explain in detail our choice for replacement.

2.0 TYPES OF DISPLAYING TECHNOLOGIES

2.1 Projectors (DLP, LCD, and LED)

There are two types of commercial projectors: transmissive and reflective. DLP projectors are categorized under reflective projectors as they use mirrors to direct the light in an image. They consist of millions of microscopic mirrors that are capable of adjusting the distance from the light source to form a dark or bright pixel. In order to feed these pixels with colors, the light beam passes through a spinning color wheel. On the other hand, LCD projectors have the light emit through an LCD panel rather than off a surface. LCD projectors create images by emitting a white light beam that passes through three mirrors. Adjusting the electrical current through the liquid crystal solution allows only certain light wavelengths to reflect. Each of the three LCD panels forms an identical image with a different hue, which then combine in a prism to form the final image. LED projectors are named for their light source as they can be transmissive or reflective ("Understanding the Differences", 2013).

2.2 LCD Screens

LCD screens use liquid crystal displaying technology consisting of two polarized glass sheets. The polarized glass functions as a filter, which allows only certain wavelengths of light to pass through. Contained within this structure is a liquid crystal fluid that shifts by varying the current in a particular area. By adjusting this current accordingly, some liquid crystal regions will become transparent and others will be obstructed, allowing specific wavelengths to pass through. LCD screens are backlit by a cold cathode fluorescent lamp located behind the LCD panel.

2.3 LED Screens

LED displays are essentially an array of green, red, and blue diodes arranged into a matrix to form pixels on a screen. LED displays produce color by lighting up the LEDs at different brightness and produce complete black by turning off all of the LEDs rather than mixing different shades of colours (Aversa, 2006. This results in vibrant colors and great contrast compared to conventional LCD displays. The pixel density of the screen can be adjusted by changing the pixel pitch (i.e. distance between each pixel), potentially reducing the number of LEDs needed to create a LED display. Resolution can be adjusted by utilizing LEDs with larger or smaller diameters for each pixel.

3.0 COMPARISON OF ALTERNATIVE TECHNOLOGIES

3.1 Social

The bezel of the LCD and LED panel leave a slight space between each display which is not aesthetically pleasing to the public who view the display. Furthermore, it does not solve the initial problem of seams between each segment stated by the stakeholder. Most projectors also suffer from the same problem much like the current setup. In terms of material sourcing, there are not many local companies that would manufacture a display of this size. As a result, with any type of screen, they would need to be imported internationally.

3.2 Economic

The following is a tabulated result of the costs and power consumptions associated with the four alternate technologies we considered. The measurements were based on the assumption that the different technologies cover the same area of content display. This area requires 20 LCD or LED screens, 100 MicroTiles, or 6 projectors in order to display the same content with variant resolutions and quality. The size of the LCD or LED screens taken into account were 55 inch, and due to a mismatch between the resolutions of the LCD screen with the other technologies, the power consumption rate is incomparable.

Technology	Cost (Canadian $)	Power Consumption (W)
Projectors	24,000	4,680
LCD	N/A	N/A
LED(4k resolution)	98,000	4,425
MicroTiles	288,000	7,900

Table 1: Comparison of Alternative Technologies

MicroTiles require a much larger capital cost to install compared to other technologies. This is due to the fact that they are not manufactured in mass production rates and they lack competition between manufacturers that offer this technology. Other technologies are relatively close in range when comparing the trade-off between the initial cost and power consumption. Nevertheless, MicroTiles offer the best performance in the long run assessment where they require the least maintenance and offer the most flexibility of all. The economic aspect might be MicroTiles' weakest point, yet it offers much more when it comes to the environmental and social aspects.

3.3 Environmental

When considering the environmental aspect, LCD and LED screens follow one another really closely in terms of packaging, plastic shells and glass that surround the internal components. The only significant difference is the backlighting source which affects the power consumption rates and lifespan. Since LCD and LED screens are mainly manufactured overseas, it is possible that looser legislation allows for less sustainable manufacturing practices. MicroTiles are designed for eventual reuse as they are mostly made of recyclable and recoverable material that are RoHS compliant. This is possible since the MicroTile has solid housing metal and removable internal parts, which makes it extremely easy to disassemble and reassemble thus extending its useful configuration and spacing range. Comparing MicroTiles to other alternative technologies, they do not contain nearly as much hazardous material used for semiconductors in LCD and LED screens (Barron, Holden, & Kelty, 2013). Unlike different types of projectors and screens, MicroTiles do not contain mercury, phosphorous, or toxic liquid coolants which makes them the environmental choice ("Christie MicroTiles - a green and sustainable design", 2013).

4.0 MICROTILES PROPOSAL

Christie MicroTiles is one of the most suitable options when weighing the social and environmental impact against economic impact. As mentioned previously, the bezel of each MicroTile is ultra-thin, depending on which model is chosen, the MicroTiles can have a seam of 1.3mm to 0.7mm, which does not take away from the overall viewing experience. Through the minimisation of the seams, the messages can be delivered without the distracting shadows between each projected image. MicroTiles are able to recognise and communicate with adjacent MicroTiles automatically, meaning that synchronisation of image, colour shading, brightness are all done almost automatically, without the need to manually configure each display. Utilising DLP technology means no mechanical parts are present, which dramatically increases the durability of the display. When used in conjunction with an LED light source, the MicroTile is designed to last for an extremely long time. Furthermore, since the internal chamber is completely sealed, dust cannot collect on the inside of the chamber, meaning that dust cannot cause dead spots on the image ("Understanding the Differences", 2013).

In terms of content delivery, Christie has JumpStart software which is easy to use and requires minimal training for staff to get used to content management. JumpStart software is designed to automatically recognise MicroTiles; therefore, no matter the shape and size of the display, the software optimises the units and lets the user handle the more important functions. JumpStart software also offers remote access, meaning that the operator does not have to be physically constrained to the room that the system is set up in to update information; this is a huge advantage over the current setup, where updating information and software is inconvenient ("Christie JumpStart", 2013).

5.0 CASE STUDY

On the Stratford Campus at the University of Waterloo, a similar type of media wall was implemented using MicroTiles. This project used 150 MicroTiles in order to produce a 9.1m by 2.0m media wall. The setup also included a Christie Media Management System, Christie Spyder video processor, 4 55” flat panels, and 7 Christie projectors (Christie, 2012).One of the problems faced with a tall design was ensuring that the support structure was level at the higher heights. To overcome this, the university also worked with rp Visual Solutions to design and build a custom structure that would be required to support the arrangement of tiles (“Three-Story-High Video Wall”, 2013).

The software that is used for this wall is the Christie JumpStart content manager program. This program allows the University of Waterloo to easily update the content specific to their needs. The end result of this project is one of the largest media walls in the world to use this type of technology with the ability to display student achievements, highlight news, or provide opportunities for individuals to showcase creative designs (Christie, 2012). This media is shown in Figure 1.

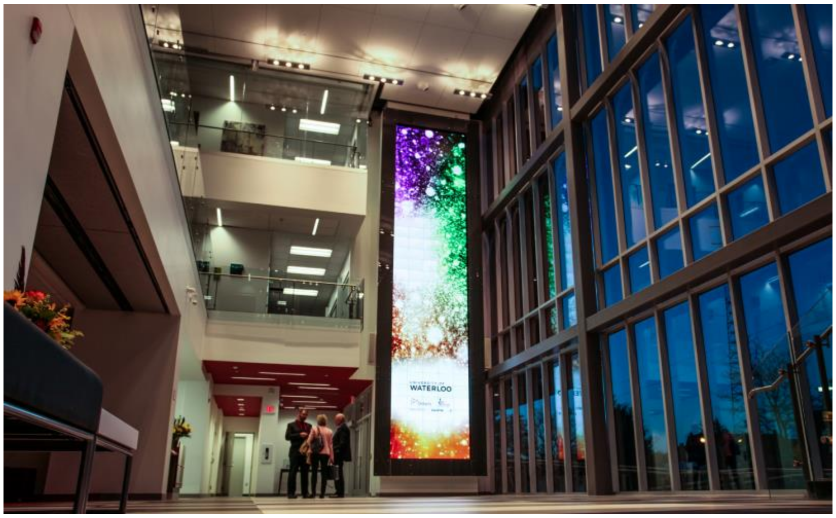

Figure 1: Media Wall at the University of Waterloo
Note. From *Three-Story-High Video Wall*, 2013

6.0 SOCIAL

6.1 Current Features

The use of MicroTiles would have many beneficial effects on the social aspect. This includes design and aesthetics. One of the issues with the current Media Wall is the large fringes of shadows that are formed between the panels. This is due to the use of multiple long throw projectors which cause the poor edge blending shown in Figure 2. The short-throw technology used in MicroTiles reduce the shadow effects; since each projection is modular, the gap negligible from a distance. As compared with standard LED, LCD, and Plasma screens, MicroTiles have a higher resolution which will make the video more attractive to view ("Christie MicroTiles Display Wall System", 2013). This effect can be seen in Figure __ below. Combining this with its small bezel, this creates a seamless design that would be visually appealing to an audience.

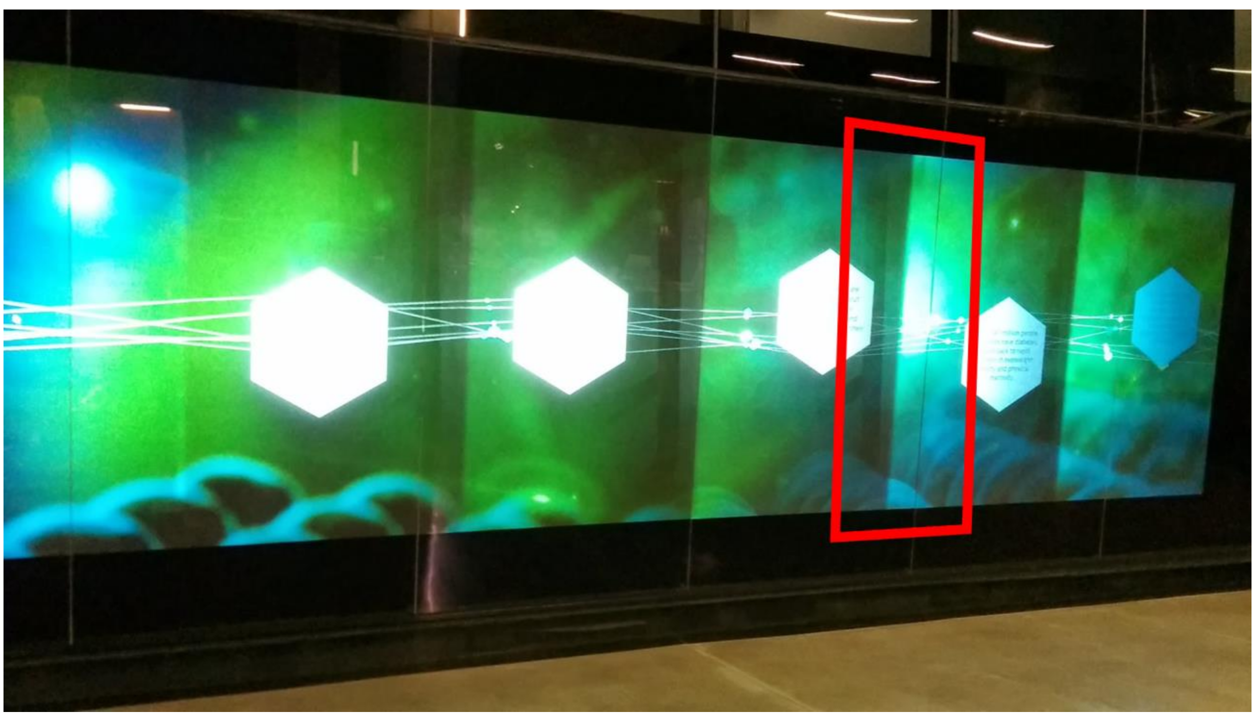

Figure 2: Shadows on Current Media Wall
Note. From Kieren Wou

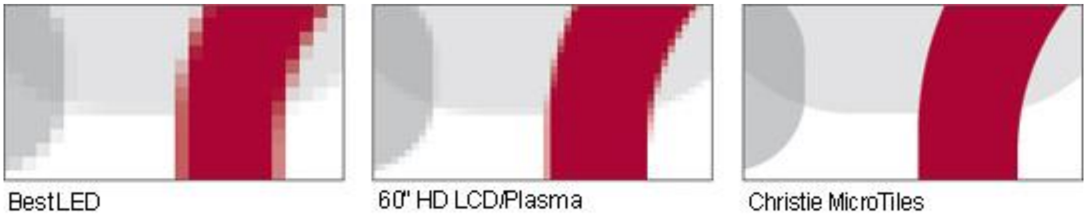

Figure 3: Comparison of Resolution Between Different Screen Technologies
Note. From *Christie MicroTiles Display Wall System* by Christie, 2013.

One of the problems being faced with the current media wall is the use of proprietary software. This makes it difficult for UBC to update and display new content. Similar to the case study of the media wall at the University of Waterloo, one available option is to use the software provided by Christie which was the JumpStart content manager. This would provide a more intuitive content manager which would make it easier to change the material that is being shown. As demonstrated in the University of Waterloo case study, the software is flexible and can be used to display different information. This feature would be beneficial if it were to be implemented for the current media wall; UBC Pharmacy would be able to highlight student projects or display updated news regarding pharmacy and current events.

6.2 Additional Features

Interactivity is an additional feature that would potentially improve the overall experience of the Media Wall. By introducing an interactive component, this could be used to improve learning whenever the wall is used to display academic information. This feature allows the audience to be more involved with the exhibit and as a result they may be more interested and enthusiastic about it (Xia & Li, 2009, p. 1943). Christie provides an Interactivity Kit that fits around the MicroTile display; this addition is also scalable to larger displays which would meet the specifications in terms of size for the current media wall ("Christie Interactivity Kit", 2013). While this feature would introduce an appealing experience for users, a limitation would be that it would not be practical to make the entire wall a touch screen. The reason for this would be that a portion of the screen would not be used above a certain height since many individuals would not be able to reach it. A solution for this would be to implement the touch screen for only the portion of the media wall that is within reach.

6.3 Material Sourcing

Another social aspect to take into consideration is the material sourcing for the MicroTiles. This deals with where Christie is importing its products in order to construct the tiles. Christie has two manufacturing sites where they construct parts for the MicroTiles, one is in Ontario, Canada and the other is in China (Christie, 2013). By supporting the product, this would also support the jobs overseas in China as well as locally in the R&D department in Ontario ("Christie R&D Commitment", 2013).

7.0 ECONOMIC

7.1 Material and Maintenance Costs

The projectors used in the current setup costs roughly $12,000 each and the cost of bulb replacements are roughly $12,000 to $15,000 annually. Each projector must be replaced every 5 years as the image fades over time. Additionally, there are 4 Edge blending devices that cost $2,000 each. Overall, the cost of components for the current setup and the cost of labour is estimated around $300,000 per decade assuming the projectors do not malfunction or break down prematurely (NGX Interactive, 2012). In comparison, the cost for starting up the media wall with MicroTiles is far more expensive. The cost of purchasing parts came up to approximately $288,000 if the MicroTiles were to take up the same area as the current wall; however, the calculated price is if each part were to be purchased individually. Using the simulation provided by Christie, the capital cost (i.e. cost of labour, parts, and replacement) was estimated to be approximately $330,000 with the assumption that 133 MicroTiles would be used to cover the area of the wall (Christie, 2013). A better quote could be obtained if we could strike a deal with the distributor; this is a possibility judging from the number of units we would need in order to cover the entire area. Over 10 years, the cost of purchasing and maintaining the MicroTiles would be projected around $500,000. Looking at cost for parts and maintenance, the MicroTiles fall short from our expectations.

7.2 Power Consumption

MicroTiles are a great alternative when looking at the life span of the system. Whereas the current projector lamps are being replaced every 2,000 hours, the MicroTiles are rated to last 65,000 on average. This translates to 7 years of continuous operation until the MicroTiles are dimmed to 50% of its original brightness (Christie, 2013). The longevity and the brightness of the LED bulbs help alleviate the problem of frequent servicing needed for the current system. Additionally, minor aesthetic damage to the MicroTiles can be self-serviced if needed; having spare parts in stock at campus can take away the need to send in parts from the manufacturer every time the display needs tuning. Given that the space for this media wall is already available, we can make use of the current infrastructure to make use as a storage room; although, we would need to make minor adjustments to accommodate the chassis for the MicroTiles.

The power consumption of the two systems was surprising. The current system totals up to roughly 6500 Watts: 780 Watts per projector, 525 Watts from the computer and 260 Watts from the edge blending device (NGX Interactive, 2012). We assumed that projectors run at maximum brightness when it is in operating mode. Energy consumption of the MicroTiles were stated to be 70 Watts per unit for typical usage, needing only one 120V outlet to power up to nine units. Although each unit uses little energy, 133 MicroTiles adds up to being 7900 Watts at 80% brightness which exceeds the power usage of the projectors ("*Technical Frequently Asked Questions"*, 2013*)*. This sums to approximately 8400 Watts for the whole system which is not ideal for this situation.

7.3 Comparison

Simply put, the saving for this investment does not pay itself back in two, three years' time. The savings will come over several years solely from the lowered maintenance cost. The projectors for each MicroTile need to be overhauled only if they are not performing up to standard compared to mandatory overhaul every 5 years for the projectors. We estimated that the MicroTiles would need to be replaced every 12 years if the wall was only operating during the day. We do not have a definitive number for the years it would take to recover the financial losses, but we anticipate it to be a couple decades before any sign of saving is seen. MicroTiles would definitely be a very long term financial commitment if the switch was to be made.

8.0 ENVIRONMENTAL

The environmental impact of a product starts from the manufacturing stage, throughout its lifespan, and extends further after disposal. It is important to elect products with minimal ecological footprint and a relatively high lifespan. The current media wall consists of six projectors where each projector holds two light bulbs that play the biggest role in the environmental aspect. Each light bulb is replaced two to three times a month which is an extremely short lifespan by any standards. Changing the light bulbs this frequently raises other ecological concerns such as the disposal and recycling of these bulbs along with the carbon footprint through transportation. Assuming each bulb weights 318 grams, this would mean that each year, 31.8 kg of lamps are being thrown away. Moving to a relatively higher lifespan components in the media wall are the projectors which are replaced every four to five years. Each of the projectors has a power rating energy consumption of 780 Watts which gives a total of 4680 Watts for all six projectors.

MicroTiles use short throw projectors with an exceptionally high lifespan of 65,000 hours or approximately 7 years. A major advantage MicroTiles have is low power rating and energy consumption, which ranges between 45-70 Watts per tile. MicroTiles include a solid metal housing and removable internal components which allows 80-90% of the MicroTile cube to be recyclable into new materials. MicroTiles are almost completely made of recoverable material and comply with the Restriction of Hazardous Substances (RoHS) Directive, as they do not include materials such as phosphors, mercury, or toxic liquid coolants. The MicroTile cubes were designed to minimize infrastructural support, as they are extremely flexible which reduces the materials needed to mount support the tiles.

In comparison, MicroTiles are manufactured using materials that leave less environmental footprint and are mainly recyclable. Another advantage MicroTiles have over the current media wall is the eco-power consumption mode which enhances the efficiency of the tiles by adjusting the brightness level of the display. MicroTiles have a much longer lifespan which reduces maintenance and frequent transportation and shipping of replacement parts. As the tiles are manufactured in small identical units, a certain tile can be used as replacement parts in the case of a failure.

9.0 CONCLUSION

In conclusion, although Christie MicroTiles have a high initial start-up cost, the ease of configuration, easy setup, almost free of maintenance, high durability and user friendly content management software almost already justifies the switch when only considering administrative and long term costs. Socially, choosing Christie MicroTiles will be much more aesthetically pleasing than the current system, due to sharper colours, more comfortable brightness and most importantly, close to seamless integration of the units, will amplify the pharmaceutical messages without distracting the viewer with obviously darkened edges. Environmentally, the MicroTile units are highly salvageable, along with RoHS compliance and also a built in eco-mode which is able to reduce the power consumption just by dimming the brightness at any time, providing a strong advantage over the current setup. Drawing upon the above mentioned reasons, it is logical to conclude that the social and environmental factors far outweigh the heavy initial cost of ownership in the long run.

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