Should All Teens Switch to Black and White Screens?

An Investigation into the Contribution of Colour to Phone Addiction in Youth

Should All Teens Switch to Black and White Screens?

An Investigation into the Contribution of Colour to Phone Addiction in Youth

Aine Matthews, Daniella Onunkwo & Eimear Sherwin

Eureka Secondary School, Kells, Co. Meath

Comments

CONTENTS

1. ABSTRACT 5

2. INTRODUCTION 7

2.1 WHY WE CHOSE THIS PROJECT 7
2.2 HYPOTHESIS 7

3. BACKGROUND RESEARCH 8

3.1 PREVIOUS EXPERIMENTS 8
3.2 ADDICTION 9
3.3 EFFECT OF COLOURS 10
3.4 Effect of mobile phone use 11
3.4.1 Radiofrequency Effects 11
3.4.2 Cancer 12
3.5 Blue Light 12
3.5.1 What Blue Light Is 12
3.5.2 Where Blue Light Is Found 13
3.5.3 Effects of Blue-Violet Light 13
3.5.4 Effects of Blue-Green Light 13
3.5.5 Digital Eyestrain 13
3.5.6 Blue Light at Night 14
3.6 Social Media 14
3.6.1 Reward Prediction Error 14
3.6.2 Dopamine 14
3.6.3 How Reward Prediction Error is Employed by Apps 15
3.7 Mental Health 16
3.7.1 Circadian Rhythm 16
3.7.2 Mobile Phone Usage effects on Mental Health 16
3.8 EFFECTS ON OUR EYES 18

4. EXPERIMENTAL METHODS 20

4.1 SAMPLE 20
4.2 PREPARATION 20
4.3 CONDUCTING OUR EXPERIMENT 20

5. RESULTS 22

5.1 DECREASE (HOURS) FOR EACH APP 22
5.2 TIME (HOURS) SPENT ON PHONES WHILE IN COLOUR VS BLACK & WHITE 25
5.3 % DECREASE IN USE OF SOCIAL MEDIA WHILE IN GREYSCALE 26
5.4 RESULTS FROM SURVEYS 29

6. DISCUSSION 34

7. CONCLUSION 36
7.1 IMPLICATIONS & RECOMMENDATIONS 36
8. ACKNOWLEDGEMENTS 38
8.1 MRS WRIGHT & EUREKA 38
8.2 ST CIARAN'S COMMUNITY SCHOOL 38
8.3 OUR FAMILIES 38
9. APPENDICES 39
9.1 SURVEY RESULTS 39
9.2 DATA FROM WEEK 1 45
9.3 DATA FROM WEEK 2 50
9.4 EMAILS 56
9.5 SURVEY 56
9.6 PARTICIPANT AGREEMENT 57
10. ..... REFERENCES 58

1. ABSTRACT

According to Jill Morton, Colour Matters, a black and white image sustains interest for less than two-thirds of a second, however coloured images hold the attention for two seconds or more. The objective of our investigation was to find out the impact that colour usage in app design has on mobile phone usage by teenagers. To do this we changed the colour filter on 123 participants iOS devices to Greyscale - a mode that removes all colour from iPhone screens, leaving the display in black and white.

We began our project in September 2018, with the aim to find a correlation between colour usage in social media and mobile phone addiction in youth.
In a 2011 study by Michelle Hackman, high school students were split into 2 groups, 1 with access to their phones and 1 without. Participants wore devices that monitored the electrical conductance of their skin, a measure of anxiety. Many of those without phones fell asleep – a result of under stimulation, meaning that when their phones – their mode of stimulation - was taken away, they lost the ability to stimulate themselves and that suggested an addiction. Based on our research of studies such as Hackman's, we hypothesised that usage of mobile phones would greatly decrease over the 5-day period that participants phones were in Greyscale.

The methodology employed during this project involved a study on 123 secondary school students within the age bracket 13-16 years. We also conducted a literary review of current relevant articles on the topic of blue light and the implications on mobile phone addiction in youth.

In order to conduct our experiment, we first contacted management in Eureka Secondary School and St Ciaran's Community School, our local boys' secondary school. After we received confirmation, we prepared our tables to collect data and our surveys, including questions on sleeping patterns, energy levels, liability to pick up and to use their mobile phones throughout the experiment.
We carried out our experiment twice, over a 10-day period each time. Our experiment can be viewed as 2 parts;

Day 1: For this experiment we recorded usage of Snapchat, Instagram, Facebook and YouTube, for the previous 5 days while the participants mobile phones were in full colour mode. We then changed the participants phones to Greyscale (black and white only)
Day 2: After the participants had their mobile phones in greyscale for 5 days, we recorded their usage for that period. We then conducted the survey.

The results for our experiment are as follows;
During the 5 days while our participants phones were in Greyscale mode, usage of YouTube decreased by an average of 36.51%, Snapchat by 22.98%, Instagram by 12.36% and Facebook by 5.86%. The overall total decrease in use of the 4 studied social media apps was 648 hours 5 minutes over 5 days, or 28.33%.
Results from our survey showed 78% of our sample found having no colour on their phones challenging. 74% reported better sleep and 52% having a better mood during our experiment.

From our experiment we have concluded that colour greatly impacts device and social media usage.

2. INTRODUCTION

2.1 Why We Chose This Project

As a group we have always been intrigued by the psychological impact our surroundings and environment have on us. We originally had ideas for our BTYSE project on the impact of peers on young people's opinions, however after researching various topics, we decided to do our project on the impact of colour on psychology as we felt that we could investigate a specific area within this topic.
We researched colour psychology and the usage of colour in app design came to our attention through the work of Jill Morton**,** a colour Psychologist and her company ColorCom. Despite the prevalence of mobile phone addiction, as seen through studies by Hackman (2011) and Choliz (2012), in society today, we could find little research on colour usage in app development. As a result of this, we felt that this area was one that is both highly relevant today yet not researched in depth and so was ideal for our BTYSE entry.

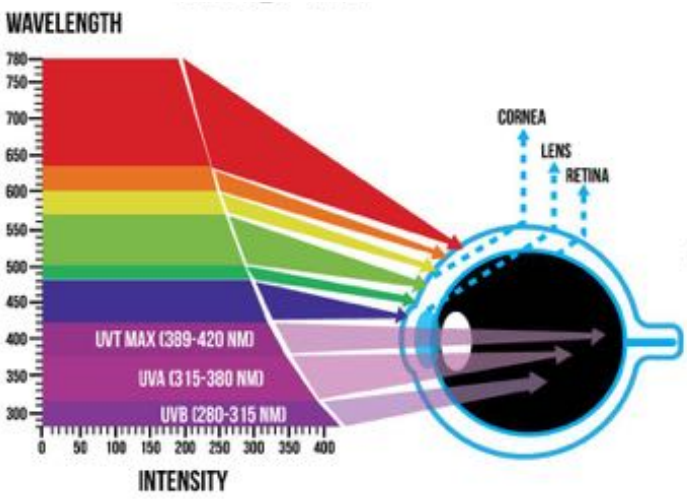
2.2 What We Are Trying to Achieve.

The aim of our project was to find a correlation between colour usage in the design of social media apps and mobile phone addiction in youth. According to researcher and cognitive neuroscientist, Thomas Z. Ramsoy, Grayscale mode "equalises everything you see on your screen" and so we hypothesised that this would make notifications, links and pop-ups less appealing to the user. If the candidate's liability to click into notifications were to decrease, then so too would their usage of social media.
Despite many articles in various newspapers and technology websites, there is little scientific research on the impact colour usage in app design has on our social media habits. We felt that we could perform a study that would show these results.

3. BACKGROUND RESEARCH

3.1 PREVIOUS EXPERIMENTS

Harvard University, America have undergone several experiments to analyze the effects of prolonged usage of phone and exposure to blue light emitted by our phones especially during the night. Some of their studies suggest exposure to blue light at night is linked to certain cancers, diabetes, heart disease and obesity. A Harvard study sheds light on the possible connection to diabetes and obesity. The researchers put 10 people on a schedule that gradually shifted the timing of their Circadian rhythms. This imitated the effect that artificial blue light has on our Circadian cycles. Their blood sugar levels increased, throwing them into a prediabetic state, and levels of leptin, a hormone that leaves people feeling full after a meal, went down.

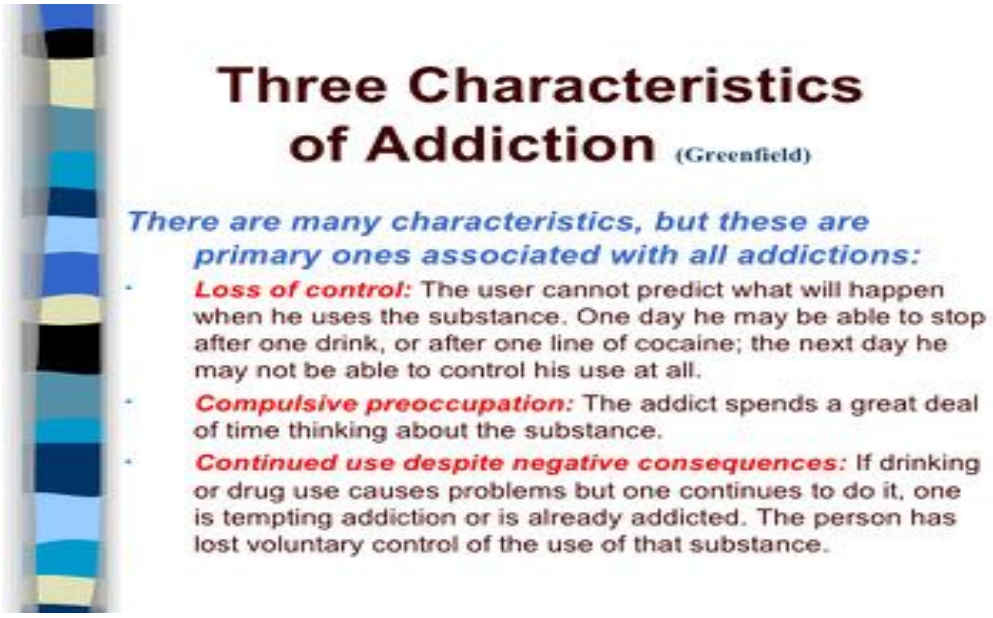


(Jill Morton)

Another Harvard researcher conducted an experiment investigating the effects of blue light and sleeping patterns. This researcher conducted an experiment comparing the effects of 6.5 hours of exposure to blue light to 6.5 hours of exposure to green light. The blue light suppressed melatonin, which is a hormone produced in the pineal gland which regulates wakefulness, for about twice as long as the green light and as well as that shifted circadian rhythms by twice as much.

Research by the university of Toledo, USA reveals that prolonged exposure to blue light triggers poisonous molecules to be generated in the eye's light-sensitive cells that can cause macular degeneration (AMD) – an incurable condition that affects the middle part of vision. Kasun Ratnayake, a PhD student at the University of Toledo who was involved in the study, said: "If you shine blue light on retinal, the retinal kills photoreceptor cells as the signaling molecule on the membrane dissolves. Photoreceptor cells do not regenerate in the eye. When they're dead, they're dead for good." Kasun also discovered that introducing retinal molecules to other cell types in the body, such as cancer cells, heart cells and neurons, caused them to die off when exposed to blue light.

3.2 ADDICTION



The characteristics of social media users show clear signs of addiction as shown in the chart above. This chart documents the 3 characteristics of addiction, as researched by Greenfield (1999)

3.3 PSYCHOLOGICAL EFFECTS OF COLOUR

Colours can influence humans behaviour, mood and even physiological processes, this can be seen through the use of colour therapy to treat various diseases. Colour perception is very subjective, as different people have different ideas about and responses to colors. Different factors such as age, gender and in particular, cultures can influence colour perceptions.

While there is no direct relationship between colour and specific behaviours, some results about colours and their corresponding impact to the brain and what they may symbolize have been determined.
Red is the longest wavelength of light on the visible light spectrum. In western cultures, red is associated with power, control, and strength. The use of red to signify danger is visible throughout the animal kingdom. Animals such as snakes have red coloration to indicate that they are dangerous. Other colours including yellow, and orange are considered warm colors and are thought to stimulate excited emotions for this reason they are used in gambling casinos. Blue is the most preferred colour across cultures. Black absorbs all wavelengths of the visible light spectrum. Black is viewed as mysterious, and in many cultures, it is associated with fear, death, the unknown, and evil.
White is perceived as delicate and pure.

The use of colour mainly impacts the right side of the brain as it is a visual impact. The right hemisphere is mainly in charge of spatial abilities, face recognition and processing music. It performs some math, but only rough estimations and comparisons. The brain's right side also helps us to comprehend visual images and make sense of what we see. It plays a role in language, particularly in interpreting context and a person's tone.
"For most humans, the left side is tied to language and the right more to visual perception, imagery, and emotion," the Spirituality and Western Psychology article said.

3.4 EFFECTS OF PHONES

3.4.1 Radiofrequent Energy

Scientists have reported adverse health effects of using mobile phones including changes in brain activity, reaction times, and sleep patterns. Phone radiation has a huge impact on human health as human brain cells communicate via electric impulses, which can be detected by non-invasive EEG (electroencephalogram) measurements. A recent study on mobile phones by researchers in the Netherlands found that when a dialing mobile phone is placed on the ear its radiation, although not cautiously sensed, is electrically detected by the brain. This Netherland's study clearly shows an EEG change as a result of exposure to phone radiation.

Mobile phones emit radiofrequency energy waves which can be absorbed by tissues close to the phone. The amount of radiofrequent energy a mobile phone user is exposed to depend on many factors as the technology of the phone, the distance between the phone and the user and the extent and type of mobile phone use. However, more energy is absorbed by children as their skulls are weaker and thinner. Hence children have the potential to be at greater risk than adults for developing brain cancer from cell phones. Individuals who are concerned about radiofrequency exposure can limit their exposure, including using an ear piece and limiting cell phone use.

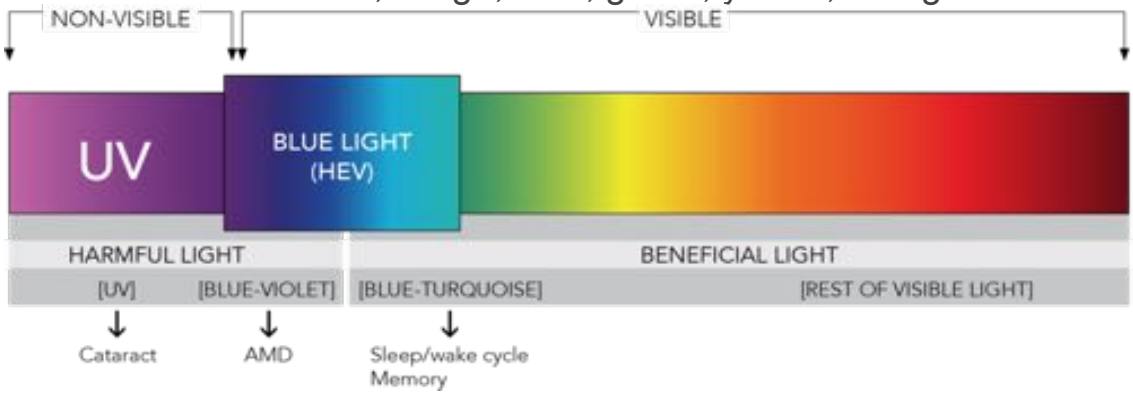
3.4.2 Cancer

According to cancer.gov, in 2007 and 2012, scientists published two different reviews of cell phones and brain tumors and concluded that studies of individuals using cell phones for more than 10 years “give a consistent pattern of an increased risk for acoustic neuroma and glioma (tumors),” with the risk being highest for a tumor on the same side of the head that the phone is used.
However, a study published in 2013 found that while long-term cell phone use was associated with acoustic neuromas, it did not predict gliomas.
In contrast, a study of 1,339 cell phone users, published in 2014, found that the heaviest cell phone users had an increased chance of developing gliomas. These heaviest users, who had a total of over 900 hours of cell phone usage, were found to have spent an average of 54 minutes on the phone per day. This is extremely low compared to the time our participants spent on their phones daily.

3.5 BLUE LIGHT

3.5.1 What is Blue Light?

Blue light is a colour in the visible light spectrum that can be seen by human eyes. Blue light is a short wavelength, which means it produces higher amounts of energy. The length of the waves is measured in nanometers (nm), with 1 nanometer equaling 1 billionth of a meter. Every wavelength is represented by a different colour and is grouped into the following categories: gamma rays, x-rays, ultraviolet (UV) rays, visible light, infrared light, and radio waves. Together these wavelengths make up the electromagnetic spectrum. The human eye is sensitive to only one part of this spectrum: visible light. Visible light is that part of the electromagnetic spectrum that is seen as colours: violet, indigo, blue, green, yellow, orange and red.



3.5.2 Where is blue light found?

Sources of blue light include the sun, digital screens (TVs, computers, laptops, smart phones and tablets), electronic devices, and fluorescent and LED lighting. When outside, light from the sun travels through the atmosphere. The shorter, high energy blue wavelengths collide with the air molecules causing blue light to scatter everywhere. This is what makes the sky look blue. In its natural form, your body uses blue light from the sun to regulate your natural sleep and wake cycles. This is known as your circadian rhythm. Blue light also helps boost alertness, heighten reaction times, elevate moods, and increase the feeling of well-being. Artificial sources of blue light include electronic devices such as cell phones and laptop computers, as well as fluorescent bulbs and LED lights.

3.5.3 Effects of natural blue-green light:

Blue-green light occurs naturally in our environment and is used to assist the regulation of the circadian rhythm, boost alertness, help memory and cognitive functions and elevate moods.

3.5.4 Negative effects of blue-violet light:

Artificial blue-violet light disrupts circadian rhythm, lowers the production of melatonin, causes AMD and digital eyestrain syndrome and increases risks of types of cancer and depression.

3.5.5 Digital eyestrain:

Digital eyestrain is a new term used to describe the conditions resulting from the use of today's popular electronic gadgets. Symptoms of digital eyestrain, or computer vision syndrome, include blurry vision, difficulty focusing, dry and irritated eyes, headaches, neck and back pain. Digital eyestrain has overtaken carpal-tunnel syndrome as the number one computer-related complaint. Digital eyestrain does not just affect adults. Children are also at risk for eyestrain due to their growing use of digital devices.
According to a study by the Kaiser family Foundation, children and teenagers (ages 8-18) spend more than 7 hours a day consuming electronic media. Before age 10, children's eyes are not fully developed. The crystalline lens and cornea are still largely transparent and overexposed to light.

3.5.6 Blue light at night

Some studies suggest a link between exposure to light at night, such as working the night shift, to some types of cancer, diabetes, heart disease, and obesity. That's not proof that nighttime light exposure causes these conditions; nor is it clear why it could be bad for us. But we do know that exposure to light suppresses the secretion of melatonin, a hormone that influences circadian rhythms, and there's some experimental preliminary evidence that lower melatonin levels might explain the association with cancer.

While light of any kind can suppress the secretion of melatonin, blue light at night does so more powerfully. Harvard researchers conducted an experiment comparing the effects of 6.5 hours of exposure to blue light to exposure to green light of comparable brightness. The blue light suppressed melatonin for about twice as long as the green light and shifted circadian rhythms by twice as much (3 hours vs. 1.5 hours).

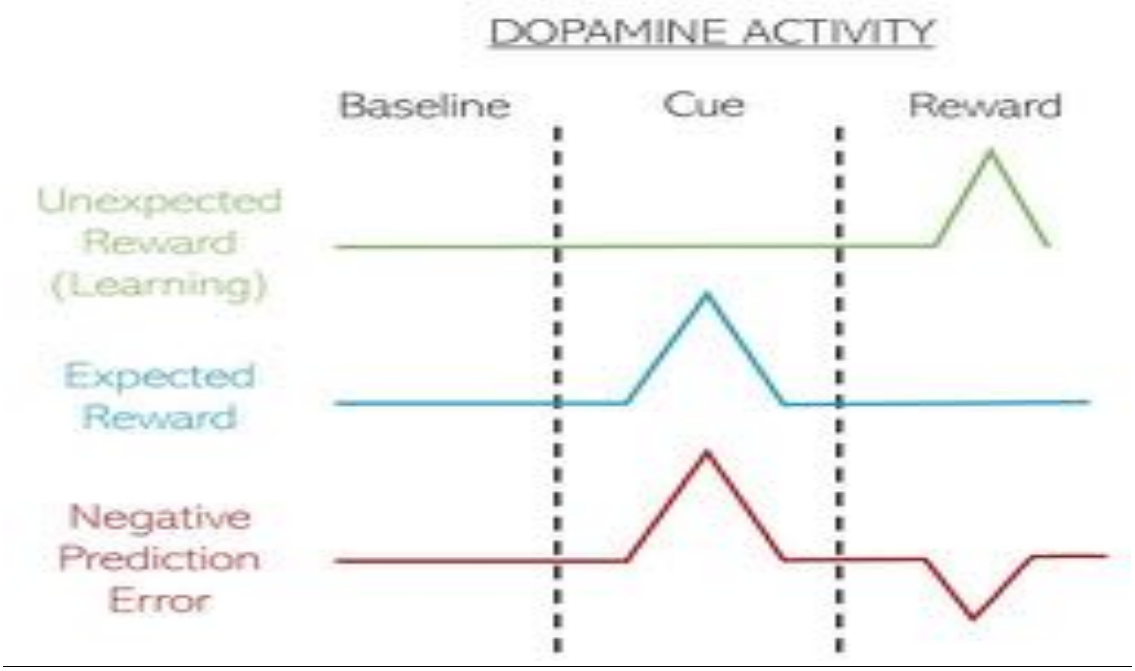
3.6 PSYCHOLOGY BEHIND SOCIAL MEDIA

3.6.1 Reward Prediction Errors

Research in reward learning and addiction have recently focused on a feature of our dopamine neurons called reward prediction error (RPE) encoding. These prediction errors serve as dopamine-mediated feedback signals in our brains. This neurological feature is something casino owners have used to their advantage for years. The time between the input and outcome provide time for our dopamine neurons to increase their activity, creating a rewarding feeling just by playing the game. But as negative outcomes accumulate, the loss of dopamine activity encourages us to disengage. Thus, a balance between positive and negative outcomes must be maintained in order to keep our brains engaged.

3.6.2 Dopamine

Dopamine is a neurotransmitter, a chemical that is responsible for transmitting signals in between neurons in the brain. Dopamine is a chemical produced by our brains that plays a main role in motivating behavior. It gets released after we exercise and importantly, when we have successful social interactions. Dopamine rewards us for beneficial behaviors and motivates us to repeat them.



3.6.3 How Social Media apps use this Learning Strategy

Many apps implement a reward pattern optimized to keep you engaged as much as possible. Variable reward schedules were introduced by psychologist B.F. Skinner, an American psychologist, behaviorist, author, inventor, and social philosopher. In his experiments, he found that mice respond most frequently to reward-associated stimuli when the reward was administered after a varying number of responses, precluding the animal's ability to predict when they would be rewarded. Humans have the same effect; if we perceive a reward to be delivered at random, we end up checking habitually. If you pay attention, you might find yourself checking your phone at the slightest feeling of boredom, purely out of habit. Apps operate on a variable rewards basis, thus fueling an addiction. This usage is evident in Instagram's implementation of a variable-ratio reward schedule. Instagram's notification algorithms will sometimes withhold "likes" on your photos to deliver them in larger bursts. When a user posts, their likes are delayed, only to receive them in a larger bunch later. Your dopamine centers have been primed by those initial negative outcomes to respond robustly to the sudden influx of social appraisal. This use of a variable reward schedule takes advantage of our dopamine-driven desire for social

validation, and it optimizes the balance of negative and positive feedback signals until we've become habitual users.

3.7 MENTAL HEALTH EFFECTS OF MOBILE PHONE USAGE

3.7.1 Circadian Rhythm:

The National Institute for General Medical Sciences describes circadian rhythm as "physical, mental, and behavioral changes that follow a daily cycle. They respond primarily to light and darkness in an organism's environment."

In humans, the circadian rhythm synchronizes certain behavioral and biological processes through a daily cycle, partly regulated by sunlight. The processes that the circadian rhythm regulates include sleep-wake behavior, hormone secretion, cellular function, and gene expression.

Today, artificial lighting is abundant in many parts of the world. For example, street lights help us see and increase security. We also have TVs, laptops, and mobile phones; and many of use them simultaneously. Lighting intensity is measured in lux units (lx). A look into the level of lux emitted from different light sources, reveals that digital screens have caused an exponential increase in night-time light intensity. In fact, a laptop alone (not used alongside a TV, mobile phone, etc.) emits over 33,000% more lux than a full moon.

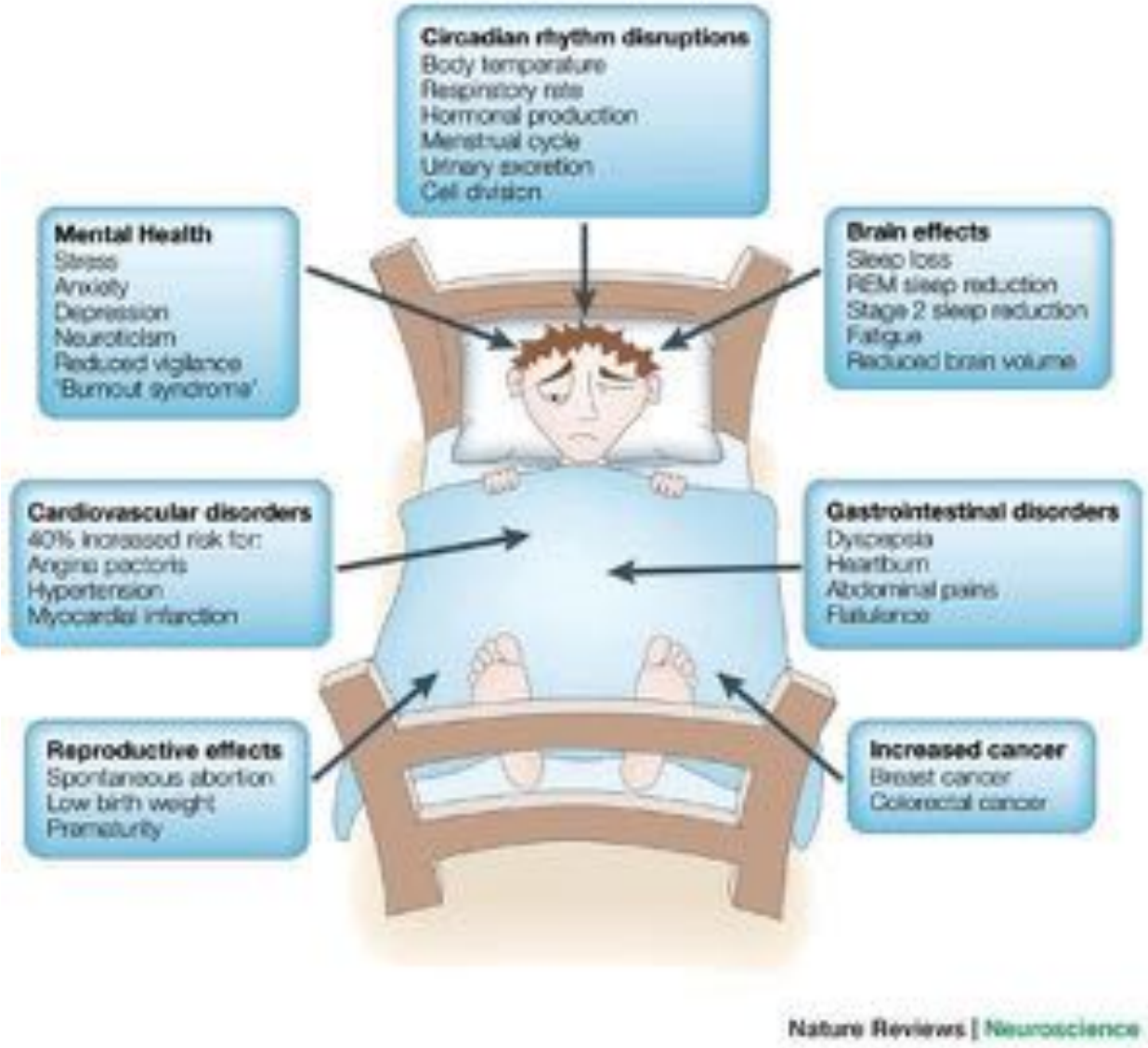
Night time lighting, specifically exposure to blue light, affects the circadian rhythm by inhibiting melatonin production. Melatonin is a hormone that peaks at night to help us get a restful night's sleep and regulates the circadian sleep phase.

3.7.2 Effects on mental health

A 2017 article in Translational Psychiatry says, "sleep disturbance is an important factor contributing to the onset and maintenance of mood disorders."

Sleep disruption is also a classic symptom of major depression, bipolar disorder, post-traumatic stress disorder, generalized anxiety and other mood disorders. Likewise, it is one of the most obvious likely consequences of exposure to night-time lighting.

The problem occurs when sleep is disturbed, because your body can't complete a full circadian cycle. As these circadian systems become are suppressed, it seems mood disorders can result.



3.8 EFFECT ON OUR EYES

4. EXPERIMENTAL METHODS

4.1 Sample size

To carry out our investigation we needed approximately 125 students aged between 13-16. We used a convenient sample of students in

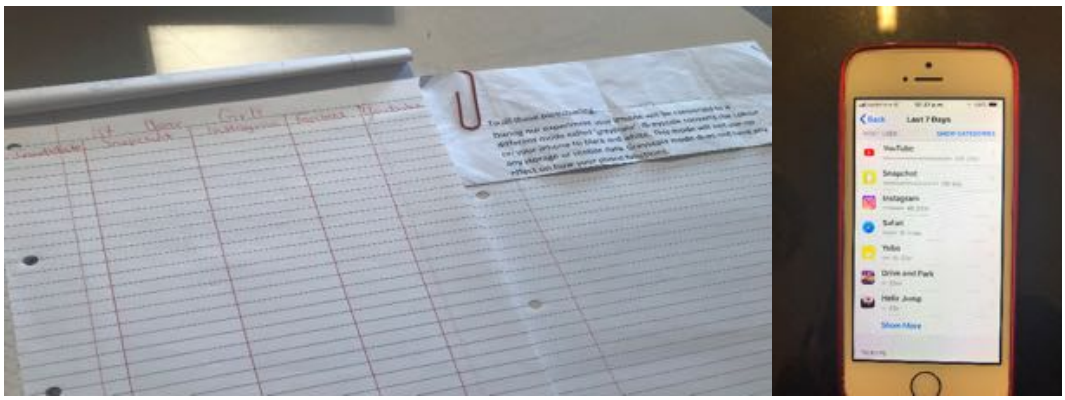
our school and the local boy's school. We took a random sample of the students in first to fourth year in these schools to give us the most accurate representation of our sample.

4.2 Preparation

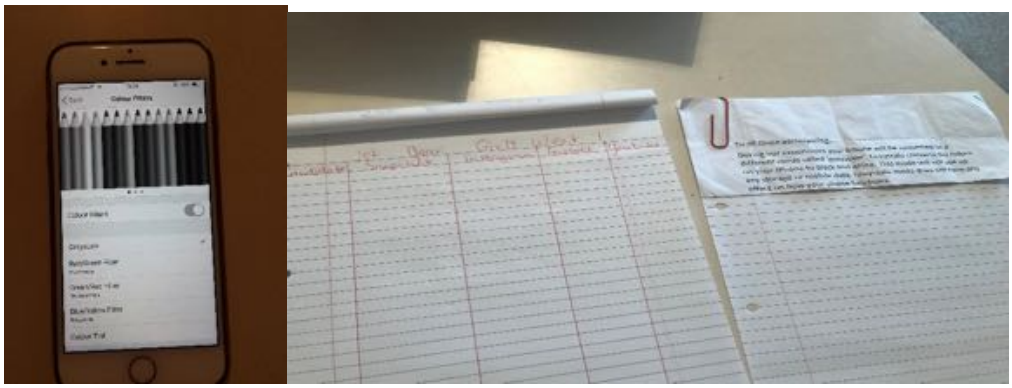
For our experiment we required a sample of boys to take part. However, as we go to an all girl's school, we had to contact our local boys' school, St. Ciaran's Community School. We emailed school management to ask permission to conduct our experiment in the school. We knew that this would be a difficult experiment to conduct as it involved using phones, which were under strict regulations within the school. Fortunately, we received permission to conduct our experiment. To prepare for our experiment we created a survey for our participants including questions on sleeping patterns, mood changes, liability to pick up/ use phone while on greyscale mode, energy levels throughout the day and eye conditions that they may suffer from. We also constructed tables to record our data. We also consulted various teachers to ask permission to conduct our experiment in during class.

4.3 Conducting our Investigation

On the first day of our investigation, we focused on our female participants. The participants signed an agreement, to say we had no liability for any damage that may happen to their phones over the course of the experiment. We gave the students identification numbers, as we did not want to record individual names as that data was not required for the investigation. We then recorded our participant's phone usage for the social media apps Snapchat, Instagram, Facebook and YouTube for the previous 5 days by viewing participants Screen Time function in the settings of their phone. We used this data as our control.

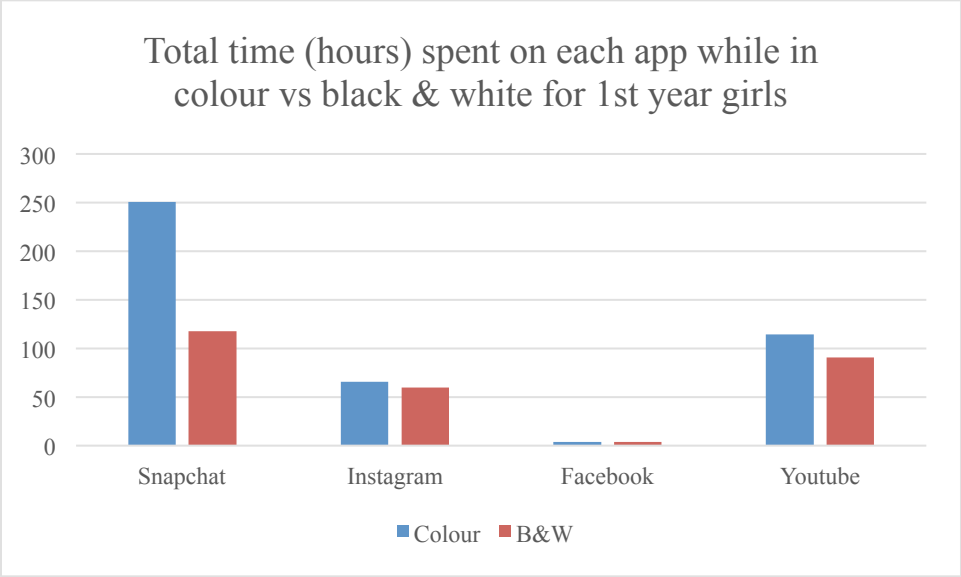


After collecting our data, we changed participants phone screens to Greyscale mode (black and white). After 5 days we collected participants data from the week they spent using Greyscale. The Screen time function allowed us to visibly see the time spent on each app. We gave the participants our surveys and recorded their data usage for the past 5 days and converted their phone back into full colour, as it was before the experiment.
We then repeated on experiment on male participants, following the same steps as we did for our female participants.



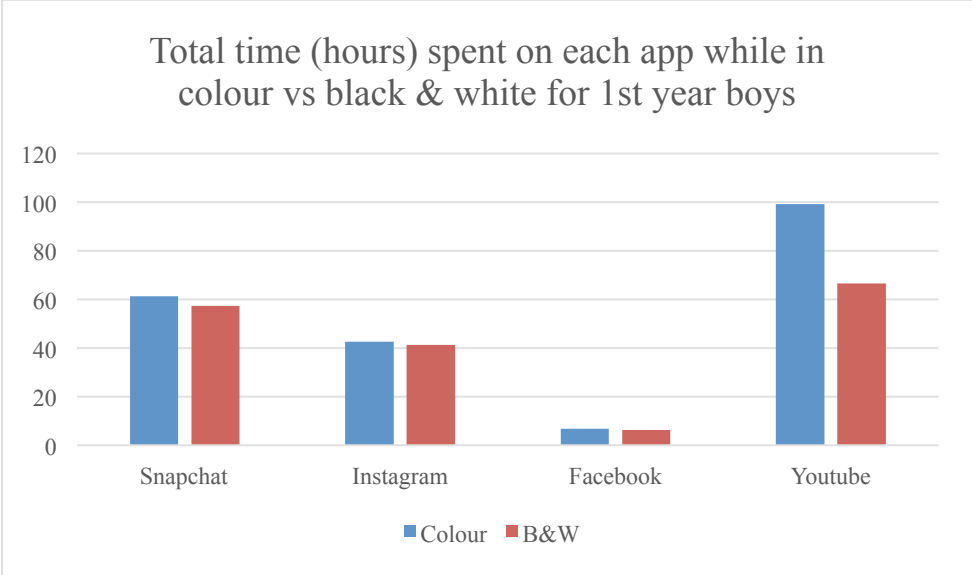
5. RESULTS

5.1 DECREASE IN HOURS FOR EACH APP, SHOWN FOR EACH YEAR AND GENDER

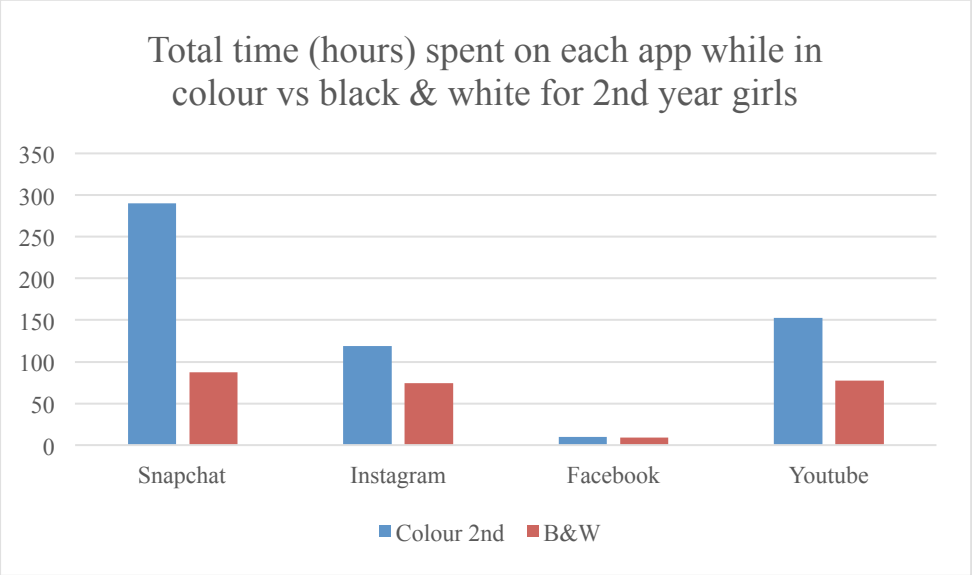


1st Year Girls
Most popular: Snapchat

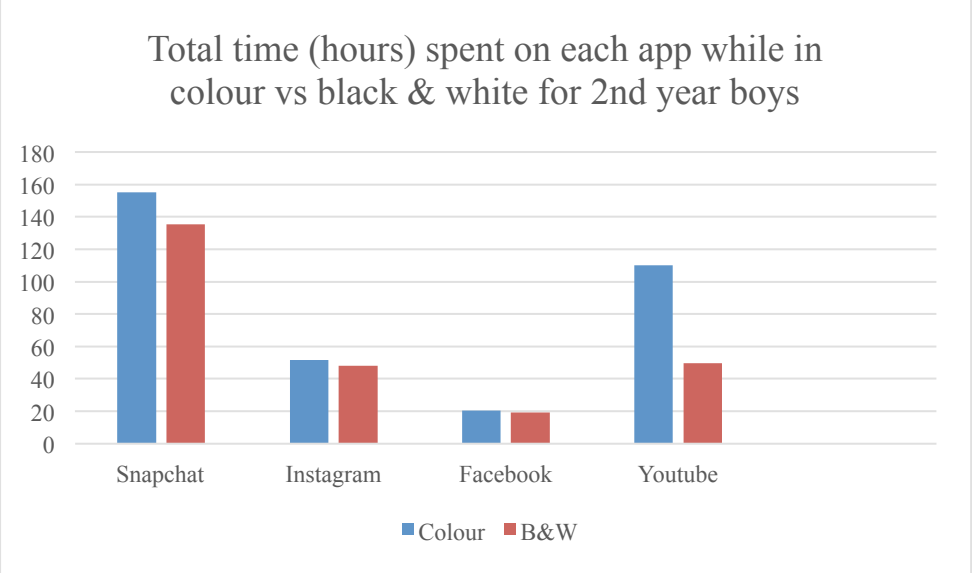
Most effected by Greyscale: Snapchat



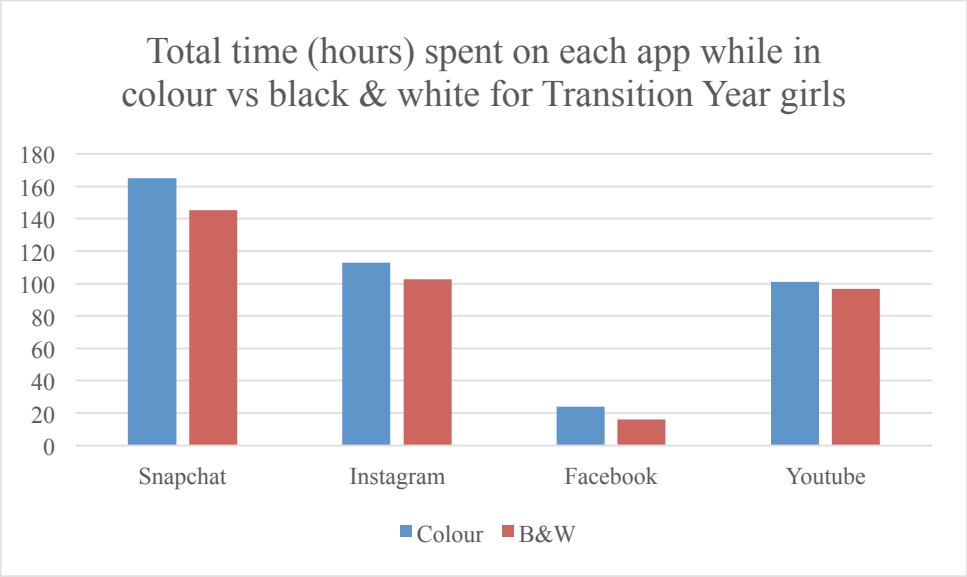
1st Year Boys
Most popular: Youtube
Most effected by Greyscale: YouTube



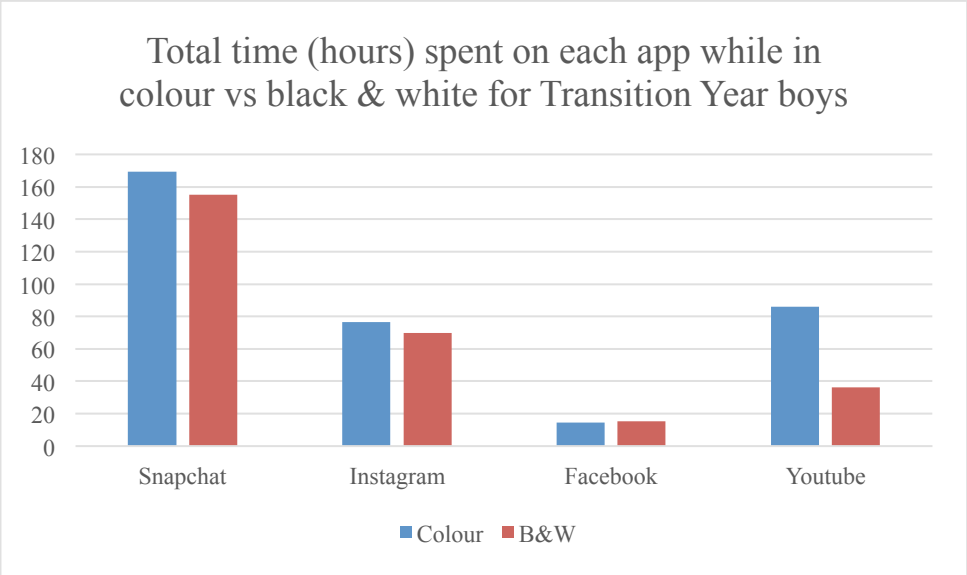
2nd Year Girls
Most popular: Snapchat
Most effected by Greyscale: Snapchat



2nd Year Boys
Most popular: Snapchat
Most effected by Greyscale: Youtube

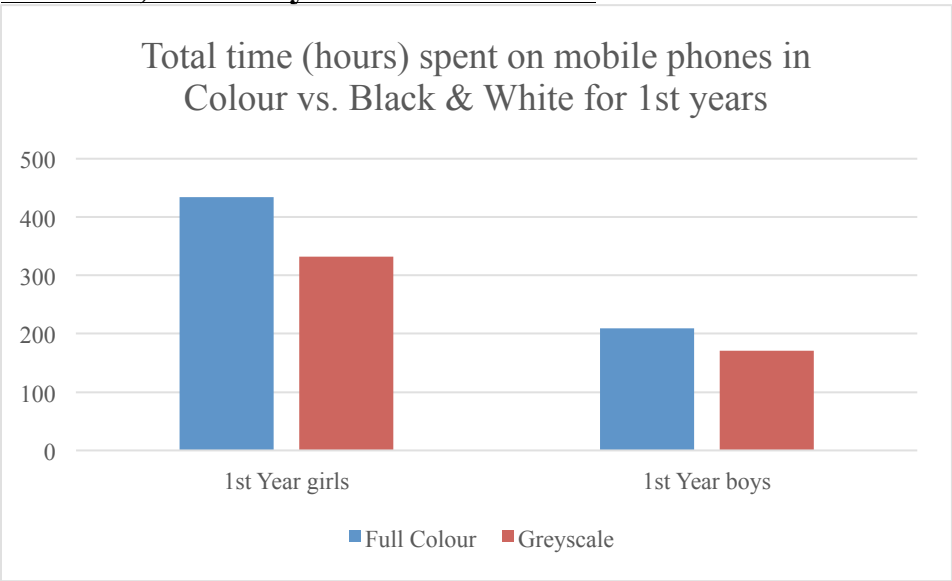


TY Girls
Most popular: SnapchatMost Effected by Greyscale:YouTube

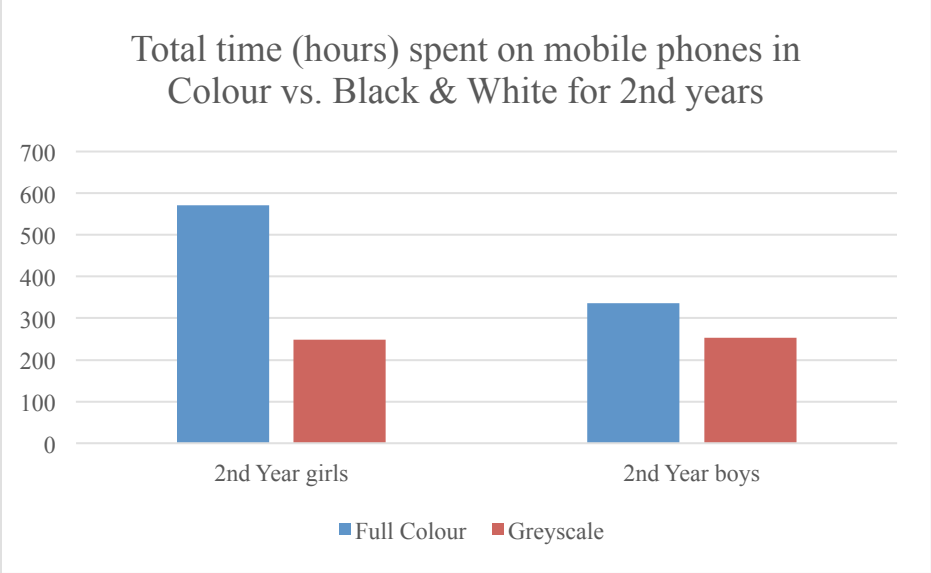


TY Boys
Most popular: Snapchat
Most effected by Greyscale: YouTube

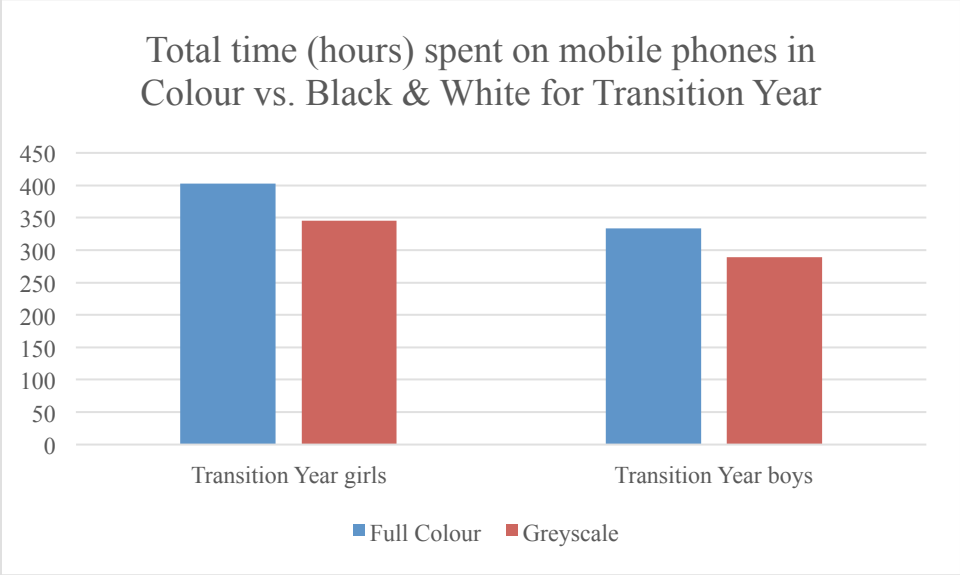
5.2 Total time (hours) spent on mobile phones while in Colour vs. Black & White, shown by Year and Gender



Total time spent on phone (hours)	Full Colour	Greyscale
1st Year girls	434.06	332.14
1st Year boys	209.43	171.31

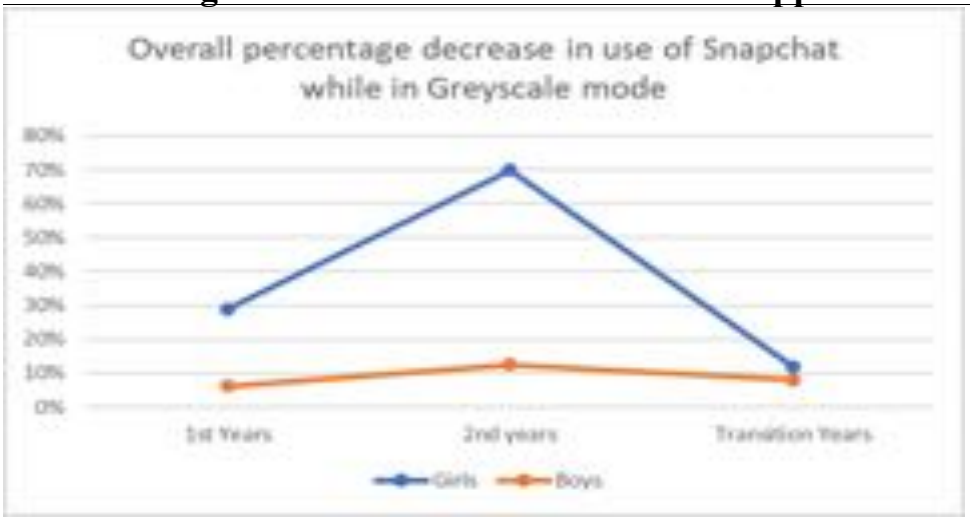


Total time spent on phone (hours)	Full Colour	Greyscale
2nd Year girls	571.57	249.02
2nd Year boys	336.57	252.42

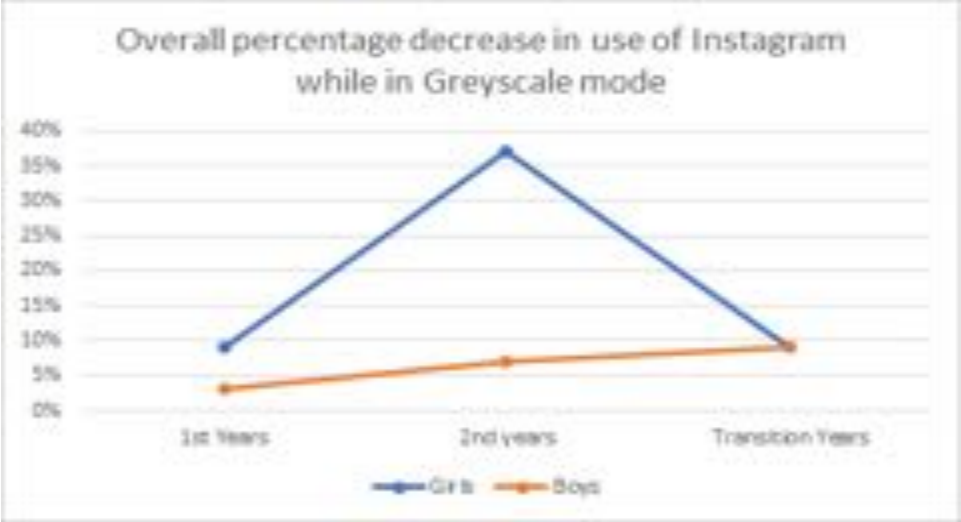


Total time spent on phone (hours)	Full Colour	Greyscale
Transition Year girls	403.03	345.49
Transition Year boys	333.28	289.5

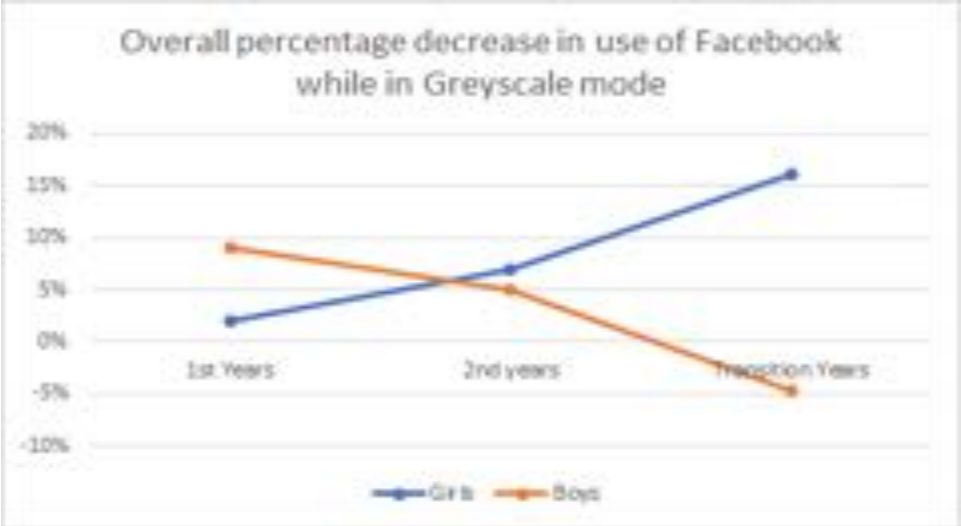
5.3 Percentage Decrease in use of Social Media apps while in Greyscale



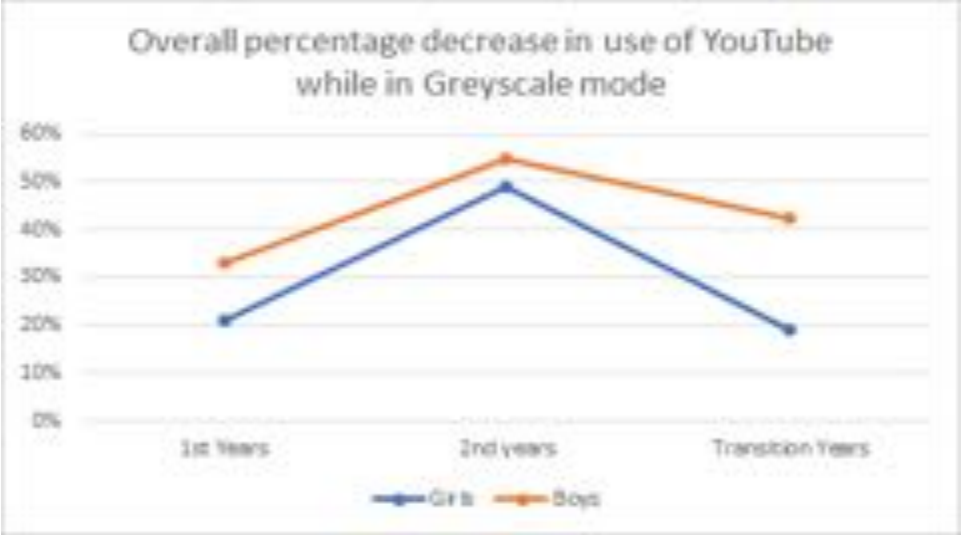
Snapchat	**Girls**	**Boys**
1st Years:	29%	6%
2nd years:	70%	13%
Transition Years:	12%	8%



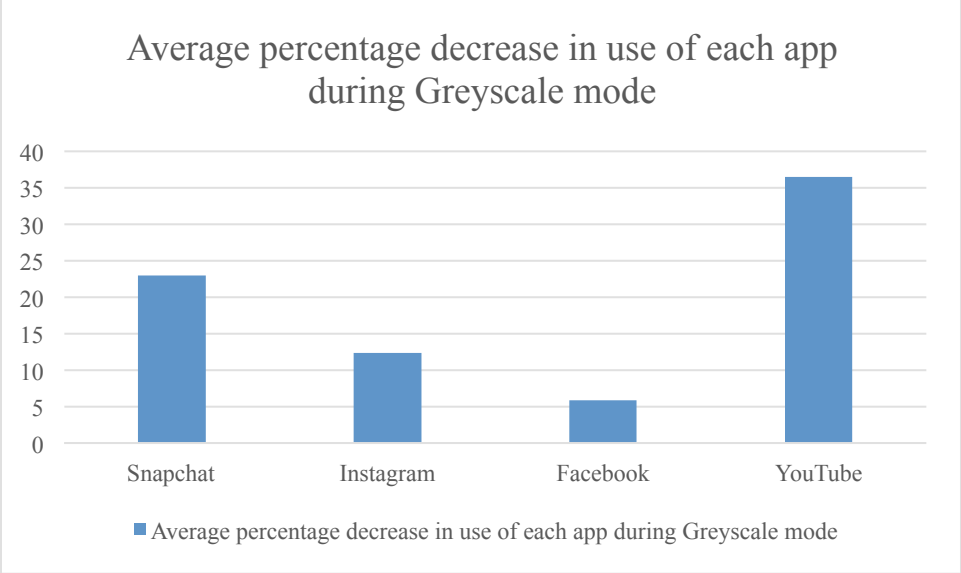
Instagram:	**Girls**	**Boys**
1st Years:	9%	3%
2nd years:	37%	7%
Transition Years:	9%	9%



Facebook:	**Girls**	**Boys**
1st Years:	2%	9%
2nd years:	7%	5%
Transition Years:	16%	-5%

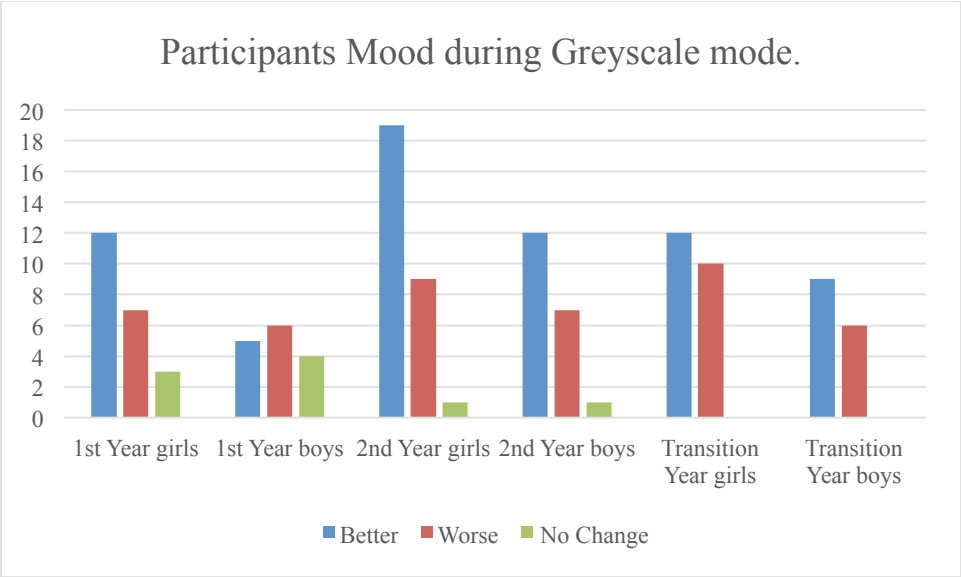


YouTube:	**Girls**	**Boys**
1st Years:	21%	33%
2nd years:	49%	55%
Transition Years:	19%	42%

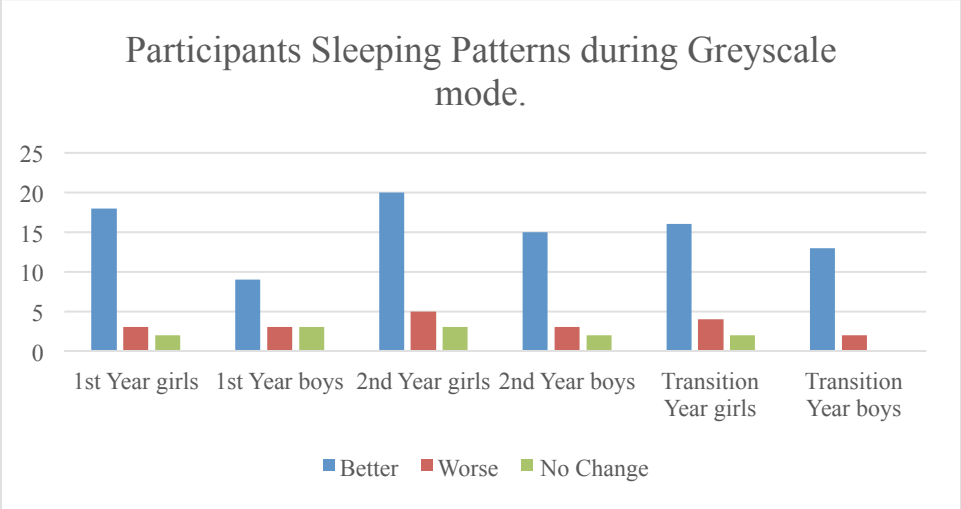


	Average % decrease in use of each app during Greyscale mode
Snapchat	22.98
Instagram	12.36
Facebook	5.86
YouTube	36.51

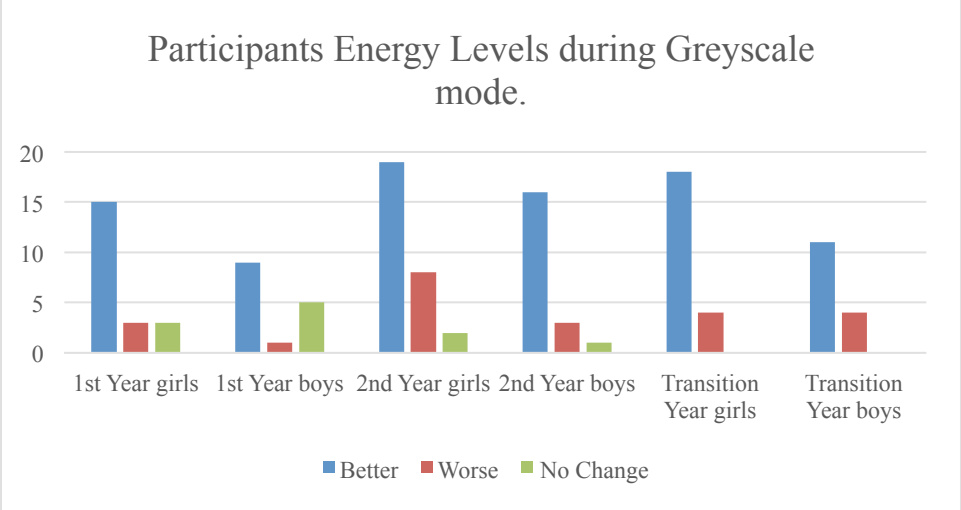
5.4 Results from surveys



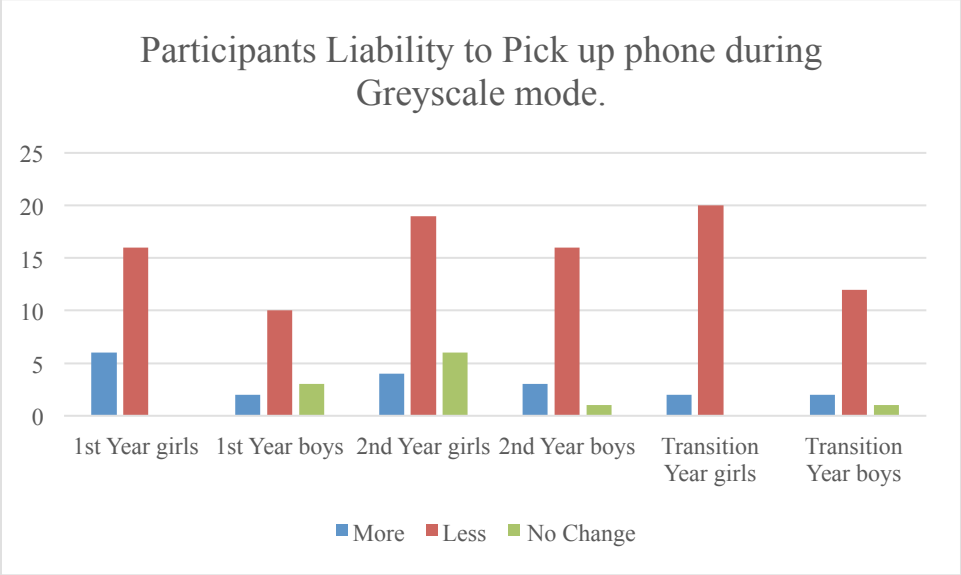
Participants Mood	Better	Worse	No Change
1st Year girls	12	7	3
1st Year boys	5	6	4
2nd Year girls	19	9	1
2nd Year boys	12	7	1
Transition Year girls	12	10	0
Transition Year boys	9	6	0



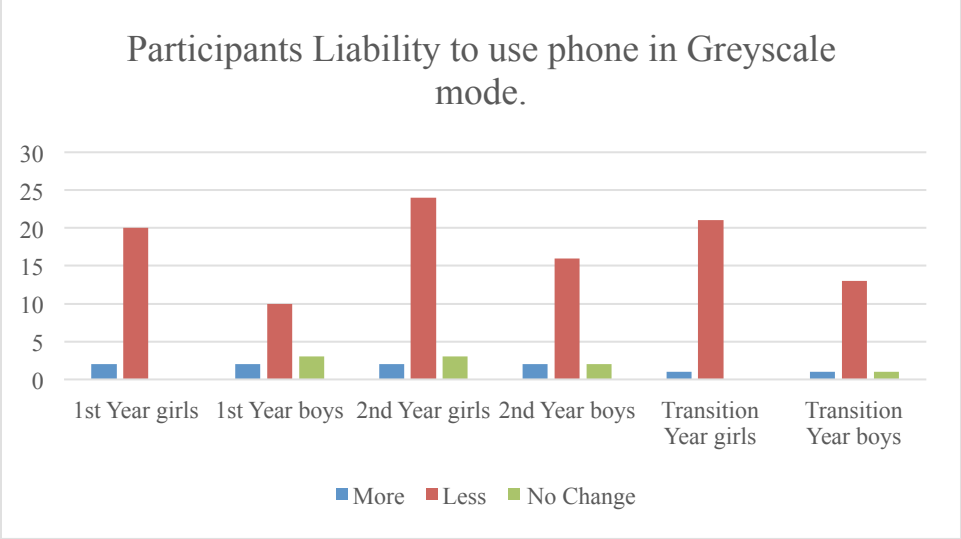
Participants Sleeping Patterns	Better	Worse	No Change
1st Year girls	18	3	2
1st Year boys	9	3	3
2nd Year girls	20	5	3
2nd Year boys	15	3	2
Transition Year girls	16	4	2
Transition Year boys	13	2	0



Energy levels throughout the day	Better	Worse	No Change
1st Year girls	15	3	3
1st Year boys	9	1	5
2nd Year girls	19	8	2
2nd Year boys	16	3	1
Transition Year girls	18	4	0
Transition Year boys	11	4	0

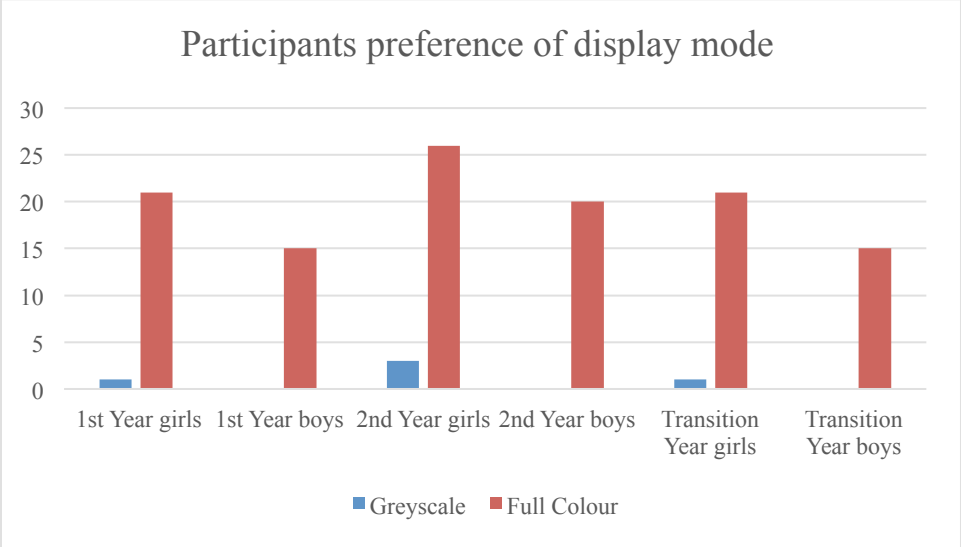


Participants Liability to Pick up phone	More	Less	No Change
1st Year girls	6	16	0
1st Year boys	2	10	3
2nd Year girls	4	19	6
2nd Year boys	3	16	1
Transition Year girls	2	20	0
Transition Year boys	2	12	1

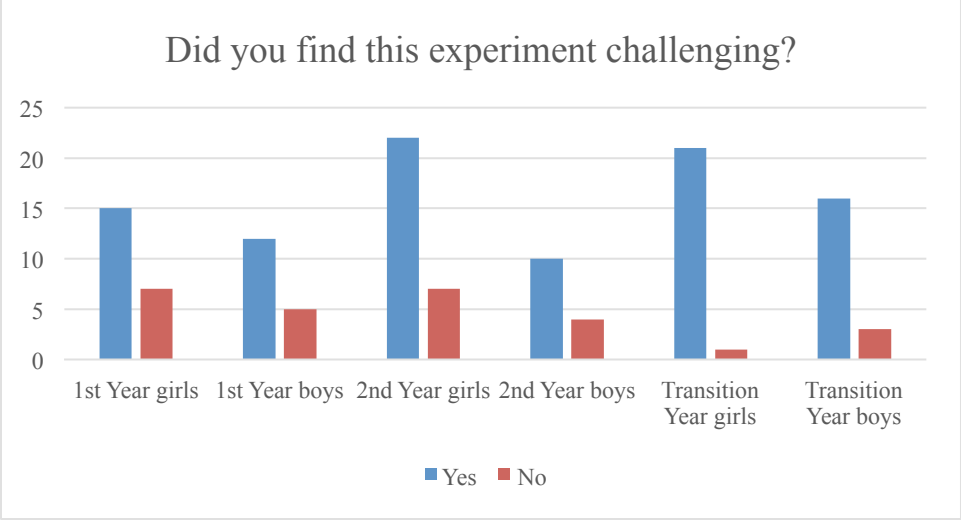


Participants Liability to use phone	More	Less	No Change
1st Year girls	2	20	0
1st Year boys	2	10	3
2nd Year girls	2	24	3
2nd Year boys	2	16	2
Transition Year girls	1	21	0

Transition Year boys	1	13	1

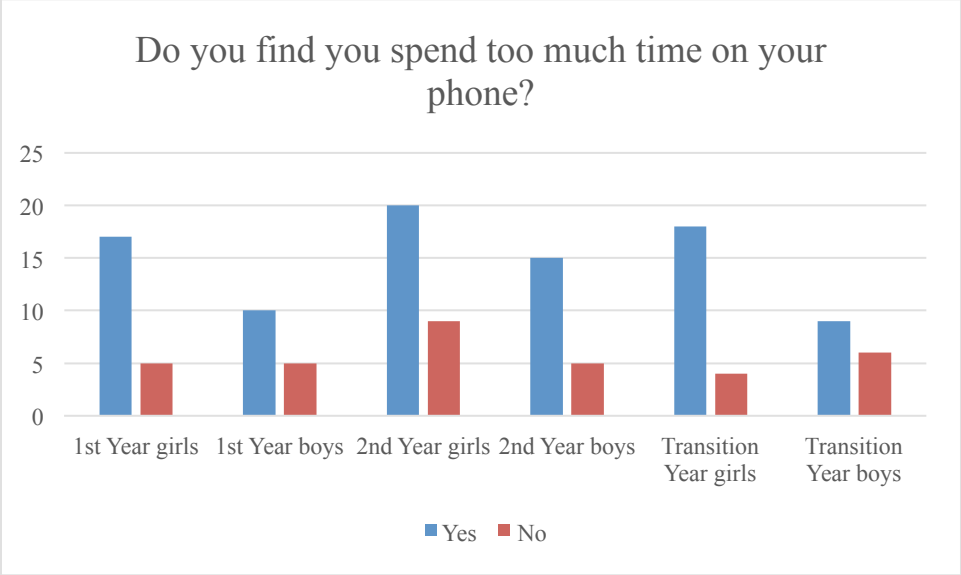


Participants preference of display mode	Greyscale	Full Colour
1st Year girls	1	21
1st Year boys	0	15
2nd Year girls	3	26
2nd Year boys	0	20
Transition Year girls	1	21
Transition Year boys	0	15

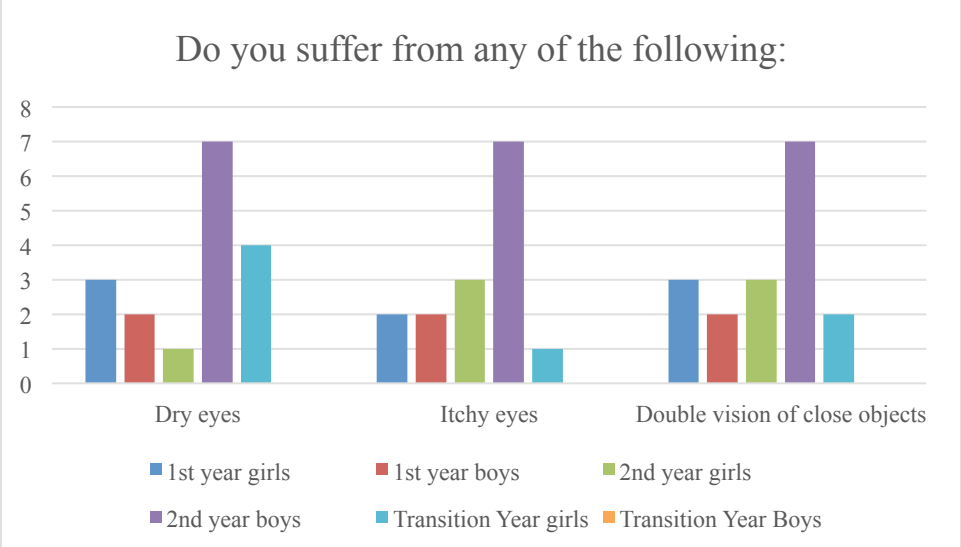


Did you find this experiment challenging?	Yes	No
1st Year girls	15	7
1st Year boys	12	5
2nd Year girls	22	7
2nd Year boys	10	4
Transition Year girls	21	1

Transition Year boys	16	3



Do you find you spend too much time on your phone?	Yes	No
1st Year girls	17	5
1st Year boys	10	5
2nd Year girls	20	9
2nd Year boys	15	5
Transition Year girls	18	4
Transition Year boys	9	6



Do you suffer from:	1st year girls	1st year boys	2nd year girls	2nd year boys	Transition Year girls	Transition Year Boys
Dry eyes	3	2	1	7	4	0
Itchy eyes	2	2	3	7	1	0
Double vision	3	2	3	7	2	0

of close objects

6. DISCUSSION

To the best of our knowledge this is the first investigation of its kind carried out on Irish teenagers. From our experiment we discovered a decrease of 28% in overall time spent on IOS devices while in Greyscale mode. Before we began our experiment, we hypothesised a decrease of 15%.

The app greatest affected by this mode was YouTube. Its average decrease was 36.51%. Prior to this experiment we predicted that Snapchat would be greatest affected by Greyscale however it was only the second largest decrease with an average decline of 22.98%. As we predicted Instagram was the third most affected app followed by Facebook with a decrease of 12.36% and 5.86% respectively.

From our studies we can see that 2nd Year girls were most affected with a 56.46% decrease after week 2, followed by 2nd Year boys with a 25.09%. We expected a lesser decrease at the start of our investigation. We can consider social factors, such as influence of celebrities and peers, and a higher original usage of mobile phones as strong components in this result.

From our surveys we can also conclude that Greyscale positively impacts participants sleeping patterns with 74% of our overall group saying they slept longer. Prior to our investigation we did expect an increase in better sleeping patterns as from our research we learned that bright colours affect your Circadian rhythm. Our results regarding energy levels were different amongst each year and gender. 68% of 1st Year girls said they had more energy while their phone was in Greyscale where as 33% of 1st Year boys said they experienced no change.

From our investigation we have concluded that the lack of phone colour impacts participants mood, interestingly it has a positive impact on females and negative impact on males. 2nd Year girls had the greatest increase in mood by 66%, however, 2nd Year boy's mood decreased by 35% within that same week. We were surprised by these results as our previous research shows that bright colours on

devices increases mood. While creating questions for our survey we did not expect our answers to reflect this finding. We also did not expect such a great variation between genders.
We found that 89% of girls said they were less inclined to use their phones while in Greyscale and 76% of boys were less likely to pick up their phones within the duration of the week. We did expect these results as colour is known to be attractive to the mind. Overall, we can see from our surveys that full colour was more popular than Greyscale amongst both genders with 96% of our participants saying they prefer their phones in full colour. Although 10% of 2nd Year girls said they preferred their phone in Greyscale, that being our highest average.

From our survey, 72% of participants reported that they feel they spend too much time on their phone, while 78% reported finding having no colour on their phones challenging. We found this result particularly intriguing as this outcome shows that even those who don't feel addicted still found our experiment testing.
The result that we did not hypothesise was the increase in usage of Facebook by 5% by Transition year boys. This result can be directly linked to the lack of usage of Facebook.

.

7. CONCLUSION

6.1 Conclusion

From our investigation we have concluded that the lack of phone colour impacts participants mood, interestingly it has a positive impact on females and negative impact on males. 55% of 1st Year girls, 66% of 2nd Year girls and 55% of TY girls said they felt better throughout the week. Although 40% of 1st Year boys, 35% of 2nd Year boys and 40% of TY boys said they felt worse over the course of our investigation. From our surveys we can also conclude that Greyscale positively impacts participants sleeping patterns with 74% of our overall group saying they slept longer. We found that 89% of girls said they were less inclined to use their phones while in Greyscale and 76% of boys were less likely to pick up their phones over the course of our investigation. There was a significant difference in total time spent on phone while in Greyscale. There was a total 28% decrease during week 2 (representing both genders). We calculated a 34% decrease in girls during the 5 days of Greyscale and a 19% decrease for boys in that same period.

In conclusion we can say that colour usage in app design impacts your mood, sleeping patterns, energy levels and total time spent using your phone. We have also found that Greyscale mode causes you to use social media less.

7.2 Implications and Recommendations:

Our project assessed the effect of colour usage in app design. The main findings of our study were that phone colours increase the time spent on electronics. This in turn has proven that colour usage in app design has impacted the rise of mobile phone addiction. Our interest in this topic was to see if using Greyscale mode on iPhones would decrease the overall time spent on apps. Therefore, to reduce time spent on mobile devices our project recommends switching to Greyscale mode.

To develop our study further we would like to repeat the experiment across a wider age group which would translate into a larger sample size, making our results more reliable.
Ideally, we would like to expand our study to include the age bracket 16-19. We would also like to investigate the physiological effects of using colour filters those of which include ‘Protanopia’ (Red/Green filter), ‘Deuteranopia’ (Green/Red filter), ‘Tritanopia’ (Blue/Yellow filter). Finally, as our experiment was restricted to IOS devices we would like to expand our studies to include Android devices.
It is important to note that there is a level of bias in this experiment as 59% of our candidates were girls. Because we attended an all-girls school the nature of our experiment is that it will be biased. Another issue we faced was that phones are not permitted in both schools we investigated therefore, posing an obstacle in our experiment.

8. Acknowledgements

8.1 Mrs. Wright and Eureka Secondary School

We would like to thank our science teacher, Mrs. Wright, for her guidance and support throughout our project. We are extremely grateful for all that she has done for us. We would also like to thank our school, Eureka Secondary School, for the support we have received and for providing us with the opportunity to enter BTYSE 2019.

8.2 St. Ciaran's Community School

We would also like thank the management of St Ciaran's Community School, Kells for allowing us to conduct our experiments in their school. We are extremely grateful for the school's assistance as our project would not
be complete without them.

8.3 Our families and friends

Finally, we would like to thank our friends and families for their support throughout our project. They have been very supportive and encouraging and our project and we are extremely grateful.

9. APPENDICES

9.1 Results of the surveys

1st Year Girls (22)	Question:	Yes/Better/More	No/Worse/Less
Question 1	Participants Mood:	Better: 12 No Change: 3	Worse: 7
Question 2	Sleeping Patterns:	Better: 18 No Change: 2	Worse: 3
Question 3	Energy Levels throughout day:	Better: 15 No Change: 3	Worse: 3
Question 4	Liability to pick up phone:	More: 6	Less: 16
Question 5	Liability to use phones while in Greyscale:	More: 2	Less: 20
Question 6	Did you prefer your phone in Greyscale?	Yes: 1	No: 21
Question 7	Did you find this experiment challenging?	Yes: 15	No: 7
Question 8	Do you find you spend too much time on your phone?	Yes: 17	No: 5
Question 9	Have you suffered from any of the following eye conditions?		
	1.Dry eye:	Yes: 3	No: 19
	2.Itchy eye:	Yes: 2	No: 20
	3.Double vision of close objects:	Yes: 3	No: 19
	4.None of the above:	16	-
	5.Other:		

1st Year Boys (15)	Question	Yes/Better/More	No/Worse/Less
Question 1	Participants Mood:	Better: 5 No Change: 4	Worse: 6
Question 2	Sleeping Patterns:	Better: 9 No Change: 3	Worse: 3
Question 3	Energy Levels throughout the day:	Better: 9 No Change: 5	Worse: 1
Question 4	Liability to pick up phone:	More: 2 No Change: 3	Less: 10
Question 5	Liability to use phone while in Greyscale:	More: 2 No Change: 3	Less: 10
Question 6	Did you prefer your phone in Greyscale?	Yes: 0	No: 15
Question 7	Did you find this experiment challenging?	Yes: 9	No: 6
Question 8	Do you find you spend too much time on your phone?	Yes: 10	No: 5
Question 9	Have you suffered from any of the following eye conditions?		
	1.Dry eye	Yes: 2	No: 13
	2.Itchy eye	Yes: 2	No: 13
	3.Double vision of close objects	Yes: 2	No: 13
	4.None of the above	13	
	5.Other		

2nd year girls (29)	Question:	Yes/Better/More	No/Worse/Less
Question 1	Participants Mood:	Better: 19 No Change: 1	Worse: 9
Question 2	Sleeping Patterns:	Better: 20 No Change: 3	Worse: 6
Question 3	Energy Levels throughout the day:	Better: 19 No Change: 2	Worse: 8
Question 4	Liability to pick up phone:	More: 4 No Change: 6	Less: 19
Question 5	Liability to use phone while in Greyscale:	More: 2 No Change: 3	Less: 24
Question 6	Did you prefer your phone in Greyscale?	Yes: 3	No: 26
Question 7	Did you find this experiment challenging?	Yes: 22	No: 7
Question 8	Do you find you spend too much time on your phone?	Yes: 20	No: 9
Question 9	Have you suffered from any of the following eye conditions?		
	1.Dry eye:	Yes: 1	No: 28
	2.Itchy eye:	Yes: 3	No: 26
	3.Double vision of close objects:	Yes: 3	No: 26
	4.None of the above:	22	
	5.Other:		

2nd Year Boys (20)	Question:	Yes/Better/More	No/Worse/Less
Question 1	Participants Mood:	Better: 12 No Change: 1	Worse: 7
Question 2	Sleeping Patterns:	Better: 15 No Change: 2	Worse: 3
Question 3	Energy Levels throughout the day:	Better: 16 No Change: 1	Worse: 3
Question 4	Liability to pick up phone:	More: 3 No Change: 1	Less: 16
Question 5	Liability to use phone while in Greyscale:	More: 2 No Change: 2	Less: 16
Question 6	Did you prefer your phone in Greyscale?	Yes: 0	No: 20
Question 7	Did you find this experiment challenging?	Yes: 16	No: 4
Question 8	Do you find you spend too much time on your phone?	Yes; 15	No: 5
Question 9	Have you suffered from any of the following eye conditions?	Yes:	No:
	1.Dry eye	Yes: 7	No: 13
	2.Itchy eye	Yes: 7	No: 13
	3.Double vision of close objects	Yes: 7	No: 13
	4.None of the above	17	
	5.Other		

TY girls (22)	Question:	Yes/Better/More	No/Worse/Less
Question 1	Participants Mood:	Better: 12 No Change: 0	Worse: 10
Question 2	Sleeping Patterns:	Better: 16 No Change: 2	Worse: 4
Question 3	Energy Levels throughout the day:	Better: 18 No Change: 0	Worse: 4
Question 4	Liability to pick up phone:	More: 2 No Change: 0	Less: 20
Question 5	Liability to use phone while in Greyscale:	More: 1 No Change: 0	Less: 21
Question 6	Did you prefer your phone in Greyscale?	Yes: 1	No: 21
Question 7	Did you find this experiment challenging?	Yes: 21	No:1
Question 8	Do you find you spend too much time on your phone?	Yes: 18	No: 4
Question 9	Have you suffered from any of the following eye conditions?		
	1.Dry eye	Yes: 4	No: 18
	2.Itchy eye	Yes: 1	No: 21
	3. Double vision of close objects	Yes: 2	No: 20
	4. None of the above	15	
	5. Other		

TY Boys (15)	Question	Yes/Better/More	No/Worse/Less
Question 1	Participants Mood:	Better: 9 None Change: 0	Worse: 6
Question 2	Sleeping Patterns:	Better: 13 None Change: 0	Worse: 2
Question 3	Energy Levels throughout the day:	Better: 11 No Change: 0	Worse: 4
Question 4	Liability to pick up phone:	More: 2 No Change: 1	Less: 12
Question 5	Liability to use phone while in Greyscale:	More: 1 No Change: 1	Less: 13
Question 6	Did you prefer your phone in Greyscale?	Yes: 0	No: 15
Question 7	Did you find this experiment challenging?	Yes: 12	No: 3
Question 8	Do you find you spend too much time on your phone?	Yes:9	No: 6
Question 9	Have you suffered from any of the following eye conditions?		
	1.Dry Eye	Yes: 0	No: 15
	2.Itchy Eye	Yes: 0	No: 15
	3.Double vision of close objects	Yes: 0	No: 15
	4.None of the above	16	
	5.Other		

9.2 Data from week 1 (full colour mode)

1st Year Boys

Day 1

Candidates	Snapchat	Instagram	Facebook	Youtube
d1	35mins	5hrs 47	-	9hrs
d2	2hrs 57	2hrs 57	4mins	8hrs 12
d3	-	-	-	4hrs 29
d4	8hrs 22	6hrs 35	-	4hrs 22
d5	5hrs 27	1hr 39	-	3hrs 52
d6	7hrs 47	3hrs 40	-	4hrs 29
d7	5hrs 39	3hrs 13	-	5hrs 24
d8	3hrs	-	-	4hrs 45
d9	8hrs 56	2hrs 25	-	3hrs 56
d10	1hr 42	45mins	-	-
d11	-	47mins	-	30hrs 22
d12	-	11hrs	39mins	5hrs 17
d13	11hrs 51	1hr 7	3mins	1hr 52
d14	5hrs	-	2hrs 4	2hrs 17
d15	-	2hrs 39	3hrs 57	10hrs 49
Totals:	61hrs 16	42hrs 34	6hrs 47	99hrs 6

TOTAL: 209hrs 43

1st Year Girls Day

1

Candidate	Snapchat	Instagram	Facebook	Youtube
a1	-	41mins	-	11hrs 39
a2	13hrs 47	3hrs 54	1hr 51	3hrs 34
a3	7hrs 6	2hrs 21	-	7hrs 26
a4	25mins	25mins	-	5mins
a5	1hr 6	10mins	-	41mins
a6	5hrs 24	3hrs 42	-	6hrs 6
a7	3hrs 39	40mins	-	13mins
a8	18hrs 42	6hrs 8	-	-
a9	9hrs 37	36mins	-	-
a10	3hrs 25	-	-	4hrs 17
a11	6hrs 42	1hr	-	12hrs
a12	8hrs 55	4hrs 25	-	7hrs 4
a13	-	-	-	3hrs 53
a14	15hrs 5	4hrs 5	-	16hrs 17
a15	21hrs 19	1hr 53	-	5hr 3
a16	13hrs 04	4hrs 3	-	-
a17	24hrs 34	2hrs 04	-	-
a18	2hrs 25	6hrs 33	-	-
a19	14hrs 44	7hrs 4	-	13hrs 54
a20	17hrs 12	6hrs 4	-	3hrs 42
a21	19hrs 05	8hrs 45	-	8hrs 53
a22	22hrs 52	1hrs 23	2hrs 3	9hrs 12
TOTALS;	250hrs 27	65hrs 56	3hrs 54	114hrs 29

TOTAL: 434hrs 06

2nd Year Boys Day

1

Candidates	Snapchat	Instagram	Facebook	Youtube
e1	45mins	1hr 16	2hrs 02	1hr 12
e2	3hrs 34	5hrs 42	-	7hrs 7
e3	39mins	13mins	-	14hrs 49
e4	2hrs 32	25mins	1hr 15	47mins
e5	5hrs 12	4hrs 9	1hr 27	3hrs 18
e6	6hrs 55	5hrs 47	-	2hrs 30
e7	13hrs 29	3hrs 50	-	2hrs 35
e8	13hrs 48	8hrs 8	46mins	10hrs 43
e9	14hrs 07	19mins	-	3hrs 27
e10	5hrs 52	44mins	5hrs 7	13mins
e11	3hrs 05	3hrs 55	-	-
e12	-	4hrs 24	15mins	-
e13	20hrs 49	1hr 27	-	56mins
e14	14hrs 33	2hrs 9	1hr 18	-
e15	2hrs	1hr 33	-	19hrs 10
e16	12hrs 56	-	6hrs 17	1hr 36
e17	5hrs 34	3hrs 13	-	14hrs 30
e18	5hrs 29	1hr 28	11mins	17hrs 47
e19	15hrs 10	1hr 56	1hr 46	2hrs 46
e20	8hrs 30	1hr	-	6hrs 30
Totals:	154hrs 59	51hrs 38	20hrs 24	109hrs 56

TOTAL: 336hrs 57

2nd Years week

1

Candidate	Snapchat	Instagram	Facebook	Youtube

b1	8hrs	2hrs 38	-	4hrs 3
b2	15hrs 17	2hrs 5	-	-
b3	3hrs 8	1hr 48	-	7hrs 22
b4	14hrs 33	8hrs 42	-	31hrs 17
b5	3hrs 18	1hr 41	-	3hrs 6
b6	29hrs	1hr 6	43mins	5hrs 49
b7	33mins	5hrs 37	-	3hrs 24
b8	5hrs 48	3hrs 5	-	10hrs 5
b9	2hrs 21	15mins	-	-
b10	2hrs 54	2hrs 12	-	5hrs 46
b11	11mins	6hrs 33	-	13hrs 25
b12	5hrs 14	4hrs 27	-	-
b13	5hrs 58	4hrs 33	-	2hrs 29
b14	6hrs 5	2hrs	-	3hrs 52
b15	22hrs	2hrs 47	-	-
b16	2hrs 31	4hrs 42	16mins	5hrs 31
b17	9hrs 52	5hrs 17	-	1hr 7
b18	27hrs 5	2hrs 52	-	6hrs 16
b19	6hrs 24	5hrs 14	-	-
b20	2hrs 48	17mins	-	3hrs 18
b21	18hrs 54	3hrs 57	-	1hr 23
b22	8hrs 32	2hrs 52	1hr 9	3hrs 27
b23	15hrs 22	3hrs 22	27mins	2hrs 16
b24	9hrs 02	4hrs 34	1hr 4	12hrs 54
b25	12hrs 59	6hrs 18	-	5hrs 07
b26	15hrs 33	1hrs 22	-	-
b27	6hrs 27	8hrs 11	-	2hrs 52
b28	20hrs 51	13hrs 07	2hrs 34	6hrs 33
b29	9hrs 44	6hrs 56	-	8hrs 57
TOTALS	290hrs 24	119hrs 08	10hrs 6	152hrs 19

Total: 571hrs 57

TY Boys Day 1

Candidates	Snapchat	Instagram	Facebook	Youtube
g1	6hrs 6	3hrs 16	3hrs 26	7mins
g2	5hrs 30	4hrs 48	-	6hrs 12
g3	4hrs 55	39mins	-	43mins

g4	10hrs 38	4hrs 9	5mins	1hr
g5	5hrs 24	3hrs 12	1hr 27	7hrs 42
g6	5hrs 4	2hrs 7	2hrs 17	1hr 30
g7	2hrs 40	8hrs 40	-	8hrs
g8	15hrs 49	8hrs 5	23mins	8hrs 53
g9	10hrs 35	3hrs 37	-	2hrs 48
g10	26mins	7hrs 36	3hrs 58	6hrs 42
g11	13hrs 45	5hrs 37	3hrs 1	4hrs 39
g12	32hrs 31	7hrs 18	-	10hrs 40
g13	28hrs 19	11hrs 1	-	-
g14	16hrs 23	2hrs 10	-	9hrs 16
g15	11hrs 8	4hrs 20	-	17hrs 51
Totals:	169hrs 13	66hrs 35	11hrs 37	86hrs 3

TOTAL:333hrs 28

TY Girls Day 1

Candidates	**Snapchat**	**Instagram**	**Facebook**	**Youtube**
d1	5hrs 22	8hrs 29	-	7hrs 30
d2	11hrs	5hrs 17	24mins	-
d3	4hrs 4	1hrs 54	-	-
d4	1hr 39	5hrs 15	-	-
d5	5hrs 2	2hrs 26	24mins	2hrs
d6	4hrs 25	9hrs 22	1hr 26	6hrs 24
d7	16hrs 42	7hrs 9	-	-
d8	14hrs 53	1hr 36	-	8hrs 34
d9	4hrs 56	2hrs 51	-	51mins
d10	2hrs 54	12hrs 41	2hrs 18	6hrs 4
d11	2hrs 37	8hrs 11	-	10hrs 40
d12	5hrs 30	4hrs 21	-	-
d13	9hrs 34	1hr 43	5hrs 43	21mins
d14	8hrs 17	4hrs 56	4hrs 17	30mins
d15	13hrs 14	2hrs 37	-	35mins
d16	7hrs 24	6hrs 56	-	2hrs 47
d17	5hrs 15	5hrs 34	-	3hrs 57
d18	30mins	1hr 47	-	15hrs
d19	13hrs 2	5hrs 26	8hrs 12	6hrs 24
d20	12hrs 45	3hrs 29	-	18hr 45
d21	9hrs 58	2hrs 54	-	4hrs 34
d22	6hrs 4	8hrs 4	1hr 9	6hrs 49
Totals	165hrs 07	112hrs 58	23hrs 53	101hrs 05

Total:403hrs

9.3 Data from week 2 (Greyscale mode)

1st Year Girls
Day 2

Candidate (A)	**Snapchat**	**Instagram**	**Facebook**	**Youtube**
a1	-	1hr	-	-

a2	20hrs 40	5hrs 11	27mins	-
a3	26	2hrs 3	-	2hrs 9
a4	4hrs 33	1hrs 54	-	3hrs 14
a5	1hr 6	1hr 6	-	1hr 9
a6	3hrs 43	1hr 52	-	3hr 37
a7	2hrs 20	53mins	-	3hrs 06
a8	20hrs 14	8hrs 22	-	-
a9	8hrs 8	48mins	6mins	7hrs
a10	6hrs 27	-	-	14hrs
a11	7hrs 6	1hr 8	1hr 20	13hrs 4
a12	15hrs 31	3hrs 44	-	7hrs 13
a13	57hrs	-	32mins	5hrs 1
a14	27hrs 14	2hrs 41	-	3hrs 37
a15	7hrs 52	1hr 59	-	14hrs 31
a16	16hrs 21	8hrs 55mis	10mins	9hrs 5
a17	5hrs 40	9hrs 24	-	-
a18	7hrs 27	50mins	20mins	30mins
a19	16hrs 30	1hr 5	-	2hrs 13hrs
a20	3hrs 21	6hrs 12	54mins	1hr 3
a21	2hrs 22	48mins	-	-
Totals	177hrs 58	59hrs 55	3hrs 49	90hrs 32
Difference from day 1	72hrs 29	6hrs 1	5mins	23mins 57
% Decrease	28.9%	9.12%	2.05%	20.92%

TOTAL: 332hrs 14 Total Difference from day 1: 101hrs 52 Total % Decrease: 23.47%

1ST Year Boys
Day 2

Candidate (D)	Snapchat	Instagram	Facebook	Youtube
d1	48mins	6hrs 03	-	10hrs 7
d2	4hrs 33	1hr 42	10mins	8hrs 12
d3	6hrs 03	3hrs 56	-	6hrs 51
d4	7hrs 14	4hrs 52	-	4hrs 48
d5	2hrs 32	4hrs	-	5hrs 16
d6	10hrs 24	3hrs 49	-	3hrs 41

d7	3hrs 45	54mins	3hrs 2	-
d8	6hrs 27	4hrs 28	-	5hrs 28
d9	1hr 6	1hr 7	-	-
d10	3hrs 12	5hrs	12mins	9hrs 10
d11	-	1hrs 4	1hr 4	5hrs 6
d12	4hrs 12	-	-	2hrs 37
d13	2hrs 23	3hrs	41mins	25mins
d14	3hrs 31	47 mins	9mins	5hrs
d15	1hr 14	35mins	51mins	-
Totals	57hrs 24	41hrs 17	6hrs 9	66hrs 41
Difference from day 1	3hrs 52	1hr 17	38mins	32hrs 37
% Decrease	6.3%	3%	9.29%	32.92%

TOTAL: 171hrs 31 Total Difference from day 1: 38hrs 12 Total % Decrease: 18.21%

2nd year Girls
Day 2

Candidate	**Snapchat**	**Instagram**	**Facebook**	**YouTube**
B1	1hr 34	3hrs 13	-	57mins
B2	5hrs 12	2hrs 34	56mins	1hr 2
B3	3hrs 7	-	22mins	23mins
B4	2hrs 45	48mins	-	-
B5	-	1hr 35	35mins	7hrs 15
B6	38mins	12mins	-	-
B7	1hr 42	3hrs 47	2hrs 4	28mins

B8	2hrs 35	16mins	11mins	6hrs 25
B9	1hr	5hrs 37	16mins	27mins
B10	2hrs 21	56mins	-	6hrs 42
B11	35mins	1hr 32	-	2hrs 33
B12	1hr 47	3hrs 22	19mins	5hrs 17
B13	5hrs 23	3hrs 47	-	7hrs 12
B14	2hrs 31	46mins	-	22mins
B15	3hrs 14	1hr 56	-	-
B16	5hrs 30	10hrs	45mis	2hrs 26
B17	4hrs 39	3hrs 45	-	1hr 26
B18	48mins	2hrs 17	23mins	4hrs 7
B19	6hrs 12	7hrs 2	-	-
B20	3hrs 36	3hrs 34	2mins	35mins
B21	1hrs 9	5hrs 57	7 mins	2hrs 11
B22	7hrs 6	1hr 47	-	1hr 2
B23	3hrs 17	56mins	-	2hrs 14
B24	2hrs 19	39mins	-	5hrs 3
B25	3hrs 12	23mins	28mins	4hr 12
B26	1hr 46	3hr 45	2hrs 19	3hrs 19
B27	2hrs 7	12mins	--	5hrs 34
B28	8hrs 12	1hr 45	35mins	3hrs 23
B29	3hr 12	3hr 10	-	2hrs 54
Totals	87hrs 28	74hrs 42	9hrs 22	77hrs 29
Difference from Day 1	202hrs 56	44hrs 26	44mins	74hrs 50
% Decrease	69.8%	37%	7.33%	49.13%

TOTAL: 249hrs 02 Total Difference from day 1: 322hrs 55 Total % Decrease: 56.46%

2nd Year Boys
Day 2

Candidate	Snapchat	Instagram	Facebook	YouTube
e1	1hrs 14	1hr 45	1hrs 10	1hr 42
e2	2hrs 53	4hrs 20	-	8hrs
e3	3hrs 11	35mins	1hr 37	1hr 21
e4	13hrs 56	1hr 46	36mins	2hrs 6
e5	1hrs 12	2hrs 34	51mins	-
e6	11hrs 1	3hrs 4	25mins	16hrs 51
e7	15hrs 25	33mins	-	5hrs 3
e8	27hrs 13	6hrs 32	-	-

e9	11hrs 26	1hr 10	6hrs 27	1hr 42
e10	3hrs	4hrs	-	-
e11	4hrs 12	6hrs 4	17mins	5hrs 1
e12	26hrs 29	3hrs 21	-	1hr 10mis
e13	1hr 32	1hr 27	13mins	-
e14	17mins	2hrs 21	4hrs 16	1hr
e15	1hrs 25	1hr 45	1hr 33	-
e16	3hrs 16	1hr 12	24mins	-
e17	2hrs 4	1hr 7	1hr 28	58 mins
e18	2hrs 18	1hr 2	54mins	-
e19	1hr 12	1hr 46	1hr 24	2hrs 12
e20	4hrs 15	2hrs 37	12mins	17mins
Totals	135hrs 31	48hrs 1	49hrs 47	19hrs 23
Difference from Day 1	19.46	3.61	1.02	60.15
% Decrease	12.56%	6.99%	5%	54.72%

TOTAL: 252hrs 42 Total Difference from day 1: 84hrs 32 Total % Decrease: 25.09%

TY Girls Day 2

Candidate	Snapchat	Instagram	Facebook	YouTube
c1	2hrs 35	2hrs 11	30 mins	1hr 35
c2	1hr 15	3hrs	-	6hrs 44
c3	34mins	5hrs 21	4hr 27	7hrs 28
c4	1hr 55	1hr 12	-	1hr 36
c5	11hrs	7hrs 34	3hrs 35	12hrs 12
c6	8hrs 44	5hrs 12	-	-
c7	1hr 31	2hrs 49	1hrs 12	2hrs
c8	7hrs 29	5hrs 23	-	5hrs 43
c9	10hrs 20	8hrs	2hrs 44	6hrs 32

c10	2hrs 6	2hrs 50	4hrs 33	47mins
c11	15hrs 57	10hrs 12	6mins	4hrs 4
c12	5hrs 28	-	-	9mins
c13	17hrs 44	4hrs 17	-	3hrs 55
c14	4hrs 2	38mins	54mins	3hrs 13
c15	5hrs 37	8hrs 52	1hr 6	3hrs 18
c16	1hrs 59	-	-	-
c17	12hrs 12	9hrs 43	-	5hrs 43
c18	7hrs 45	4hrs 21	-	4hrs 47
c19	2hrs 37	2hrs 4	34mins	1hrs 23
c20	9hrs 34	8hrs 56	21mins	1hrs 54
c21	5hrs 41	3hrs 28	-	4hrs 59
c22	9hrs 18	6hrs 34	-	3hrs 45
Totals	145hrs 23	102hrs 37	20hrs 2	81hrs 47
Difference from Day 1	19hrs 44	10hrs 20	3hrs 51	19hrs 18
% Decrease	11.95%	9.15%	16.12%	19.09%

TOTAL: 345hrs 49 Total Difference from day 1: 42hrs 14 Total % Decrease: 10.48%

TY Boy's Day 2

Candidate	Snapchat	Instagram	Facebook	YouTube
g1	15hrs 21	5hrs 12	2hrs 38	-
g2	16hrs 49	10hrs 39	5mins	7hrs 38
g3	14hrs 11	3hrs 57	37mins	4hrs 23
g4	3hrs 33	4hrs 21	4hrs	17hrs 37
g5	10hrs 12	1hr 36	-	12hrs 29
g6	15hrs 5	7hrs 37	-	-
g7	11hrs 9	8hrs 36	-	45mins
g8	16hrs 36	5hrs	4mins	-
g9	11hrs 21	2hrs 31	3hrs 56	-
g10	9hrs 11	4hrs 5	14mins	-
g11	5hrs 5	2hrs 9	1hr 30	3hrs 2

g12	4hrs 54	3hrs 13	-	21mins
g13	32mins	12mins	32mins	54mins
g14	13hrs 43	7hrs 42	-	2hrs 32
g15	7hrs 23	2hrs 54	1hr 44	-
Totals	155hrs 5	69hrs 44	15hrs 20	49hrs 41
Difference from Day 1	14hrs 8	6hrs 51	41mins*	36hrs 22
% Decrease	8.36%	8.94%	4.65%**	42.26%

TOTAL: 289hrs 50 Total Difference from day 1: 43hrs 38 Total % Decrease: 13.08%

*41-minute increase

**4.65% increase

9.4 Emails

Email we sent to researcher Mr Maeir;

Subject: BTYSE 2019

From: Eimear Sherwin [Eimear.Sherwin@eurekaschool.ie]

To:

Dear Mr Maeir,

I and 2 other 15-year-old girls have recently been accepted into the BT Young Scientist Exhibition, Ireland's biggest school's science competition. Our project is entitled "Should all teens switch to black and white screens? - An insight into how colour usage in app design influences phone addiction" For our experiment, we gathered 100 students, aged between 13 and 17 with an iPhone, as iOS devices have a built-in feature that allows you to check the

time spent on each app. We recorded the usage of the social media apps for the past 5 days, when the candidate's phone was set to normal settings with colour. We then changed their settings to only show their screens in black and white. After 5 days, we recorded the participants usage again and conducted a survey to find if participants were more liable to pick up their phones etc. Our analysis of our results has shown decreases in phone usage up to 35%. We are aware of your work on colour usage and its influence in our emotions. We would be extremely grateful if you could send us your work or findings from your studies, to use as references in our experiment write up. We would also really appreciate if you could recommend or send us any other information we could reference.
Thank you so much for taking time to read this email, looking forward to hearing from you soon,
Eimear Sherwin
Eureka Secondary School, Kells, Co. Meath, Ireland

9.5 Survey

Participant number: Year:
1.Participants mood: better/worse
2.Sleeping patterns: better/worse Slept longer/shorter
3.Energy levels throughout the day: better/worse
4.Liability to a) pick up phone: more/less b) use phone while it's on grey scale: more/less
6.Did you find any difference in using your phone while it was in grey scale? Yes/No If yes please expand
_____
7. Have you suffered from any of the following eye conditions?
Dry eye itchy eye double vision of close objects other:
_____
8. Do you prefer having you phone in:
Full colour / Greyscale
9. Did you find this experiment challenging?
Yes No
10. Do you feel you spend too much time on your phone?
Yes

9.6 Participant Agreement

10. REFERENCES

- www.Harvard health.edu – Blue light has a dark side: https://www.health.harvard.edu/staying-healthy/blue-light-has-a-dark-side

- www.theguardian.com - The truth about blue light: does it really increase insomnia? https://www.theguardian.com/lifeandstyle/2018/may/28/blue-light-led-screens-cancer-insomnia-health-issues

- www.colour-affects.co.uk- Psychological properties of colour www.colour-affects.co.uk/psychological-properties-of-colours

- www.psychologicaltoday.com - Blue light hazards
https://www.psychologytoday.com/us/blog/sleep-newzzz/201403/blue-light-hazardous-sleep-helpful-while-awake

- www.levineyecare.com - How blue light effects your eyes and brain
https://www.levineyecare.com/effects-blue-light/

- www.allaboutvision.com - Blue light: it's both good and bad for you
https://www.allaboutvision.com/cvs/blue-light.htm

- www.colormatters.com - Colour Psychology
https://www.colormatters.com/color-matters-blog/entry/blog-archive/a-color-thats-worth-80000000

- www.Bmcpublichealth.biomedcentral.com - Mobile phone use and stress, sleep disturbances, and symptoms of depression among young adults - a prospective cohort study
https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-11-66

- www.jamanetwork.com/ - Problematic Internet Use Among US Youth
https://jamanetwork.com/journals/jamapediatrics/fullarticle/1107596

- www.livescience.com