INVESTIGATION INTO THE IMPACT OF REMOTE LEARNING ON PHYSICAL AND MENTAL WELLBEING

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Abstract

The problem of COVID-19 and the lockdowns it has caused have had a knock on effect on the provision of education. This has caused the vast majority of schools and universities in the UK to enter a state of remote learning. This project focuses on the potential drawbacks of remote learning on the physical and mental well-being of those involved.

Acknowledgments

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1. Introduction

1.1. Project Overview

Over the past year, people all around the world have been subject to multiple restrictions and lockdowns due to the onset of the COVID-19 pandemic. Arguably the most affected area has been in education provision which has, for the most part, been shifted to an online platform. As the majority of learning has been moved online, so too has there been an increase in average screen time and time spent within homes. While it has offered a solution to the challenges posed by social distancing, it has not been made clear whether this will have effect on the mental and physical well-being of those partaking.

1.2. Project Aims

The ultimate aim of this project is to determine whether or not remote learning has a significant impact on the physical and mental wellbeing of people. In order to come to a satisfactory conclusion to this, a series of questions must be answered:

- Is there a link between an increased amount of remote learning and cases of poor mental and physical well-being and to what extent?
- What are the key contributing factors to poor physical and mental well-being within the scope of the investigation?
- What are the mitigating factors to developing poor physical and mental well-being?
- Are there any potential, realistic, solutions that would resolve or limit the extent of the issue?

1.3. Project Objectives

In order to meet these aims, a set of objectives will also need to be completed:

- To identify the connection between extended learning remotely and poor physical and mental well-being, a set of causal loop diagrams will be created that map out the connections between each aspect.
- Devise a set of experiments from the diagrams that will test theories for the mitigating factors.
- Develop models for simulation from the experiments that can be run with real data to prove or disprove these theories and identify the areas that need more support.
- Identify real solutions through the analysis of the data from the models that could be implemented to mitigate the discussed problems.

1.4. Project Scope

In order to manage a realistic investigation the scope of this project will only encompass university students and lecturers. However, there will be a natural overlap with any group that is taking on remote learning for an extended period of time. This scope has been selected due to ease of access to university resources and figures. Also, a wider scope would require further time and resources that are not manageable. Furthermore, other areas of learning such as primary and secondary schools have introduced periods of in person learning whereas universities have remained dedicated to remote learning for the duration of the COVID-19 pandemic. This cements the students and lecturers of universities as the most effected by remote learning and therefore are most susceptible to the negatives of it.

1.5. Assumptions

To produce accurate conclusions for this project, the investigation must be clear of personal bias and unsupported assumptions. To help ensure this, all decisions and pieces of the project will require data and evidence to support them. However, there will need to be some assumptions made in order for progress to be made with the project. These assumptions will be 'informed assumptions' as in any case of data being used, it shall be based on existing data from studies and will therefore have a high degree of accuracy. Some general assumptions must also be made at the start of this investigation in order to begin. The first of which being that, the various system dynamics tools that will be used work and can provide valued insight. It is also assumed that data researched is accurate and correct. Finally, it is also assumed that there is a tangible solution to the problem and policy can be informed due to the results of the investigation.

2. Background Research

2.1. Education Provision

Universities have been providing education within the UK for hundreds of years. According to (Universities UK 2020) there were 2.38 million students studying in universities across the United Kingdom between 2018-19. This is certainly a substantial amount of people that are under the effects of remote learning as of the writing of this report. Likewise, (Universities UK 2020) also claims that during this time period there were 439,955 staff working within the higher education sector. These numbers are certainly substantial and demonstrate a clear need for this investigation as there are a great number of students and staff out there that could be at risk.

(HESA 2021) claims that in 2019 35% of first degree qualifiers attained a first class honours. This is a particularly high figure and represents a steady increase in performance over the previous few years. It is immensely important that this level of attainment remains strong while under the troubling situation universities around the world are facing. To this end, determining the most effective learning methods while complying with COVID-19 based rules is of utmost importance.

2.2. Existing Mental Well-Being

Mental well-being/mental health has been studied extensively within universities and society as a whole for a number of years. Institutions such as the NHS and the Samaritans have been collecting numerous stats and figures about mental health in the UK for years. These statistics provide a helpful background to measure how much of an impact the COVID-19 pandemic has had on mental health.

According to (Samaritans 2019) suicide rates have been on the rise for the past few years and there were a total of 6,859 suicides in the UK and Republic of Ireland during 2018. The 2019 stats (Samaritans 2020) claim that 2019 had an extra 321 suicides within the UK than 2018, demonstrating suicides are increasing. Despite this, the suicide rate has remained the same between these two years. Delving deeper into mental health statistics, (Mind 2021) produced these figures over the previous year:

- 1 in 5 people have suicidal thoughts
- 1 in 14 people self-harm
- 1 in 15 people attempt suicide

All these figures are extremely high and demonstrate the clear risk that all people are at risk of developing poor mental-wellbeing. Students are not immune to this terrible trend either. (Megraoui 2021) claims that one student in dies by suicide every four days. These figures demonstrate the

disastrous trend being followed for the past few years. The figure below is taken from (Samaritans 2019) and displays the suicide rates amongst young people over the many years the Samaritans have been gathering data. This displays the extent to which suicides effect younger people.

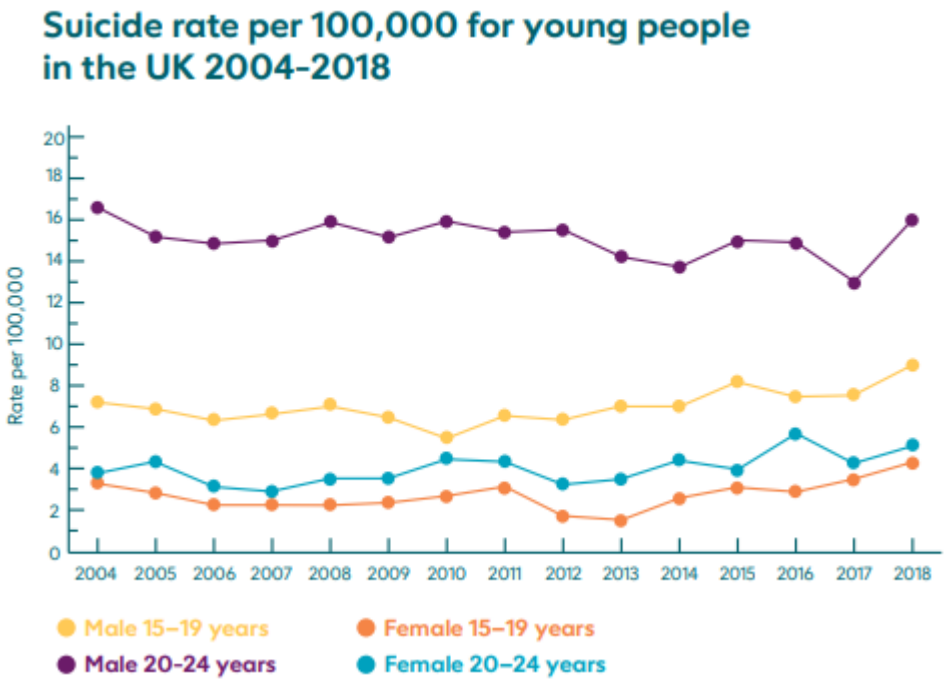

Figure 1 - Suicide rate per 100,000 for young people

Given this, it would be natural to expect a continuation of this as COVID-19 appeared or an even greater amount.

However, initial statistics report that this has not been the case. According to (Appleby 2021), suicide rates have actually decreased within the past year. The cause of this is at present unknown for certain but (John et al. 2020) argue that this may only be a "pulling together" phenomenon that may not last. While official statistics, it does raise a set of questions about why these initial values have been reported. What forced or unforced aspects of lockdowns could reduce the risk of suicides? Is it a case of everyone feeling a need to pull together and work through a universal problem? And is it temporary or will the rates remain lower for the duration of the pandemic and lockdowns? Somewhat supporting this theory, (Ammar et al. 2020) concludes that there has been a significant physiological strain induced via extended home confinement.

Regardless of the surprising statistics from lockdown, the suicide and mental health problem faced is far more than just substantial.

2.3. Existing Physical Well-Being

Much like mental well-being, physical well-being has been studied in great depth due to its importance in growth development and necessity for a person to remain in good health. Poor physical well-being has long been linked with extended periods of time without exercise, whether this has come to be during the lockdowns remains to be seen. Remote learning has had a number of drastic effects on how we go about learning and some of these effects may not be entirely beneficial.

Screen time is one factor contributing to physical well-being that may be increased with an increased amount of remote learning. A study produced by (Miller 2021) claims that 49% of participants felt that their screen time had increased since the pandemic began. Also, 50% of the students who reported an increased screen time believe that their eyesight have been affected by it. Another statistic reported in the study showed that 23% reported headaches or migraines as a direct result of this increased screen time. (UAB 2021) claims that research has shown that excessive exposure to blue light (the same as screens) can cause damage to sensitive nerve cells behind the retina which can lead to eyestrain and focusing problems. The general consensus is that moderated exposure to computer screen is imperative to healthy vision and the increased amount of screen time reported by almost 50% of the population may have a significant impact on the nations eye care. The figure below displays the high amounts of children with eyesight issues already existing. Data taken from (RNIB 2017)

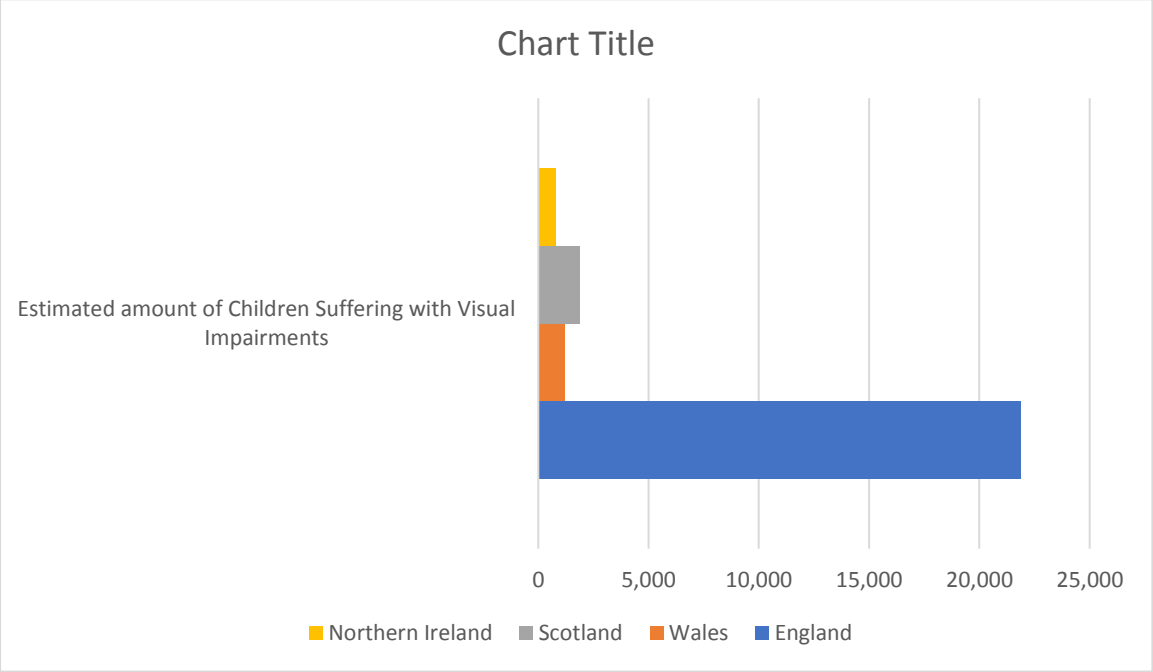

Figure 2 - Estimated Amount of Children Suffering with Visual Impairments

Sleep is something that is universally important to every aspect of good physical and mental well-being. This is another factor that is potentially being impacted by an increase in remote learning. It was found in (Hisler et al. 2020) that an increase of screen time does negatively impact upon sleep duration and sleep disturbances in children and adolescents, which is likely to also transfer over into young adults and adults in general. According to (NHS 2018b), sleep helps with a variety of problems ranging from mental well-being to heart disease. Up to 16 million UK adults report having trouble sleeping according to NHS statistics. Due to an already high value and an established link between screen time and sleeping disorders, it seems clear that increasing screen time will have a negative effect on physical well-being.

The final factor that effects physical well-being that will be researched is that of exercise. According to (NHS 2018a), there are numerous benefits to exercising regularly, one of which being the reduction of the likelihood of early death by up to 30%. While the first lockdown did report some increased exercise as more people began picking up different types of staying fit, this trend did not continue into the second one. According to (Hawkes 2021), two fifths of the population reported a

reduced amount of exercise during this time. This startling trend clearly shows that there is a potential issue.

2.4. Impact of COVID on Education Provision

For this section, six universities' COVID-19 policies will be reviewed and compared to demonstrate the various different responses to the pandemic. The universities (other than Cardiff) shall be chosen at random in order to achieve a non-biased study. Cardiff University shall be the first studied due to it being the location this report is being written from.

Cardiff University have a page to illustrate their current policies on COVID-19 (Cardiff University 2021). The first aspect to discuss is the remote study policy. This allows students at the university to study completely remotely until the end of the 2020-21 period of study. This applies to any student concerned about the safety of being on campus. However it does not apply for courses that require in person teaching. The second part of Cardiff University's policies is the safety net. This safety net applies to 2020/21 students and has been extended from the prior year. This policy effects extenuating circumstances, examining boards and classification of degrees. The first change is that students can self-certify if they have extenuating circumstances in order to get extensions of coursework and dissertations as well as the deferral of time-limited examinations or assessments. Examination boards use scaling to prevent unexplained variation in marks and marks will not be capped if an examination is attempted. Finally, degree classifications will calculate average marks with the goal of ensuring no students are disadvantaged. Cardiff University have also declared that large scale lectures will not be likely to return in September 2021.

The second university viewed is Oxford University. Oxford University has a slightly less forgiving policy when it comes to COVID-19 than Cardiff University does. While (Oxford University 2021) does claim that "assessment support packages" are available to students who study there, there is no apparent safety net policy that will uncap marks of resists. However, their exam boards can review outcomes and compare them to prior year's outcomes and the extenuating circumstances system allows students to apply without direct evidence. They also plan on returning to normal in person teaching when the September term begins.

Following onto the third university studied, The University of South Wales (USW). The USW are currently using a "No Detriment Policy" (University of South Wales 2021). This policy applies to students who are not in their final year and applies to examinations and coursework. As the name implies, it is a policy that aims to help prevent a dip in performance sue to the COVID-19 pandemic. On top of this, they share the same extenuating circumstances policy as both Cardiff and Oxford universities. Their website also claims that they intend to return with a blended learning format in the coming year.

The University of Nottingham have another different form of a safety net policy. While no uncapped resists are being offered, they have update the extenuating circumstances policy and have their exam board reviewing results to ensure performance of students does not decrease unexpectedly (Nottingham University 2021).

The fifth university studied is the University of Edinburgh. The university offers an unchecked 7-day extension to deadlines as opposed to the other's blanket 14. They also have a policy of allowing aggregated passes if one module receives an unexpectedly low mark (Edinburgh University 2021). They also offer the resisting of courses treated as a 'first attempt' if given special circumstances which would result in an uncapped mark.

Finally, Swansea University. Swansea University offer a “No Detriment Framework” (Swansea University 2021), which is a modified version of the safety net they had in the previous academic year. This framework allows for the appeal of failed modules to be improved to a passing mark and the further improvement of passed modules as well. Failed examinations can also be resit at uncapped marks unless the student is in their final year.

This summarises each of the chosen universities policies on COVID-19 progression. These policies are all fairly varied and demonstrate that there is not one distinct answer on how student performance should be guaranteed by the university. Some of these differences are presented in the figures below.

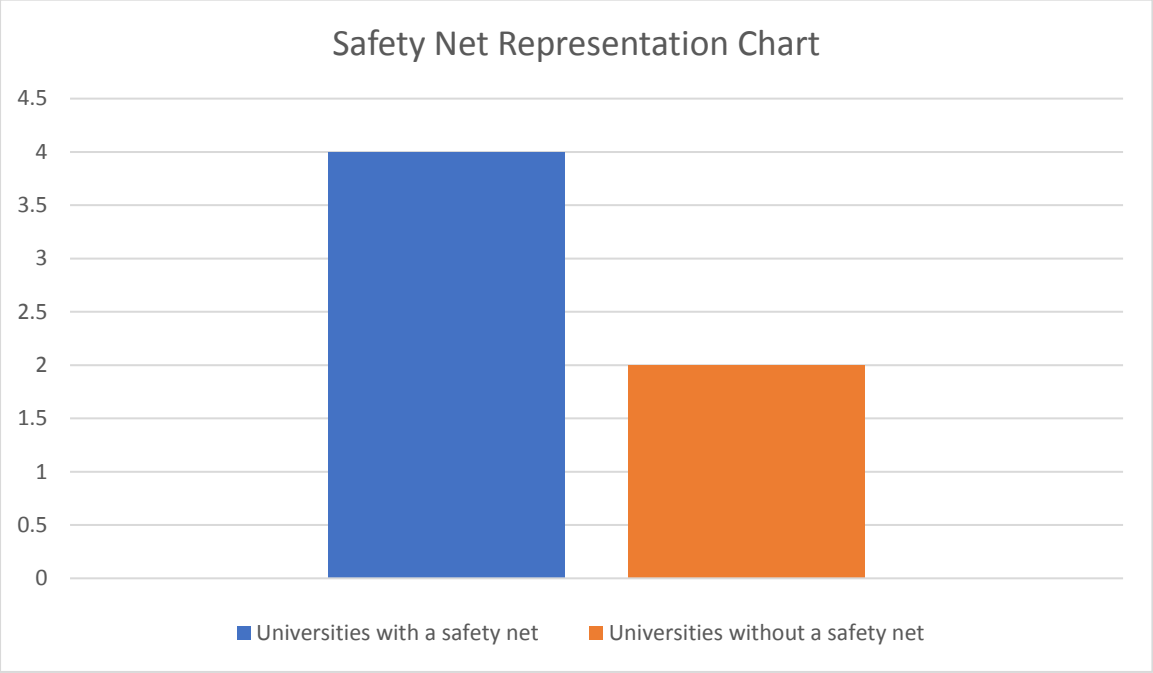

Figure 3 - Safety Net Representation

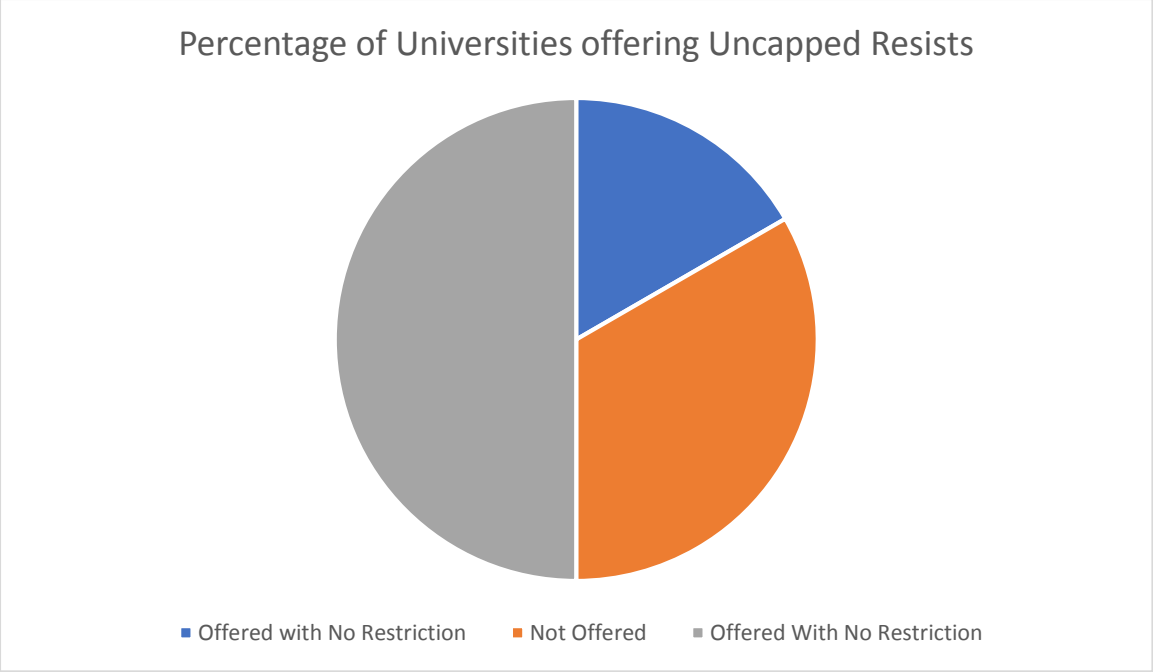

Figure 4 - Uncapped Resit Representation

3. Approach

Education is one of the most important aspect of modern society and this is displayed most prevalently through the sheer amount of existing research on each and every aspect of it. Within the university field alone there are countless studies ranging from factors affecting concentration all the way to graduation. In (Rute 2004), it has been found that a university degree can be instrumental in ascertaining higher level jobs and pay. This demonstrating the importance of providing informed and accurate study of the problem at hand. In order to do so, numerous systems and statistical analysis methodologies will be used within this investigation to ensure these standards are upheld. This section shall detail them.

Measuring the extent of theoretical data (e.g. likelihoods of developing poor physical well-being) is not an exact science. However, these methodologies have been tried and tested through numerous years and will provide more than suitable results.

3.1. Systems Theory

Systems theory introduced itself as a method of addressing the every growing complexity of the world's problems. It was in part created to counter to the main methods at the time which were inherently reductionist which was under scrutiny (Reiter 2018) at the time for being unable to address wholes, interdependence and complexity. The way systems theory sidesteps this is by tackling issues on different levels of abstraction to generate a view as a whole while also scrutinising and determining results. The 'system' itself is largely a theoretical. It exists as a conceptualisation of complexity in order to properly analyse and understand the complexity of problems. It has also been referred to as an ecological approach (Reiter 2018) due to its emphasis on larger ecosystems which allows creativity to emerge.

The idea was first published in 1968 from Ludwig von Bertalanffy's works. It is claimed in (What is Systems Theory? - Social Work Theories & Approaches. 2020) it is claimed his idea was that the process could be applied to all areas of science, not just his own are of biology. This idea came to be due to the interconnected nature of everything and how subtle changes can have a greater knock-on

effect. Since its conception, systems theory has been accepted by the scientific community as a whole and is often used when analysing a wide scale problem.

There are a number of methodologies within systems theory. Within this report, the ones that will be used shall be covered and reviewed.

3.2. System Characteristics

The key concepts and characteristics of a system are universal. These can be applied to any form of system with certain similarities between each. What characteristics are valid and useful are often interchangeable from person to person as shown in (Pituch and Lee 2006), this could refer to functionalities, interactions and responses. For this report, the focus shall be on the characteristics of inputs and outputs, structures, boundaries and relationships. Each characteristic will fall into one of these broader categories:

- The system itself is made out of various interconnected components of varying types of relationships.
- Systems can be broken down into even further connected sub-systems, appearing to serve individual purposes but interlocking together to form a much larger system as a whole.
- A system will have sets of inputs and outputs that alter various other parts of the system in many ways that range from near insignificant to essential for system function on its greatest hierarchy.
- There are boundaries to be placed on a system for the sake of practicality. This allows for realistic understanding of the system in a way that can be managed by the average systems theorist.
- An open system is one that can be influenced by the environment. For the sake of the experiments, this will be assumed to be true in this case. Otherwise, there would be no purpose to performing experiments as no mitigating factors or solutions to the problem would be discernible from the data.

3.3. System Dynamics

System Dynamics has been described by (Hight 1995) as such; “System dynamics is an approach to observing and analyzing any complex organization in a comprehensive manner: seeking to understand its structure, the interconnections between all its components, and how changes in any area will affect the whole system and its constituent parts over time.”

System Dynamics represents the structural elements of systems through the representation of real aspects within stocks and flows. The importance of this comes with the identification of key aspects within the system and acknowledging the relations it has with other such key aspects and simulating alterations in their values to determine consequence. As such, finding solutions within such a methodology can create further effects than initially anticipated due to the intense interconnections between the various parts of said system. However, it is by far the most effective method of system modelling to capture the larger picture in a manageable way.

The process of System Dynamics is logical and sequential. It follows through with the idea that all actions have consequences and the main reason for doing this is to use information gathered through research to simulate actions and their consequences. This can then be used to inform real world decisions and rules. (Homer 2019) displays the mechanisms of rule change in succinct way.

Figure below:

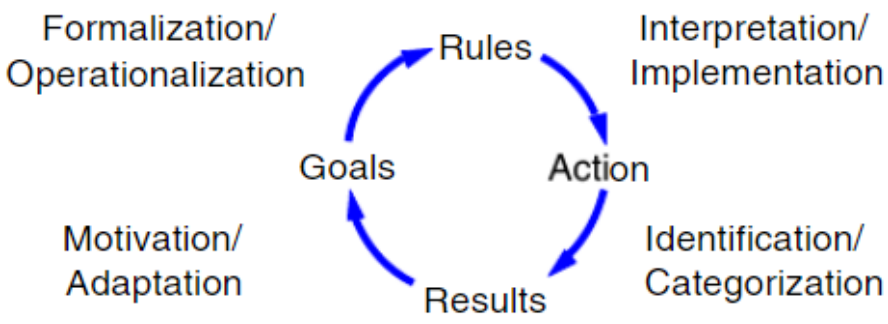

Figure 5 - Mechanism for Rule Change

3.4. Feedback Loops

When creating the structures within a System Dynamics model, often loops can be formed which represent a cyclical form of feedback. These feedback loops allow for further analysis of relationships and other requirements. There are two types of loops that can show up within the models:

Positive Feedback Loops – (Lumen 2017) describes positive feedback loops as "snowballing" or of a "chain reaction". This descriptions exemplifies the nature of positive feedback loops in that they will further increase an output. These are often the loops that need identifying most as left unchecked can drastically increase a value that is undesirable. As one value increases, so too does another. The figure below displays the basic structure of a positive feedback loop:

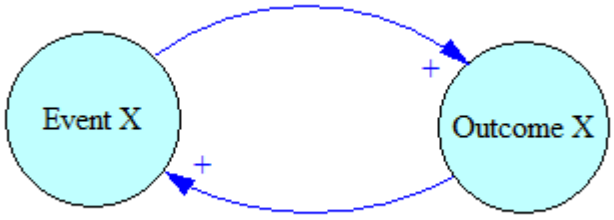

Figure 6 - Positive Feedback Loop

Negative Feedback Loops – In (Lumen 2017) negative feedback loops are described as a method of systems which allow them to stabilise. These exist where a value would be above or below a desired level and help to maintain the value to what is desired. It can be described as a system where, as one thing increases another decreases. The figure below displays the basic structure of a negative feedback loop:

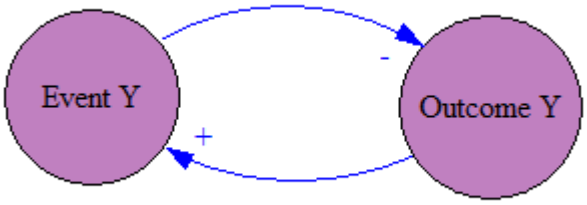

Figure 7- Negative Feedback Loop

3.5. Stocks and Flows

The final method of System Dynamics used within this investigation are stock and flow models. This process involves taking feedback loops from the previous section and identifying which ones are to be studied. (Aronson and Angelakis 2018) suggest that the best way of doing this is to apply units to each variable and use that to determine their position as either a stock or a flow.

Stocks are variables that are being measured. Those which the values and units are of particular value. They are influenced by the flows and are often cases of something.

Flows are variables that have an effect on what is being measured. In (Aronson and Angelakis 2018) it is claimed that variables with the units of time are often most suitable for this but are not definitively correct as such. They will act they will decrease or increase the value of a stock based on what end direction the arrow is in relation to the stock.

Variables also influence the equations of stocks and flows to create a larger picture of effects.

4. Implementation

The first step in implementation of the project was to identify the causality of aspects making up the problem and mapping them out in causal loop diagrams. This creates a visual representation of the problem and allows for the identification of loops within these diagrams. These are then used to form the basis of the later models. These diagrams contain nodes to represent the varying aspects of each topic and arrows to represent the relationships between them. "+" on an arrow represents that they have positive correlation whereas, "-" means they have a negative correlation.

Initially, a single diagram of all aspects together was created. However, this was split into the final diagrams which are each based on a key aspect of the problem. Although, each model contains sections that link to other models to represent the connections they share. The colour coding is as follow:

Table 1 CLD Colour Key

Colour	Focus Area
	Academic Attainment
	Physical Well-Being
	Mental Well-Being
	COVID

Separating the diagrams into four allowed them to be easier to read for review and also had the added benefit of separating and identifying loops between nodes in the diagrams.

4.1. Mental Wellbeing Causal Loop Diagram

The first diagram created is for the area of mental wellbeing. This maps out the causality based on the central node “Instances of Poor Mental Well-being” along with the relationships and units of each. Within the diagram, the main loops are around the node “Number of Students Feeling Apathetic”. Thus identifying it as an aspect that should be required within the later model simulations and even a potential parameter to experiment with how much of an effect it has on mental well-being. The nodes that are directly linked with “Instances of Poor Mental Well-being” can be used to inform the creation of ‘flows’ later as well.

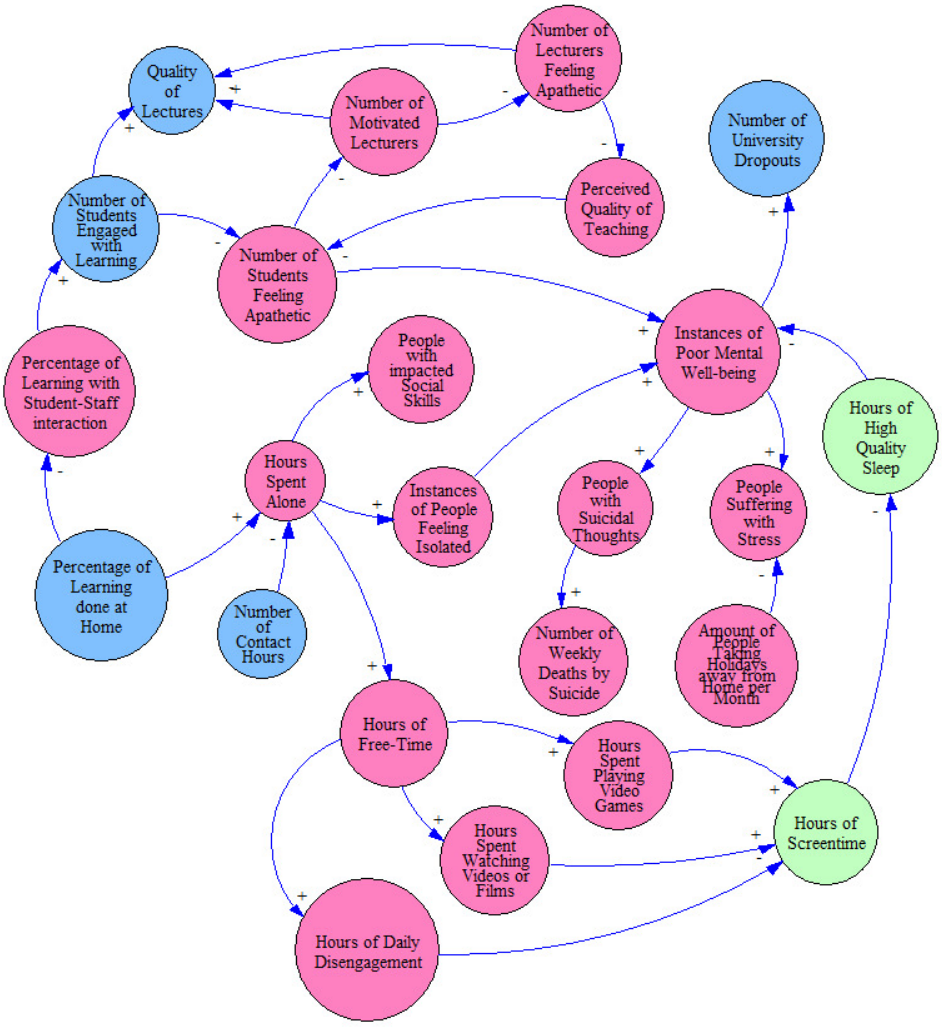

Figure 8 Mental Well-Being CLD

The following table depicts the key aspects of the diagram as well as the relationships of each. Not every relation and node has been represented, only the ones that were deemed the most relevant to the issue. Each factor also has a justification for its inclusion and a reference to the source which provided the inspiration for the link in the first place.

Table 2 – Mental Well-Being CLD Table

Factor	**Linked to**	**Polarity**	**Justification/Assumption**	**Evidence**
Amount of Lecturer-Student Interaction	Level of Student Engagement	+	the more interaction with lecturer and lectures the greater the student engagement	(Moore et al. 2008)
Instances of Poor Mental Wellbeing	Number of University Drop-outs	+	More cases of poor mental wellbeing will increase the amount of students who cannot keep up with their studies	(Mental Health Foundation 2016)
People with Suicidal Thoughts	Number of Weekly Deaths by Suicide	+	An increase in people contemplating suicide will increase suicides	(Samaritans 2020)
Amount of People Taking Holidays away from Home per Month	People Suffering from Stress	-	The more people that take holidays away from home, the less they will be stressed	(Greenberg and Berktold 2006)
Number of Students Feeling Apathetic	Number of Motivated Lecturers	-	The more apathetic students the less lecturers remain motivated	(Williford et al. 2001)
Number of Lecturers Feeling Apathetic	Perceived Quality of Teaching	-	Less motivated lecturers leads to a lower perceived quality of teaching	(Fazackerley 2019)
Hours Spent Alone	Instances of People Feeling Isolated	+	The more time spent alone, the more people feel isolated	(Larson 1990)

4.2. Physical Wellbeing Causal Loop Diagram

The second causal loop diagram is centred on physical wellbeing and the node “Instances of Poor Physical Well-being”. Within this diagram, there is a key loop within students getting medical attention and their desire to do so. This is then expanded upon directly within the second experiment to determine how this can impact the likelihood of recovery from poor physical well-being.

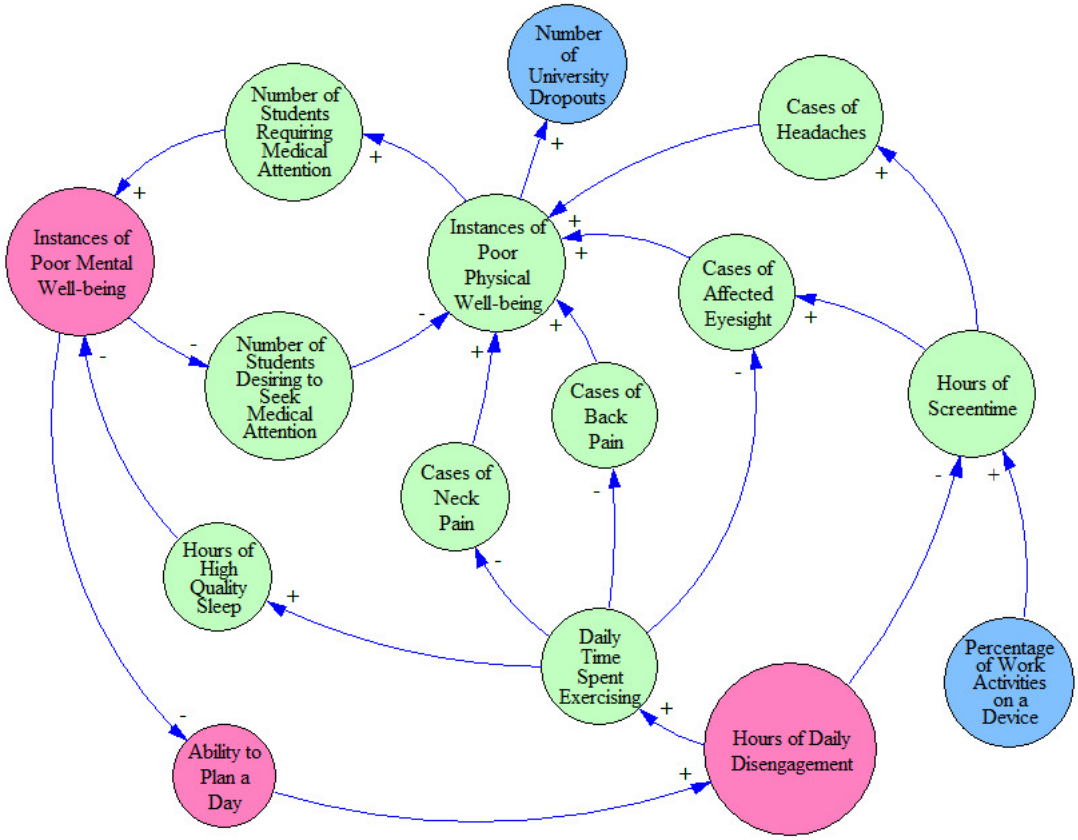

Figure 9 Physical Well-Being CLD

The data from the above figure has been represented in the table below.

Table 3 - Physical Well-Being CLD Table

Factor	Linked To	Polarity	Justification/Assumption	Evidence
Instances of Poor Physical Well-being	Number of Students Requiring Medical Attention	+	The more students that are suffering from poor physical wellbeing, the more that will need medical attention	(NHS 2020)
Hours of High Quality Sleep	Instances of Poor Mental Wellbeing	-	The less sleep students get, the worse their mental health	(NHS 2018b)
Number of Students Desiring to Seek Medical Attention	Instances of Poor Physical Wellbeing	-	Students that seek assistance for the poor wellbeing will have it resolved	(Hall 2018)
Number of Students Requiring Medical Attention	Instances of Poor Mental Wellbeing	+	Students that require Medical Assistance will have worse mental health	(NHS 2020)
Cases of Headaches	Instances of Poor Physical Wellbeing	+	More headaches means worse physical health	(UAB 2021)
Cases of Effected Eyesight	Instances of Poor Physical Wellbeing	+	More headaches means worse physical health	(UAB 2021)
Cases of Back Pain	Instances of Poor Physical Wellbeing	+	More headaches means worse physical health	(NHS 2020)
Cases of Neck Pain	Instances of Poor Physical Wellbeing	+	More headaches means worse physical health	(NHS 2018a)
Hours of Screen time	Cases of Affected Eyesight, Cases of Headaches	+	More Screen time leads to worsened eyesight and more frequent headaches	(Hisler et al. 2020)

4.3. Academic Attainment Causal Loop Diagram

The Academic Attainment CLD figure has been set up to show the impact of poor physical and mental well-being on student performance. While this diagram is important, the previous two take precedence due to their representation of cause whereas academic attainment is more focused on effect. The figure displays the connection between mental and physical well-being and university performance. It also details the connection between this and student's engagement with learning.

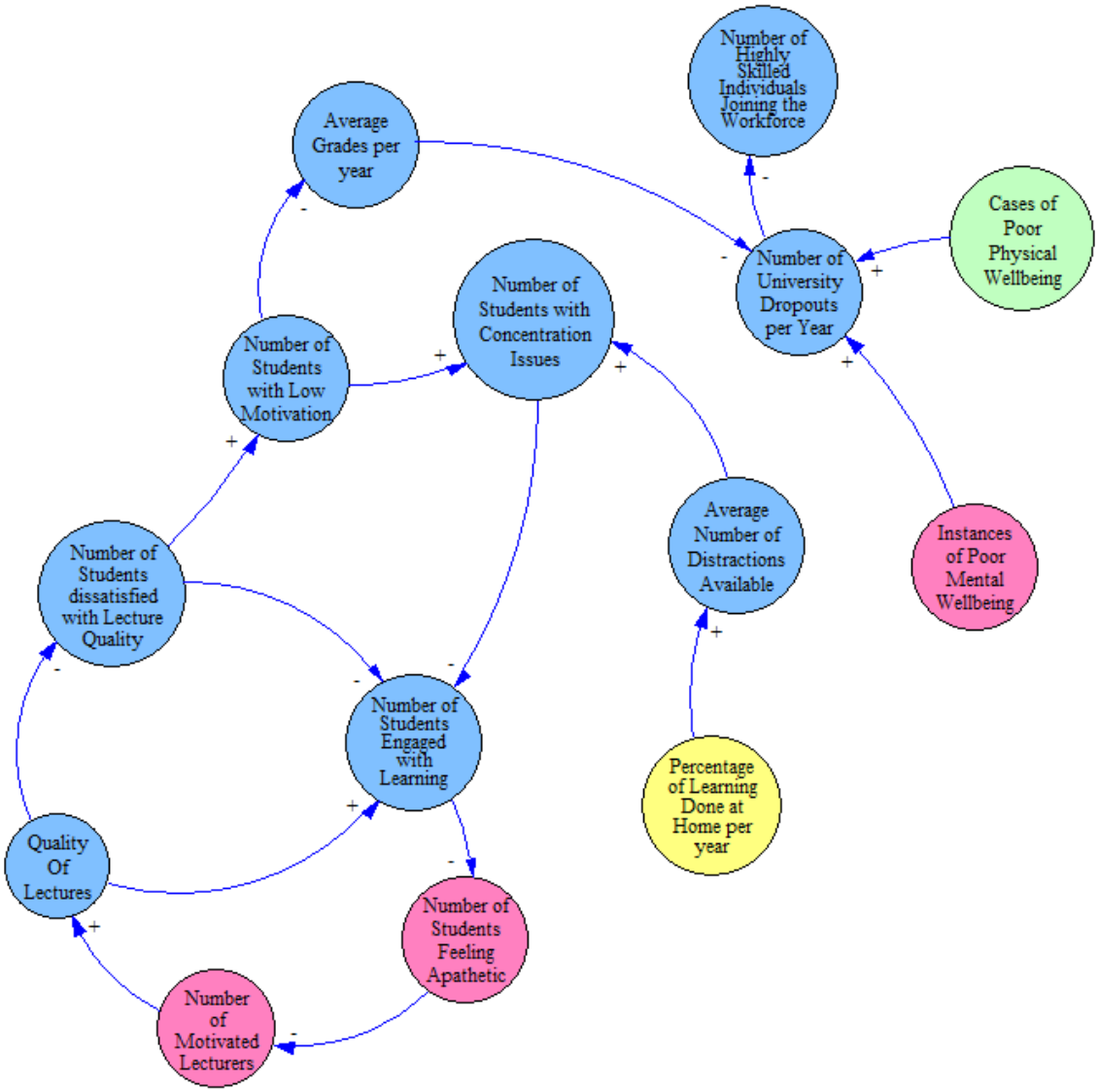

Figure 10 - Academic Attainment CLD

While a smaller figure than the other, the academic attainment CLD is no less important as students who drop out will have, in effect, wasted a large amount of their time and money. Finding a method of improving these numbers would increase the student's happiness and the university's standing. The following table justifies and explains each node's inclusion.

Table 4 - Academic Attainment CLD Table

Factor	Linked to	Polarity	Justification/Assumption	Evidence
Percentage of Learning Done at Home per Year	Average Number of Distractions Available	+	The more Learning done at home, the more distractions students will have	(Ammar et al. 2020a)
Number of Students with Concentration Issues	Number of Students Engaged with Learning	-	The harder it is to concentrate, the less students will be engaged	(Moore et al. 2008)
Quality of Lectures	Number of Students Dissatisfied with Lecture Quality	-	The higher the lecture quality, the less students are dissatisfied with lecture quality	(Williford et al. 2001)
Number of Students with Low Motivation	Average Grades per Year	-	Less motivated students will produce worse grades	(Williford et al. 2001)
Number of University Drop-outs per Year	Number of Skilled Individuals Joining the Workforce	-	More University dropouts will result in less skilled people joining the workforce	(Roberts 2021)

4.4. COVID Causal Loop

The final causal loop diagram is centred around the spread of the COVID-19 virus and how it has had a knock-on effect on mental well-being. The creation of this diagram was done through researching already existing system models on Covid and using the points from those models to create a new one that had a relation to physical and mental well-being. This culminated in the below figure that, through connection with the mental well-being model, has been linked with the problem as a whole and displays the root cause of the extended remote learning that has taken place over the last year.

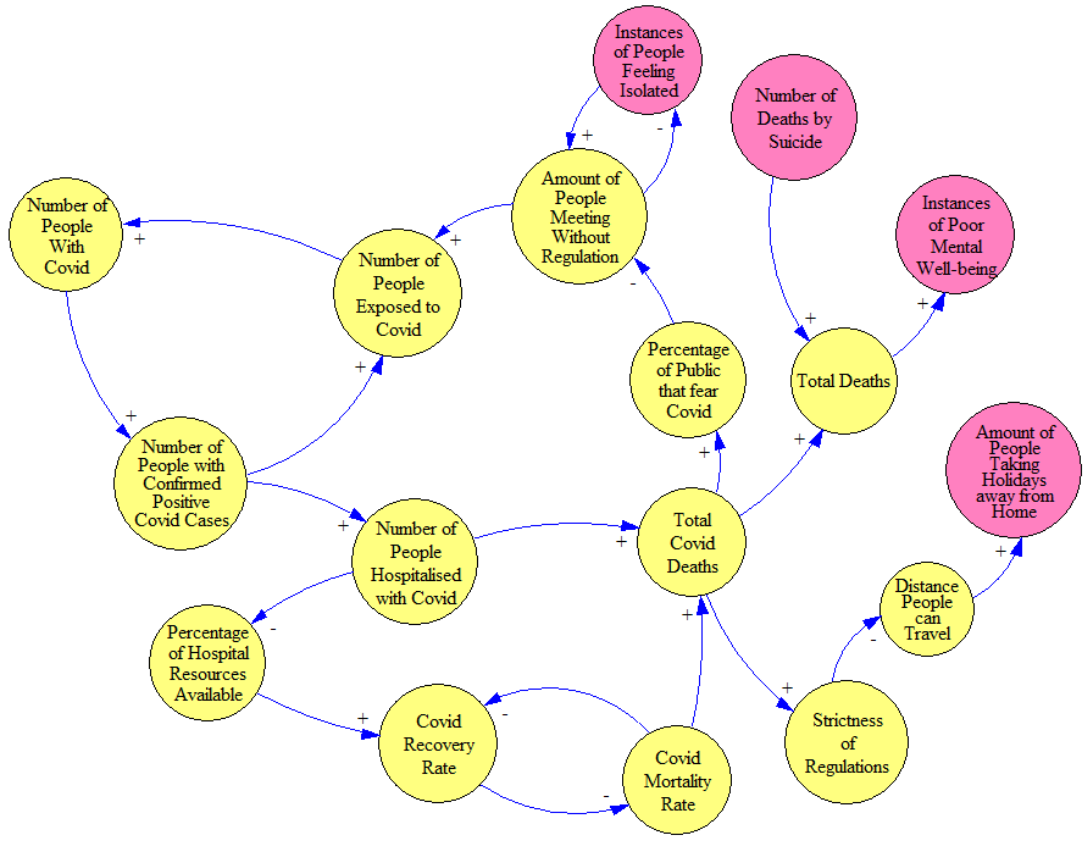

Figure 11 - COVID CLD

The COVID table, shown below, represents the various important nodes and links of the above table. The table takes the key nodes from the figure and justifies their inclusion.

Table 5 - COVID CLD Table

Factor	**Linked to**	**Polarity**	**Justification/Assumption**	**Evidence**
Total COVID Deaths	Total Deaths	+	More people dying of COVID will increase the total deaths	(Appleby 2021)
Percentage of Public that Fear COVID	Amount of People Meeting without Regulation	-	The more people that are afraid of COVID, the less will meet	(Cardiff University 2021)
Number of People Exposed to COVID	Number of People with COVID	+	The more people that are exposed to the virus the more that will catch it	(System Dynamics Society 2020)
Number of People with Confirmed Positive COVID cases	Number of People Hospitalised with COVID	+	More positive COVID cases will result or more people being hospitalised with COVID	(System Dynamics Society 2020)
Strictness of Regulations	Distance People can Travel	-	The more strict the policy, the less distance people are able to travel	(System Dynamics Society 2020)
Percentage of Hospital Resources Available	COVID Recovery Rate	+	The more free resources, the better people's chances of surviving are	(System Dynamics Society 2020)
COVID Mortality Rate	COVID Recovery Rate	-	The more people that die, the worse the survival odds are	(System Dynamics Society 2020)

4.5. Experiment Series

Following the creation of the causal loop diagrams, a set of experiments were developed based upon the diagrams. These experiments, detailed below, set out to address the problems developed in the scope and how to potentially resolve them.

Accompanying the figures of each experiment are tables detailing the data behind the model, how it fits together and accompanying justification.

4.6. Experiment Series 1

As experiments were being developed for both physical and mental well-being, it became clear that a smaller experiment would need to be done on 'screen time' due to its frequent appearance and changing nature. The goal of this experiment was to determine how much extra screen time pre-recorded lectures added when compared to live ones and from this determine a reasonable screen time value to use within the other experiments.

In order to do this, the stocks and flows were chosen that could represent the increase and decrease of screen time separately and activities that were either on a screen or off it were chosen as variables that would increase them. Finally, "hoursOfPreRecordedLectures" was chosen as a changeable parameter to determine how much of an impact it would have on screen time.

The experiment itself displays how the hours of each add up each day to the total amount over a span of weeks or months.

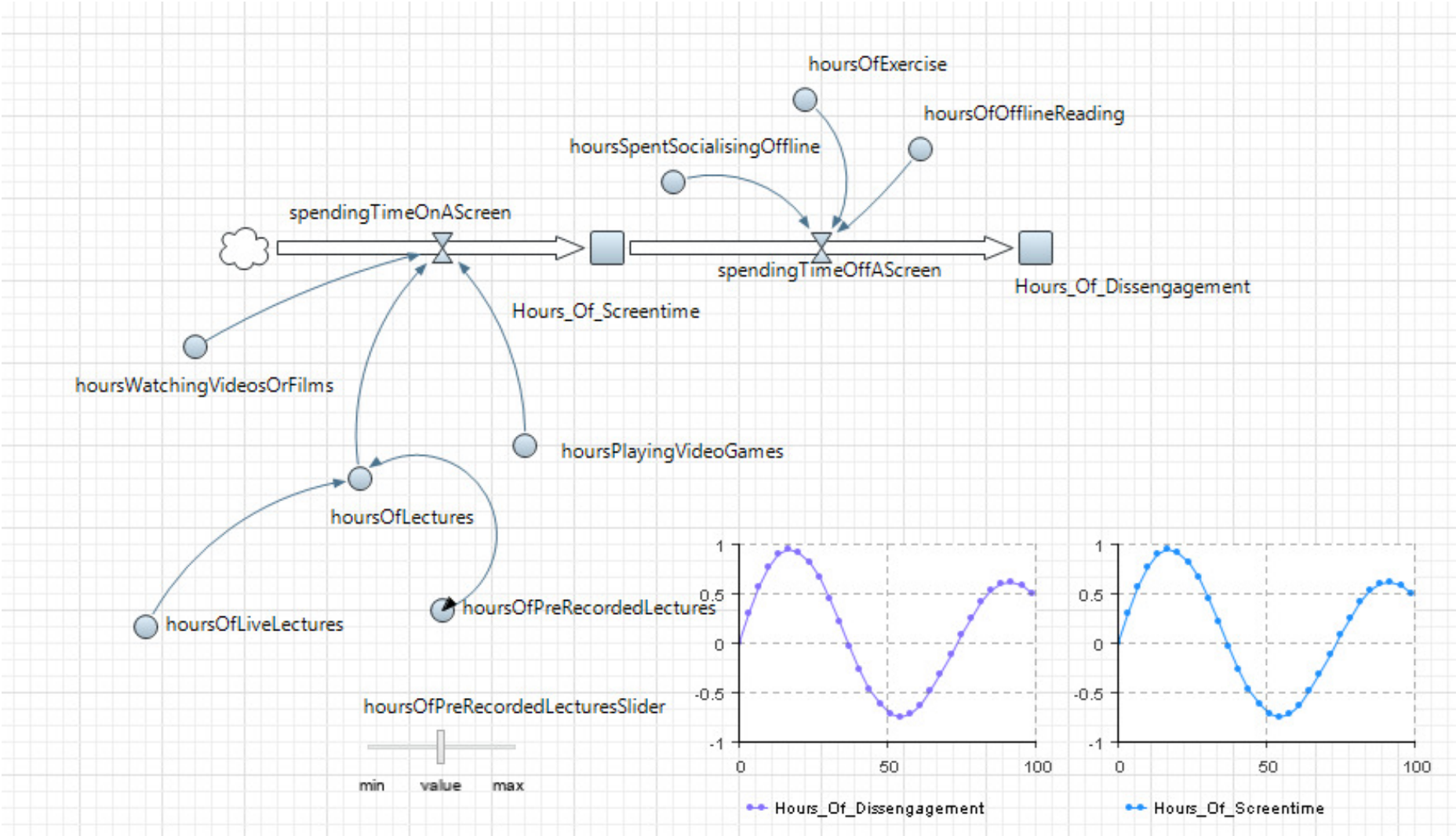

Figure 12 - Experiment Series 1

Table 6 - Experiment Series 1 Table

Factor	Model Type	Units	Initial Value	Justification	Evidence	Equation
Hours Of Screen time	Stock	Hours	0	This is what is the goal to be measured	N/A	spendingTimeOnAScreen – spendingTimeOffAScreen
Hours Of Disengagement	Stock	Hours	0	A stock that would increase as screen time decreases	N/A	spendingTimeOffAScreen
Spending Time On A Screen	Flow	Hours	N/A	A flow that increases the amount of time spent on a screen	N/A	hoursPlayingVideoGames + hoursOfLectures + hoursWatchingVideosOrFilms
Spending Time Off A Screen	Flow	Hours	N/A	Likewise, reduces the time on a screen	N/A	hoursSpentSocialisingOffline + hoursOfOfflineReading + hoursOfExercise
Hours Watching Videos or Films	Dynamic Variable	Hours	1	Average amount of hours spent watching tv a day	(Bowman 2006)	N/A
Hours Of Lectures	Dynamic Variable	Hours	N/A	Lectures are currently spent on a screen so adds to screen time	N/A	hoursOfLiveLectures + hoursOfPreRecordedLectures
Hours Playing Video Games	Dynamic Variable	Hours	1.2	Average weekly divided by 7 for daily hours	(Combs 2021)	N/A
Hours Spent Socialising Offline	Dynamic Variable	Hours	1.2	Study claims in the US that 20% of work time was spent doing socialising with a	(Manrai and Manrai 1995)	N/A

				work day being 6 hours		
Hours Of Offline Reading	Dynamic Variable	Hours	0.5	Prior stats show the UK reads on average for 3.5 hours a week divide to find the daily amount	(Chandler 2020)	N/A
Hours Of Exercise	Dynamic Variable	Hours	1	NHS guide on how much exercise to do a day	(NHS 2019)	N/A
Hours in a Day	Dynamic Variable	Hours	24	N/A	N/A	N/A
Hours of Live Lectures	Dynamic Variable	Hours	5	Day taken from my timetable	04/11/20	N/A
Hours of Pre-recorded Lectures	Parameter	Hours	0	As they are online they add to screen time	N/A	N/A

4.7. Experiment Series 2

After creating the “Screen Time Experiment” a second experiment was made that focused on the mental well-being aspect of the project. Goals of this experiment were to determine the effects of adding or subtracting the amount of counsellors available to university students on recovery from poor mental well-being. This was chosen as it is a very real and easy potential solution to one of the problems presented. If an increase in councillors would improve the general mental health of students, then this would be a simple way of helping those who need it.

The stocks chosen are based off of the respective CLD. The relationship between “Instance of Poor Mental Well-being” and the accompanying nodes provided the basis for the connectors within this experiment. Similarly, various variables within the experiment are also lifted directly from their relationships with the CLD. Finally, “councillingSessionsAvailable” has been chosen as the parameter so that the changing values can be studied. For this parameter, values from 0 to 20 were chosen as they represented far extremes that would not be exceeded.

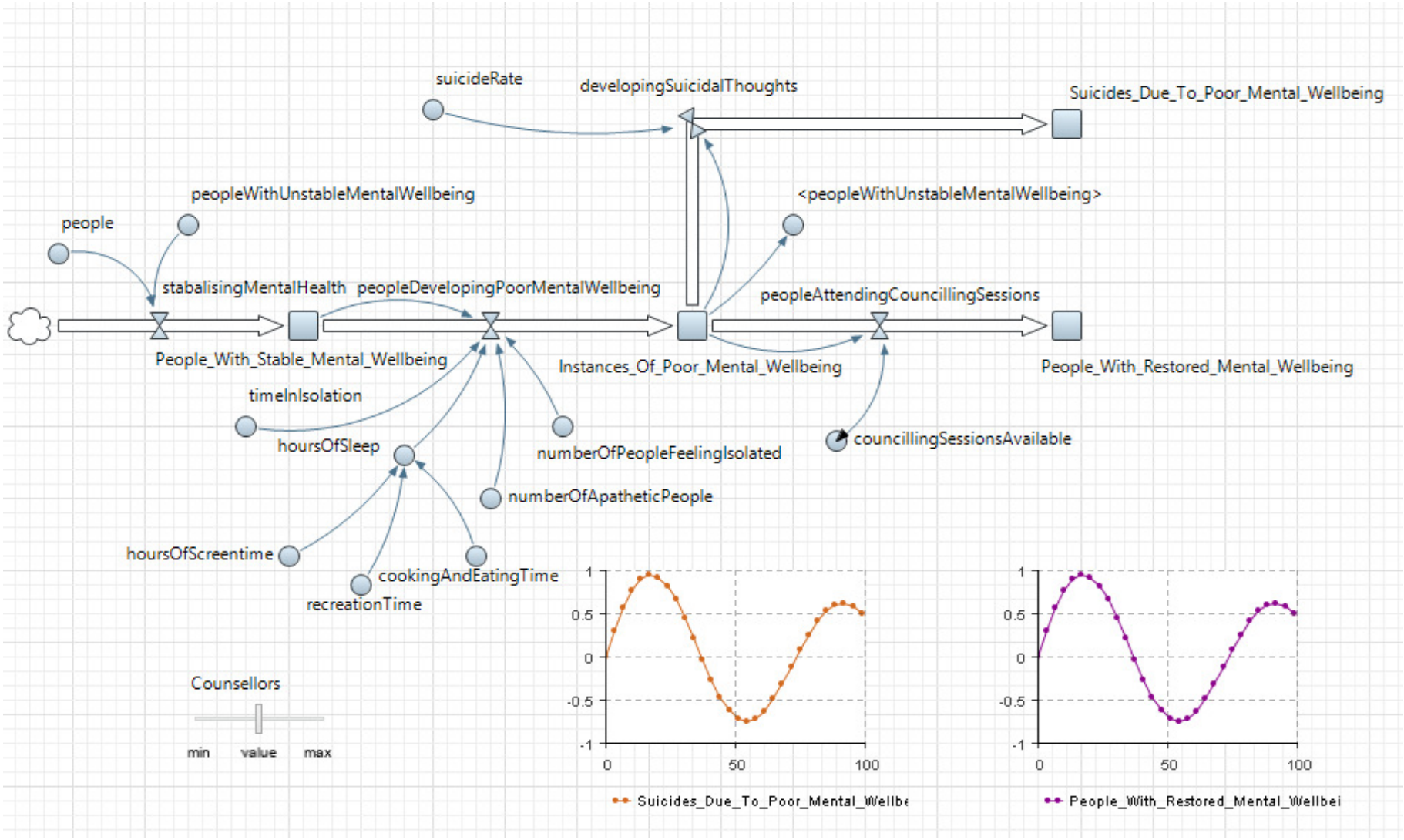

Figure 13 - Experiment Series 2

Table 7 - Experiment Series 2 Table

Factor	Model Type	Units	Initial Value	Justification	Evidence	Equation
People With Stable Mental Wellbeing	Stock	people	N/A	The ideal goal that through experiments will increase	N/A	StabalisingMentalHealth - peopleDevelopingPoorMentalWellbeing
Instances Of Poor Mental Wellbeing	Stock	people	0	The midpoint between the two main outcomes	N/A	peopleDevelopingPoorMentalWellbeing – developingSuicidalThoughts - peopleAttendingCouncillingSessions
People With Restored Mental Wellbeing	Stock	people	0	The recovery of people from poor mental well-being will allow for more people that are healthy and happy	N/A	peopleAttendingCouncillingSessions
Suicides Due to Poor Mental Wellbeing	Stock	people	0	What needs to be minimised through this experiment	N/A	developingSuicidalThoughts
People Developing Poor Mental Wellbeing	Flow	people	N/A	The beginning flow that kick-starts the model into being	N/A	People_With_Stable_Mental_Wellbeing*(0.1*(numberOfPeopleFeelingIsolated + numberOfApatheticPeople + hoursOfSleep + timeInIsolation)/hoursOfSleep)
Developing Suicidal Thoughts	Flow	people	N/A	The flow that represents the worst case scenario	N/A	Instances_Of_Poor_Mental_Wellbeing * suicideRate
People Attending Counselling Sessions	Flow	people	N/A	As people attend sessions, their mental health should improve	N/A	Instances_Of_Poor_Mental_Wellbeing*(0.1*councillingSessionsAvailable)
People With Unstable Mental Wellbeing	Dynamic Variable	people	N/A	2016 estimated that 17% of people suffered with some form of mental illness in the UK.	(Mental Health Foundation 2016)	peopleWithUnstableMentalWellbeing

People	Dynamic Variable	people	66800000	2019 estimate of UK population	(ONS 2021)	N/A
Time in Isolation	Dynamic Variable	Hours	7	Average person spends 29% of their time alone. 29% of 24 hours is 6.98	(Larson 1990)	N/A
Hours Of Screen time	Dynamic Variable	Hours	7.2	Time simulated from the screen time experiment	N/A	N/A
Hours Of Sleep	Dynamic Variable	Hours	N/A	Variable that greatly impacts people's health and well-being	N/A	24 - (cookingAndEatingTime + recreationTime + hoursOfScreentime)
Number Of Apathetic People	Dynamic Variable	people	153.6	60% non-attendance reported as low motivation of 256 students	(Moore et al. 2008)	N/A
Number of People Feeling Isolated	Dynamic Variable	people	8315	One in four university students report feeling loneliness or isolation and there are 33,260 students at Cardiff	(Busby 2021)	N/A
Suicide Rate	Dynamic Variable	Rate	0.0162	Rate is 16.2 per 100,00	(Manders and Windsor-1890)	N/A
Counselling Sessions Available	Parameter	Number	0	What will be changed	N/A	N/A
Recreation Time	Dynamic Variable	Hours	2.7	Time taken from the screen time experiment	N/A	N/A
Cooking Time	Dynamic Variable	Hours	2	Average time adults spend cooking and eating food a day	(Francis 2020)	N/A

4.8. Experiment Series 3

In order to address the physical well-being aspect of the project, a third experiment was then developed. For this experiment, the focus was placed on long term health conditions and how to limit their development. To do this, varying amounts of exercise per day are simulated and the cases of long term health conditions are measured along with the alternate recovery.

The stocks and flows of this experiment represent the development of poor physical well-being and either the recovery or worsening of these conditions to the point they become a serious long term health condition such as substantial persisting back pain. Likewise, variables have been set that related to this flow and the parameter of exercise can be edited to view whether or not it can prevent the formation of these long term health conditions. A further parameter of screen time was later added to create more accurate equations and help with the overall flow of the simulation.

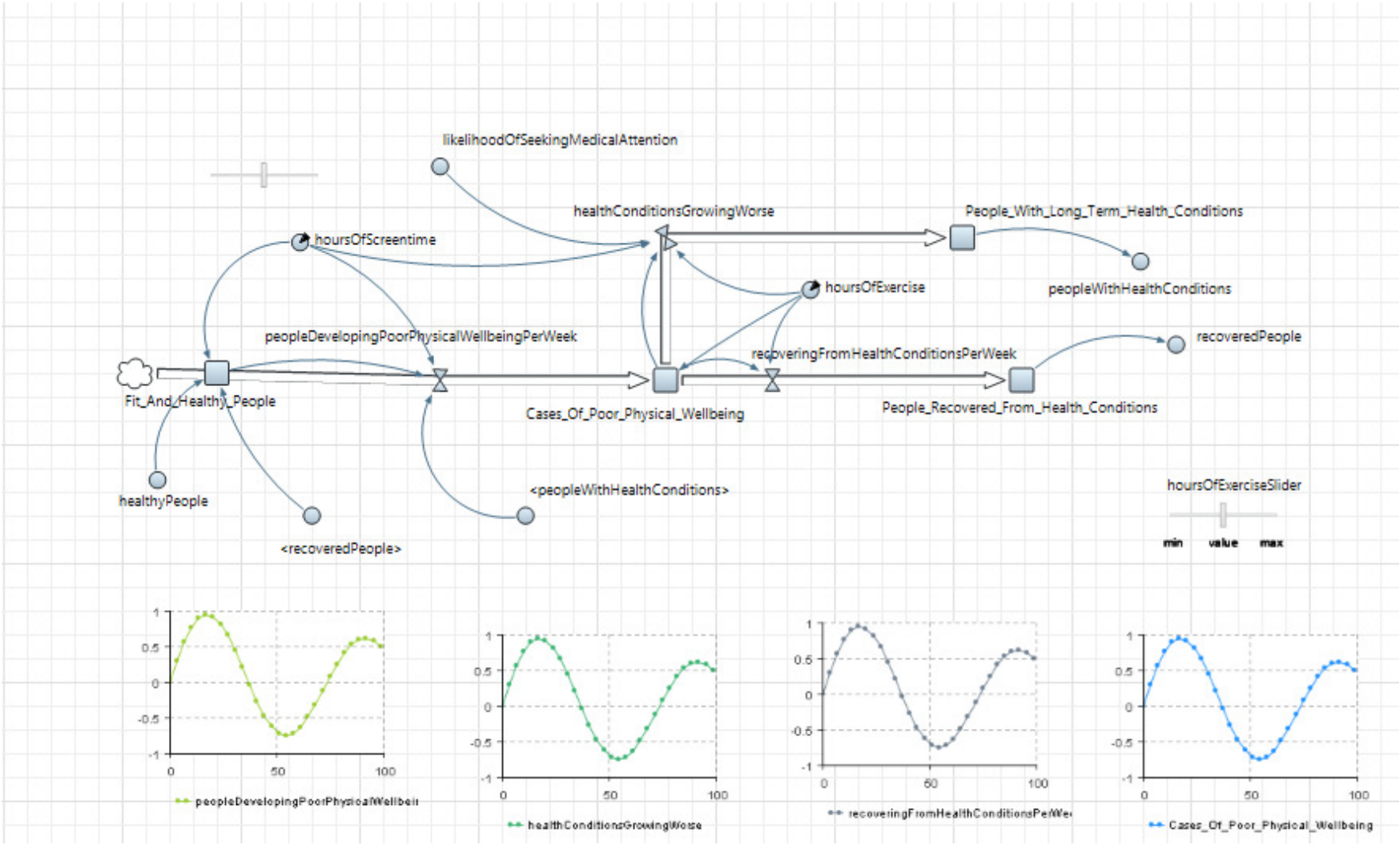

Figure 14 - Experiment Series 3

Table 8 - Experiment Series 3 Table

Factor	Model Type	Units	Initial Value	Justification	Evidence	Equation
Fit and Healthy People	Stock	People	0	The ideal state	N/A	recoveredPeople + healthyPeople / hoursOfScreentime
Cases Of Poor Physical Wellbeing	Stock	People	0	As people develop poor physical well-being through remote learning they will fall here	N/A	(peopleDevelopingPoorPhysicalWellbeingPerWeek + healthConditionsGrowingWorse) - (recoveringFromHealthConditionsPerWeek) * hoursOfExercise
People With Long Term Health Conditions	Stock	People	0	The end that needs to mitigated/ worst case	N/A	healthConditionsGrowingWorse
People Recovered From Health Conditions	Stock	People	0	Through the experiment, more people should end up here	N/A	recoveringFromHealthConditionsPerWeek
People Developing Poor Physical Wellbeing per Week	Flow	People	N/A	Flow that represents people initially falling into the poor physical well-being category	N/A	Fit_And_Healthy_People / (hoursOfScreentime) + peopleWithHealthConditions
People Recovering From Health Conditions per Week	Flow	People	N/A	What should be increased through the experiment	N/A	Cases_Of_Poor_Physical_Wellbeing + (hoursOfExercise * 7)
Health Conditions Getting Worse	Flow	People	N/A	Flow representing people who are falling into the worst case	N/A	(Cases_Of_Poor_Physical_Wellbeing * likelihoodOfSeekingMedicalAttention) + hoursOfScreentime / hoursOfExercise
People With Health Conditions	Dynamic Variable	People	N/A	Group that influences the amount of people that can get health conditions	N/A	People_With_Long_Term_Health_Conditions

Recovered People	Dynamic Variable	People	N/A	Variable representing amount of people capable of getting ill again	N/A	People_Recovered_From_Health_Conditions
Healthy People	Dynamic Variable	People	4500000	Estimated percentage of population in good health	(National Statistics 2015)	N/A
Likelihood Of Seeking Medical Attention	Dynamic Variable	Rate	0.25	Three quarters of men don't seek medical help when displaying symptoms	(Hall 2018)	N/A
Hours of Screen time	Parameter	Hours	7.2	Time simulated from the screen time experiment	N/A	N/A
Hours Of Exercise	Parameter	Hours	0	What will be experimented with	N/A	N/A

4.9. Experiment Series 4

Finally, another experiment was created that could simulate the spread of COVID-19. This experiment demonstrates how big of an impact COVID-19 had on the amount of remote learning undertaken and in turn, how this may have affected the mental and physical well-being of students and lecturers both. The values and structure of this model are based on the information found at (System Dynamics Society 2020).

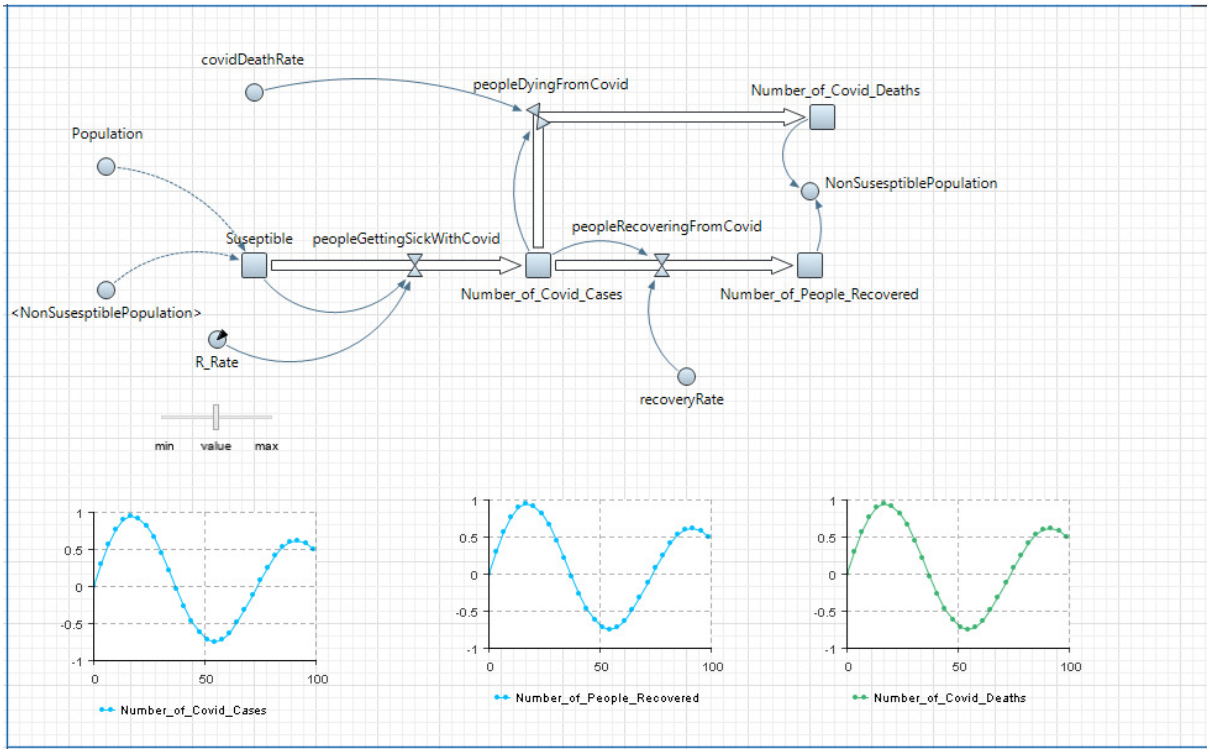

Figure 15 - Experiment Series 4

5. Analysis and Results

5.1. Results of Experiment Series 1

Experiment Series 1 or the screen time experiment set out with the purpose of determining a suitable screen time value for the other models and to display how screen time adds up over time. When ran with the same simulation as one day on the university timetable for a student (04/11/20), the value output for a single day was 7.2 hours. This value has then been used for experiment series 2 and 3.

Experimentation was then done to determine the impact of adding more and less hours of pre-recorded lectures was done to see how this affected overall screen time within the span of three weeks. The results are displayed in the figure below:

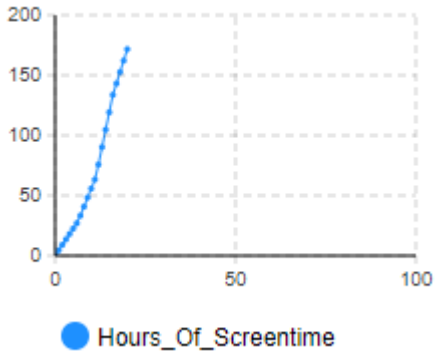

Figure 16 - Screen Time Values

On the graph, there is a marked increase as the amount of relative hours of pre-recorded lectures compared to live ones increases, so too does the screen time per day. This is seen in the mid-section of the graph, where the incline grows steeper. During the experiment, the amount of pre-recorded lecture hours was set at one, then raised to five at the point where it changes within the graph and then further reduced to two for the final three points on the graph.

A further simulation was then run to see how screen time added up over time. The simulation was set to three hours of pre-recorded lectures and allowed to run for 20 seconds, which is roughly equivalent to 20 days. The resulting effect it had on screen time was a stunning 155.55 hours accumulated over this time. Re-running the experiment at six hours of pre-recorded lectures produced a total of 212 hours, a considerable increase.

These experiments demonstrate that pre-recorded lectures do have a more significant impact on total screen time than live ones do. Due to the fact they require further research and sessions for answering questions and completing tasks, this value can have a significant impact on student well-being.

5.2. Results of Experiment Series 2

Experiment Series 2 or the mental well-being experiment set out with the purpose of determining whether or not an increase in counselling support would result in less cases of poor mental health. When running the simulation, the number of counselling sessions available can be altered mid experiment to alter the flow.

The two figures produced by this experiment are a result of changing the value of counselling sessions available as the experiment progressed.

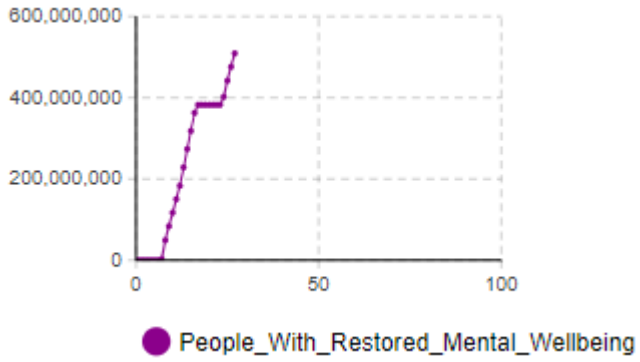

Figure 17 - Restored Mental Wellbeing graph

Figure 18 - Suicides Graph

The experiment run here involved a simulated total of 25 days. For the first five days, the sessions were set at 0. The following five, at 10. The third five at 20 and then up till the 20th day it was set to 0 again. The final five days were run at 5 counselling sessions. This has had a noticeable effect on the values and corresponding graphs. The first figure displaying people with restored mental well-being follows the expected curve as when there are less sessions available, the rate at which people recover from their poor mental well-being is less than when there are more sessions. Similarly, the rate of suicides also follows an expected trend. As the sessions available increases, the rate at which suicides increase also increases. Thus, a link between availability of counselling sessions and mental-wellbeing. With this being the case, it seems as though an increase of counselling staff and available sessions would be of a benefit to staff and students alike. However, that being said, extra counselling sessions alone do not prevent suicides as the graph does not plateau. Therefore, it seems a further study on suicide prevention methods within the university would be most beneficial.

5.3. Results of Experiment Series 3

Experiment Series 3 or the physical well-being experiment was created with the purpose of determining the effect an increase in exercise has on cases of poor physical well-being. This experiment was slightly different to the others as it contained two parameters. These being hours of screen time and hours of exercise. These can be altered while running the experiment, just as the others and will be changed for the experiment below.

There are four graphs on display within the simulation. For the sake of the report there will only be two figures shown here as those are what is being measured. For this first experiment, the screen time will be set at 7 hours and the amount of exercise shall be tested at values 1, 2 and 3 hours for

20 days as these are reasonable amounts and what were originally planned within the experiment definitions. The values obtained from this experiment are as follows:

Table 9 - Results from Physical Well-being Experiment

	1 hour	2 hours	3 hours
Recovered	26,611	24,049	1,052
Developed long term health conditions	6,724	6,009	219

These results are certainly surprising and without context may make no sense at all. However, within the model, less people began developing poor physical well-being in the first place as more hours of exercise were introduced. Therefore, as exercise increases, the less total long term health conditions begin to develop.

The second experiment run was over a simulated period of 30 days and featured the days split into three tens, each with a different screen time value. The first being the 7 hours that the screen time experiment produced. The second set of ten days will use the value of 5 hours and the final 10 will be 9. These have been chosen as they are the upper and lower quartiles of the initial value. The results are shown in the figures below.

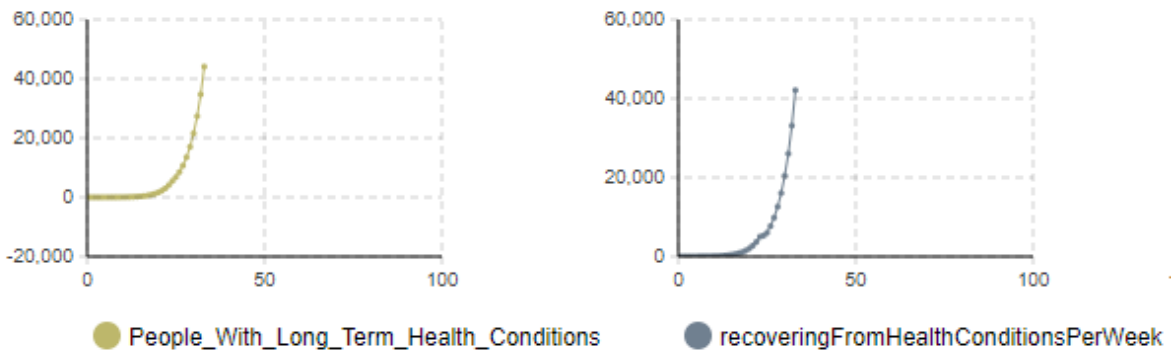

Figure 19 - Second Physical Well-being Experiment

The results from this experiment show a drastic increase in long term health conditions as the hours of screen time becomes 9, so much so that it dwarfs the rates of prior hours. This demonstrates a clear impact of screen time on physical well-being. The second graph shows a curve that grows steeper at higher numbers of hours of screen time. However, it appears the simulation does take some time to 'warm up' as it remains consistently plateaued for the beginning of the experiment. This is definitely an issue, however, it does still show a pattern from which conclusions can be inferred.

From this series of experiments, it can be inferred that an hour exercise should be a minimum requirement for students' remote learning as without it, there are considerable higher likelihoods of developing poor physical well-being and long term health conditions.

5.4. Results of Experiment Series 4

The purpose of experiment series 4 was not to produce any particular values. It exists to run a simulation of COVID-19 spread and does just that.

5.5. Analysis of Results

Overall, there are certainly things to be taken form the results gathered as part of the experiments. However, there are also many more questions that will need to be answered as part of further studies. Firstly, it has been made apparent that there is a need for more counselling sessions available through the university. Secondly, there should be some time for students to get at least an hour of outdoors activities each day. This could be in the form of intentional gaps in the timetable at suitable times during the day in which students can go out and get the exercise they need. Finally, screen time needs to be reduced for the sake of both physical and mental well-being. While these are valid insights, there is still a lot of work that needs to be done in order to minimise poor well-being amongst students and lecturers.

6. Future Work

As previously mentioned, there are still a number of related topics related to the problem that could use further investigation. Within this section of the report, these projects that would help get an even bigger picture will be recommended.

Experiment series 2 and 3 both show that one mitigating factor alone is not enough to prevent the problem. Within experiment series 2, it was shown that counselling sessions, while certainly beneficial to mental well-being, are not enough. Likewise, in experiment series 3, it was shown that more exercise cannot prevent the development of long term health conditions. To determine further ways of limiting these numbers, a set of questions have been developed that need to be answered through further studies and investigations which will hopefully provide a more definitive answer as how to limit if not prevent the development of poor mental and physical well-being related to remote learning.

- To what extent does each variable effect the development of poor mental well-being?
    - Meeting with friends and family regularly
    - Do assessments undertaken during remote learning cause more stress than those done while regular learning is taking place

This, as well as the following question, would help to determine the impact of each factor that impacts poor well-being. The variable taken here are based off of figure 8, being the variables connected with mental well-being. That being said, any variables that could be thought of would be valid topics for investigation.

- To what extent does each variable effect the development of poor physical well-being?
    - Time spent in high quality sleep
    - Amounts of visits with a general practitioner

Like the prior question, this one has been developed to identify impact of factors not considered to be as important during this investigation. These variables are based on ones gathered form figure 9 but again are not definitive. Finding all the impacts of factors related to well-being is important as it would allow appropriate policy to be developed which prioritises certain ones.

- Is it possible to increase the likelihood of students seeing early treatment for developing poor physical well-being and prevent long term health conditions from developing at all?

This question addresses the prevention of one of the issues. If students and staff are more likely to seek medical help, it may also then reduce the amount of long-term health conditions that develop.

- Is there a definitive answer to whether there have been more or less suicides during the lockdown period?

This question aims to find a more definitive answer to whether lock down and remote learning has had an impact on suicides in the UK. The recent upsurge in news coverage may not have been related to an actual increase in numbers but instead a lack of other stories to cover due to lockdown. Currently, there is no answer to this question which does very much need an answer.

These are the questions that should be asked within a follow up study. While the current investigation has yielded valid and useful results, it would be helpful to answer these further for the sake of providing backing and the illustration of the picture on a larger scale that could not be achieved within this alone.

7. Reflection

The large size of this project presented many difficulties. In order to circumvent issues, steps were taken. These steps worked to reduce the impact of multiple problem, from bias to impracticality. Within this reflection, explanations shall be given as to why certain decisions were made and whether or not they were effective at achieving their purpose.

7.1. Assumptions

As mentioned as a part of the introduction, a number of assumptions had to be made as a part of this investigation. Catching and understanding where they came from was important to prevent bias. This would have been an issue as bias can lead to the creation of models that fit a particular viewpoint instead of being naturally evolving. This was challenging as assumptions are not a conscious decision that is made, making identifying and rationalising them all the harder. Many assumptions are built from what we believe to be common knowledge from what we have learned. An example of this could be 'knowing' that spending time alone is bad for your mental health because that is what most of us have been taught. While it was these assumptions that led to the start of the investigation, it was important that they didn't make it through into the investigation itself.

Going into the investigation, there was also the assumption that through the research and models completed, a definitive answer to the problem would be produced. As the project progressed, this assumption was challenged and it became clearer that further research into various areas would need to be undertaken in order to answer all the questions surrounding mental and physical well-being during the pandemic, not just in remote learning. Challenging this assumption then led to the review of articles that were not directly related to remote learning, providing a much clearer view of mental and physical well-being as a whole.

As the report progressed, the assumption that the key aspect of the report would be on the results changed to be the analysis of these results. Meaning, the reason why the results are the way they are became more important that the results themselves. While the results were useful, the analysis then provided a basis for recommendation on further research topics and experiments to study and try. Despite this, there are clear trends displayed within the data that can be used and would help to improve student well-being.

7.2. Approach

The first stage of this investigation was to perform research and a rudimentary literature review of different universities' responses to the COVID-19 pandemic. Initially, the focus was on studies and scholarly articles that solely focused on the impact of remote learning on mental and physical well-

being. However, it soon became clear that this was not the most effective approach. By broadening the scope cover pre-Covid data and other factors, a larger picture could be envisioned that then fed onto the remote learning aspect and allowed for faster and easier data collection. The review of various universities' policies facing COVID-19 provided an opportunity to compare and contrast in the form of a literature review, this helped to start the idea that there was no one definitive answer to the problem and helped form later sections where one influence was not creating as strong as an effect as expected.

While the sources considered initially were only scientific journals and the like, later research yielded webpages and new articles that proved just as if not more useful. Finding articles on mental and physical health were not overly challenging as there has been plenty of research done throughout the years. However, finding recent data was more challenging as organisations have yet to release official statistics from the time spent during lockdown. The method to overcome this problem was simply more time. Compilations of potentially relevant articles were collected and then reviewed to determine whether or not they would be of any use to the project.

The referencing tool Mendeley was used when collecting sources as it provided an easy way to store and reference. This proved incredibly valuable as it allowed for faster data collection without being bogged down by memorising sources.

Systems Dynamics Approach

After completing the initial research of the topic to collect statistics and various figures, the next stage was to define the methodologies that would be used to experiment and model this data. To this end, the approach of system dynamic was chosen. This was with the goal of using the processes discussed in the approach section to develop models and experiments that uncaptured a view of the system as a whole. Its prevalence use within scientific communities was the factor that put it into consideration. The main reason for selecting it however, is best summarised by (Teehan 2018) which says that system dynamics is a flexible methodology that enables the user to understand and communicate complexity in a useful way. On top of this, it allows the identification of chains of causality in a non-linear approach and as the problem at hand is non-linear, appeared to be the most effective method to achieve results.

The process of System dynamic can structured into stages (Teehan 2018). These four stages guided the process undertaken within this report and are as follows:

1. Problem Definition

    This stage consisted of the mapping out of the problem in the causal loop diagrams. While these were the product of this stage, the process of visualising and mapping of every aspect of the problem were very much a part of this stage.

2. System Description

    Once rudimentary diagrams were created, these were the redefined and re-evaluated until a more complete system description emerged.

3. Simulation Model

    These were simply the simulation models that were created during the implementation phase.

4. Policy Design

    This came in the form of analysis and conclusion from the results gathered by the simulation models.

Following these points as a guide has led to the creation of models that illustrate the viewpoint held within this report in a way that can be clearly understood and replicated.

7.3. Implementation

The first aspect to reflect upon within the implementation phase was the causal loop diagrams. The creation of these diagrams was exceedingly useful for both mapping out the system to understand it and then later as a basis for the simulation models. For the creation of these diagrams, the modelling software Vensim was used. This was selected for its relative simplicity compared to other modelling software available. As causal loop diagrams are not overly complex, the simplicity of Vensim allowed for quick learning and easily understood diagrams. This allowed polarity of relationships to be displayed clearly and also allowed for the creation of easy to digest smaller models broken down from larger ones. It was also useful when working in reverse from the diagram to find research for the ideas placed. The visualisation of ideas heled in defining what was not known and what needed to be know. Overall, creating the causal loop diagrams in this style helped greatly as it provided an understandable learning environment that allowed for the picking up of later techniques used. Unit consistency was not achieved between all the diagrams but they still served their purpose to the necessary extent.

Next were the simulation models. These posed to be far more difficult than expected and were the most challenging part of the investigation. Finding relevant data to use was very challenging as a large amount of it was from varying years and conforming it all took some time. On top of this, developing the models and their equations was something that needed to be learned, taking an even greater amount of time and work. In order to transfer ideas between the causal loop diagrams and the simulation models, key stocks were identified and the connections between them became the flows and variables. This method allowed for the implementation of prior work and was far more efficient than creating brand new ideas would have been. The software used to create these was AnyLogic. This software was chosen because it allowed for the creation of more advanced models and the display of data through graphs. While this section was difficult, if repeated it would be done in the same way. The methodology of system dynamics and the processes undertaken were effective and provided a suitable outcome.

As a final point, initially experiment series 4 was planned to have more bearing on the other experiments. This however, proved unnecessary as the other experiments provided enough data on their own and further testing would have been inefficient.

7.4. What was learned from the Investigation

A lot has been learned from this experience. Prior to this project, I had little to no experience in systems modelling and systems dynamics. Therefore, I have learned how to do everything contained within this report. I have also learned how to plan a large scale project from regular meetings with my supervisor and creating a project plan. The investigation has also introduced me to the tools discussed in the previous paragraphs. Overall, I have learned key skills in systems modelling that allow for the creation of models and simulations. These skills are very much transferrable to other projects and should serve well in further research projects.

8. Conclusion

In conclusion, this has been a long and challenging project but it has also been a validating and beneficial one. Through this investigation the answer to the problem has been reached to an extent. It is clear that remote learning has had an impact on mental and physical well-being but further study would be required to determine the extent and to come to a decisive solution. That being said,

the insights from this report could be used within policy as recommendations have been made and results gathered. There were some issues when it came to time as this put pressure on the report and led to less experiments than there could have been. However, these would have been superfluous anyway. Overall, this investigation was a success and worth the time spent working on it.

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