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"HOW CAN AN ACCESSIBLE ONLINE ASYNCHRONOUS HOME EDUCATION PLATFORM FOR CHILDREN BE DEVELOPED?"

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ABSTRACT

Learning for individuals with additional needs has always been an issue focused on within education settings. However, with the pandemic bringing to light how accessible and convenient home learning can be, there is opportunity for the development of a platform which can assist those learning from home with additional needs to learn better.

A literature review was performed to explore existing literature on home education and learning platforms as well as find antecedents. The results of which informed a pilot study. A survey was conducted using likert scales; the results of which were analyzed to determine the opinion of parents of important variables to their child's education. These results formed the basis of requirements for development of a platform. The developed platform was tested by home educating parents of children with Autism Spectrum Disorder and Dyslexia. The parents completed a survey based on the TAM3 model and five participants were interviewed on their experience. The results of the study informed the creation of a framework for developing future e-learning technologies for home educated children with additional learning needs.

The study resulted in findings on home educating parents needs including: ways to collaborate and communicate with other parents through forums and direct message, search the platforms content with filters for content type, log learning activities in a digital journal, interactive content for their children's learning and authoring tools allowing for creation of courses tailored to the individual child's needs.

The study contributes to the niche area of home education technologies for children with additional needs and provides a basis for future studies in this field.

CHAPTER 1 - LITERATURE REVIEW

INTRODUCTION

Many children with disabilities have additional needs which cannot be met in traditional classroom environments. Particularly once they are in later years of education, before Learners with disabilities (LwD) can receive needed support to access E-learning, they often have to cope with additional layers of administrative procedure (Seale, 2013). This means that support outside of universities and when LwD are younger is essential to set them up for success for pursuing further education and for general life.

This thesis will aim to explore how an educational platform can be developed which meets the needs of parents of disabled children in the UK supporting their child's learning through asynchronous online resources. The focus of this study will be supporting individuals through providing a web service which can support parents to assist learning through multimedia content, organisational tools and support networks.

Users of such a platform may be schools providing an additional resource to students to use from home, parents who are using their own funding to support their child outside the classroom and also parents choosing to educate their child independently from the school system. These three use cases have different needs and as such the focus of this study will be on supporting parents independently seeking resources as opposed to schools supporting students from home.

Accessibility is an important issue as many students needing additional support may have one or more disabilities, this thesis will focus on individuals with Autism Spectrum Disorder (ASD). These individuals may have a range of sensory processing issues along with social and behavioural challenges which need support through the platform. These LwD may have a range of educational levels which do not correlate with their age group and as such the platform will cover a range of abilities.

BACKGROUND

ELECTIVE HOME EDUCATION

In the UK, parents who choose to unenroll a child from the school system are considered to be electively home educating. Elective home education (EHE) is not directly supported by the UK government and the education of such children is the responsibility of parents choosing EHE. EHE statistics are not held by the government and as such exact numbers of home educators are unknown. This study seeks to identify the needs of a platform to support parents in this situation and gain further understanding of needs of EHE parents.
The reason behind parents electing to home educate can vary from family to family and change over time. Rothermel found that a motivation behind home educating was the changing dynamic within a family; the school curriculum is fixed and unadaptive but home educating allows the parents to adjust their child's learning dynamically (2011).

EHE families with children with ASD have similar motivations. Reasons found were the inflexibility of schools, poor knowledge and lack of constituency when handling their child's specific needs; children with ASD that are EHE have opportunities for learning in different environments, to have additional breaks and more social interaction while learning (Daniels, 2017).

AUTISM SPECTRUM DISORDER

Autism spectrum disorder is defined by the CDC as "A developmental disability caused by differences in the brain." (2022). When placed in a traditional classroom setting children with ASD may not be supported appropriately. Extar challenge is placed on the teacher of a class to accommodate the needs of an ASD student and not all teachers are experienced with this and as such mainstream education may not fully support all ASD children.

One study looking at ASD children in mainstream primary education found that teachers had to adjust their language as ASD students take things more literally; this means teachers language choices are restricted when discussing in front of the class having to avoid double meanings and be explicit (Soto-Chodiman et al., 2012). In addition, the study found that ASD learners can be made to feel isolated due to how other learners without ASD perceive their interactional behaviours, mobility and speech as unsettling or distracting. Children with ASD tend to participate in more solitary, less complex play than those of their peers and it was found that ASD children have worse symptoms of sensory processing and social interaction defects than non ASD children (Matsushima and Kato, 2013).

DYSLEXIA

The NHS defines dyslexia as "a common learning difficulty that … causes problems with certain abilities used for learning, such as reading and writing." (2022). Learners with dyslexia require additional assistance with accessing educational resources as these are commonly presented as written documents. Research supports that students with dyslexia can feel excluded and lack confidence when faced with e-learning without appropriate support causing them to withdraw from the learning activity presented (Woodfine, Baptista Nunes and Wright, 2008). As such, this should be considered when developing an e-learning platform.

E-LEARNING

E-Learning is the use of often online electronic methods to learn. This can cover any educational level from early years to university level. Content used in E-learning include pre recorded multimedia, interactive web elements as well as gamified content. E-learning can be synchronous or asynchronous.

Massive open online courses (MOOC) are a type of E-learning platform such as skillshare. They are asyscnhous meaning users can acces material at any time as opposed to traditional education with set schedules. They generally are driven by the pace of students and delivered with pre-recorded media as opposed to live VOIP chat or video seminar. This study mostly focuses on asynchronous E-Learning due to the focus on home learning driven by parents who may have varying schedules.

In my previous studies into perceptions of E-Learning platforms (See Appendix B) it was found that flexibility of asynchronous E-learning allowing for a self set study pace to fit the course into their personal schedule was expressed as what made E-learning appeal to participants (Webb, 2022) Furthermore, this study also found that lack of social interaction made E-learning less appealing to more traditional education methods.

GAMIFICATION

Gamification refers to the conversion of educational content by adding objectives and interactive elements as well as reward for completing these objectives such as points or ranking in a leaderboard. Gamification engages users, motivates action and promotes learning (Kiryakova, Angelova and Yordanova, 2014). Users can be motivated by the additional challenge and icentised with rewards depending on their personality type. Chris nodder explores the concept of persuasion with such motivations in *Evil by Design* (2013) different personality archetypes can be motivated by pride, such as being the highest ranked on a leaderboard or by greed with collecting badges or items. This can be used to encourage and upkeep participation with the education material.

WEB TECHNOLOGIES

HTML5 in combination with javascript will provide the basis for the web platform. Using js.Express to create the architecture of the site along with an SQL database to store users data and course information. Phaser is an online open source game engine for web based mobile and browser 2D games which uses HTML5 and javascript to help users create games for the web.

ANTECEDENTS

E-LEARNING FOR ASD

There is significant existing research on how ASD users can utilise E-learning however some of this is untested and purely theoretical while other research looks at existing solutions and evaluates these. The below section reports on the findings of previous studies and evaluates how they may be of use to answer the research question.

One article in the literature review analysed existing free apps with the key word autism and rated them; the study found very few apps that were highly recommended in all areas explored (Cara, Gallardo-Montes and Fuentes, 2021). This indicates there is a shortage of effective apps aimed at ASD learners existing on the market for free. There may be paid apps which are more effective but these were not explored. The study concluded that the app's appearance, usability, accessibility and pedagogical aspects should be considered closely to ensure its usefulness for an ASD individual. Therefore, this should be applied to the research question; the aforementioned characteristics are desirable for the resulting web platform.

Another article explored developing an app for parent and teacher use to improve inclusion of ASD students via monitoring the students progress and communication with parents (Mazon et al., 2022). The results of feedback on this app indicated that personalisation was important to allow for effective communication between parties to allow for stakeholders to dynamically update information about the child. A section for a list of tips and effective strategies for the specific individual was recommended. The study also emphasises the vulnerability of users and as such the importance of security for the app itself. Therefore, security and ability to update and be flexible with information on a user of the web platform appear to be desirable features.

A further article describes an untested educational environment for children with autism which adapts to each child's characteristics through system adaptation and self regulation using fuzzy logic (Vittorias et al., 2018). This environment shows promise and with testing could prove to have results for ASD children. NOESIS uses applied

behaviour analysis enhanced with educational procedures aiming at mirror neuron activation. These have been found to be effective strategies with ASD children.

Shminan, Fauzan and Aren pushed that web based learning is effective for home based delivery for caregivers of autisitc children (2016) They reviewed literature discussing Telehealth; this adopts communication technologies to deliver service over distance using software, video conferencing and virtual interactive programs to teach social, emotional, academic and communication to ASD individuals. It was found that telehealth removes barriers to help for ASD individuals, improves social-communicative behaviours as well as enhancing parents' understanding and satisfaction. Therefore, this shows merit for ASD learners using distance learning methods to help parents and ease their learning.

One article explores a game for ASD children to learn life skills through immersion which takes ASD children's needs into account (Chang et al., 2012). The study uses "time in the game world as a trigger and uses fuzzy membership function value to weight activities"' in order to automatically generate the activities for the children to perform. This study does not cover the effectiveness of this method but sets out how it would be evaluated. The use of fuzzy logic to create automatically generated activities that make sense to ASD children could be useful to consider when creating a learning game for ASD users. The concept of ensuring the activity makes sense particularly applies to ASD learners who can be literal in their interpretations of communication.

Hulusic and Pistoljevic discuss science of teaching, learning theory, serious game design and computer science advancements to create a curricla for those trying to create an educational serious game for children with ASD (2017). The paper aims to use the science of teaching, learning theory, serious game design and computer science advancements when recommending a method to be followed for creating a learning game. The curriculum developed started with topics such as introduction to serious games, educational game design and HTML5, CSS and JQuery. From week 4, a spiral approach introduced game elements and progress was discussed. In week 12 beta testing with ASD children was performed allowing for direct feedback from workers at a special educational needs centre who observed and recorded behaviour. Then corrected versions were submitted and demonstrated. This study may prove useful to show how to create games for ASD children for those without experience by following the structure of the curriculum and testing with ASD learners in an appropriate environment.

A study on a web application, Kiddie Grid, designed with ASD children in mind; it uses colourful objects, user friendly design, interactive activities, eye tracking and AR to improve children's creativity, communication, interactive cognitive and attentional skills (Gunathilake et al., 2022) The e-learning platform uses PHP, MySQL, FLask Python and TensorFlow technologies as well as AR, image processing, eye tracking and machine learning.

OpenCV eye tracking algorithms were used to track the attention of the child using png snapshots from the camera every 20 seconds, the capture is converted to Python Imaging Library or OpenCV image format. If the child seems to have lost attention a new activity is presented this is checked using an OpenCV algorithm to match the direction of the child's gaze to the screens coordinates and javascript was then used to shift activities based on the focus of the child. The study also tracked emotions of the child using facial expression detection. A dataset of expressions was used to train a Convolutional Neural Network to identify the child's facial expression. This method may prove to be effective in helping ASD children to keep focused on an activity and therefore improve effectiveness of their learning.

Hodgetts, Zwaigenbaum and Nicolas explore needs for improvement of services for ASD children based on families opinions (2014) Relevant needs identified in the study were the need for information on where to access support, need for community and acceptance of ASD individuals and a small percentage of participants sought better training for education providers. Henceforth, any developed platform should consider meeting the specified needs for community and accessibility of support resources to be useful for ASD families.

Another paper investigates the opinions of special educators on practices, emphasis instructional areas, preparedness and access to resources (Knight et al., 2018) The biggest factor considered when choosing strategies by special educators was Individual student needs which was expressed by 84.9% of participants indicating needs of students is the most important factor considered by experts when deciding how to educate children with additional needs. The survey also identified the special educators stressed importance on social skills (91.6% of participants), reading/language (89.5%), Maths (86.7%), Communication (87.3%) Self determination (75.5%), daily living (86.7%) and career development/vocation (72.7%). Therefore, these are areas that an e-learning platform should aim to focus on developing in ASD students.

A further study advocates for a user centred design approach for Augmented Alternative communication (AAC) apps for ASD students (Lubas, Mitchell and Leo, 2014) Many AAC apps exist on the market and as such this paper suggests an approach to create apps with instructor and user in mind. PArents, instructors and users feedback should be considered and taken onboard in the design process of such an assistive tool. AAC could be integrated into the proposed web platform to assist with communication between the ASD learner, their parents and other stakeholders such as teachers or private tutors that may use the platform alongside the child.

Judy, Krishnakumar and Hari Narayanan, explored a customised learning individual learning approach for web based learning for ASD learners which adjusts difficulty and generates appropriate materials for learners needs (2012). They layout elements of a semantic web platform: Knowledge base, Search engine, Access Interface,

Ontology, Annotations and Metadata. They use machine learning, specifically a genetic algorithm to create individual learning paths for the individuals online learning. This outline does however seem to be untested but the ideas behind the approach have merit for developing a platform which can personalise learning.

GENERAL WEB LEARNING

This section evaluates literature identified which explores non-ASD children's education via E-learning but still has relevance to developing an effective platform for use by parents at home or for those with general special educational needs.

Nagamori explored a web database for collaboration between teachers which helped to lead to the development of guidance plans for supporting children (2007). The database solves issues relating to managing the children's behaviour providing strategies that have worked previously and feedback on how to handle the behaviour going forward. Collaboration was also found to motivate the teachers using the system. This concept of shared resources could be applied to a tips or forum section of an accessible web platform to allow for collaboration and sharing of information.

Another article explored a web application for education using VR; can be used for sending home work, video lessons for supporting outside of class learning (Marašević and Gavrovska, 2021). Users reported a generally positive experience of the VR elements and expressed desire for adding a 360 view. The need for security and encryption was discussed in the article along with the performance over the internet being an important factor.

A further study used machine learning to generate personalised learning materials from a child's interests and can predict the child's learnability (Banik, Bhuiyan and Jahan, 2015). The solution used intelligent interfaces to adjust content to the users needs such as slowing down videos and offering dyslexic students alternative input methods or presentation of materials in non text form. The study also looks at personalised search results based on previous search data. The prediction of the students ability level proposed seems to provide mostly accurate results.

A web tool was for children, parents and teachers and therapists to create a web bank of materials which can be personalised to be used independently by learners (Ramic-Bkric and et al., 2019). The survey participants concluded that the tool was useful and easy to use, allowed for dynamic creation of content to enrich and improve academic performance as well as tailor test types to the skill level of an individual learner. These results indicate that the web tool was effective. The tool allows for the making of gamified content such as drag and drop and multiple choice questions through the use of back end and front end components. The technologies used include:

Gradle for the backend, for security Secure Sockets Layer, OAuth2 and Spring Security, databases Redis and MySQL with the assistance of Hibernate, JavaScript framework VueJS with ECMAScript6, ESLint and Airbnb style and Socket.io. These technologies may be useful for developing future accessible web platforms.

METHOD

A systematic review was undertaken to explore existing research on web platforms for users with ASD and parents educating from home. The Springer database was selected due to its higher concentration of research specialised in education. IEEE has a high concentration of technology specialised papers and was chosen for this reason to include more technical studies. The SAGE journals database holds the Autism journal and as such the database was chosen to get further research on ASD. Various keywords and search terms were used until the final queries were selected in the table below (See Figure 1). The results include journals as well as conference papers and although not as thorough or reliable as journals these contributed valuable knowledge journals did not cover. The PRISMA method was utlisied to assure a standardised approach to retrieving papers. The below diagram (Figure 2) illustrates the PRISMA method used to select and filter the resources.

Database	**Date Searched**	**Query**	**Filters**	**Results**
Springer	17/02/22	"web e learning autism"	Computer Science	15
SPRINGER	17/02/22	"Web e learning autism"	Education	36
IEEE	17/02/22	"e learning autism web"		8
IEEE	17/02/22	"autism learning web"		20
SAGE	17/02/22	"[All web] AND [[All online learning] OR [All e-learning]] AND [All technology] AND [[Title autism] OR [Title asd]]"		27

Figure 1 - Table showing search Queries

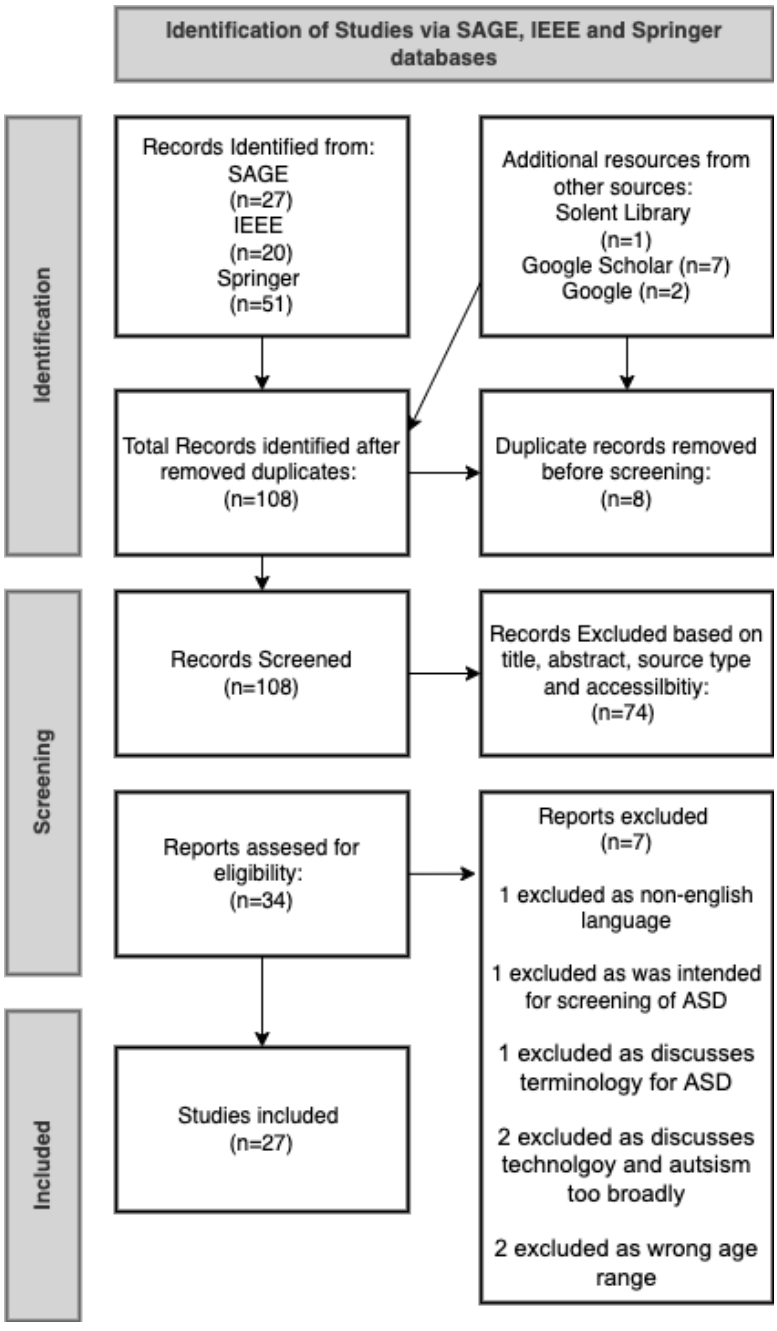

Figure 2 - Diagram showing PRISMA method of literature search performed detailing reasons for exclusion and filtering process.

LIMITATIONS & BIAS

As many results were returned from queries, studies which may include insight to the topic area may have been excluded due to the filtering process being strict. There is always risk of bias however, care was taken to use appropriate sources to avoid this.

SUMMARY OF LITERATURE REVIEW

Through my previous studies into the needs of LwD for E-learning, I have identified success factors for an accessible E-learning web platform: accessibility protocols, compliance with WGAC standards, demonstrable results, flexibility, career driven content and interaction (Webb, 2022). Building on this, the following recommendations for technologies, content and features were determined based on the research found in this literature review.

The literature reviewed identified potential technologies used by antecedents such as HTML5, CSS, JQuery, python, MySQL, PHP, MySQL, FLask Python, TensorFlow, AR, OpenCV, Eye Tracking algorithms and CNN machine learning. These technologies may be useful in the development of an accessible Elearning platform in this study and future studies. Security is an important consideration, as the users are vulnerable, encryption and other security techniques should be implemented to keep data secure. Performance and ease of use are important generally but are also important to avoid losing the attention of ASD learners and as such performance tests of latency and of usability of the user interface should be a requirement of a successful web platform.

In terms of learning content, reading/language, maths, daily life, communication, career/vocational, social skills and self determination should be included based on the opinions of special education experts. Gamification has shown evidence of improving motivation of users to uptake and continue to use a technology to aid their learning. Serious games and gamified elements have been used across various studies and seem to show signs of promise.

This background research has also identified further requirements to meet needs of ASD and home educating families with the E-learning platform with features. Survey results of ASD families indicated community and accessibility of support resources were identified as needed services for support. As such a feature such as forums to improve community and allow for resource sharing should be included in the requirements for the platform. In addition, a place for storing details on strategies and tips for the ASD individual may be a useful feature for ASD parents as collaborative knowledge was indicated across multiple studies as beneficial; a section of the platform should be dedicated to tips and strategies and would hold a database of rated strategies. Also across many studies, the concept of personalisation and adaptation to the need of the individual seemed to be a factor which would

help ASD learners to continue to use and benefit from the technology therefore, some element of personalisation of features for the web platform would be an appropriate addition to the requirements. This could come in the customisation of content shown to the user. A user profile should be a feature needed to hold data on the user to monitor performance to implement improvements and target areas the learner needs help in. This profile may also benefit when collaborating with a teacher or private tutor. As well as this, a search engine will be used to access the courses.

HYPOTHESIS

With the above in mind the following hypotheses for testing effectiveness and success of the platform have been determined and will be built upon with further primary research:

H1 - The platform uses a search engine to access a database of courses

H2 - The platform allows for communication between users

H3 - The platform facilitates the sharing of knowledge and support resources

H4 - The platform allows for creation of a user profile detailing users results, skills and completed courses

H5 - The platform has interactive content with elements of gamification

H6 - The platform allows for content across subject areas such as maths, reading/language, career/vocation, daily life, communication, social skills and self determination

H7 - The platform is easy to use

H8 - The platform facilitates flexible learning

H9 - The platform allows personalisation

H10 - The platform meets WGAC accessibility standards

H11 - The platform is secure

CHAPTER 2 - PILOT SURVEY

INTRODUCTION

RATIONALE

A survey has been chosen to collect data as this is appropriate to determine influencing factors for individuals intentions to use a product. The survey will allow for the collection of quantitative data to analyse objectively as well as some qualitative data that can provide further insight. This allows for the bulk of the data to be easily processed for faster clearer analysis but also means that there is opportunity for participants to bring up other features beyond the scope of the survey.

OBJECTIVES

1. Survey factors to find what is important to parents
2. Analyse results of survey
3. Determine the application of these results to the project's requirements
4. Determine development plan to carry out requirements

METHOD

HYPOTHESES AND RESEARCH QUESTIONS

In the preceding literature review hypotheses for testing the success of the end product were determined. These hypotheses were:

H1 - The platform uses a search engine to access a database of courses

H2 - The platform allows for communication between users

H3 - The platform facilitates the sharing of knowledge and support resources

H4 - The platform allows for creation of a user profile detailing users results, skills and completed courses

H5 - The platform has interactive content with elements of gamification

H6 - The platform allows for content across subject areas such as maths, reading/language, career/vocation, daily life, communication, social skills and self determination

H7 - The platform is easy to use

H8 - The platform facilitates flexible learning

H9 - The platform allows personalisation

H10 - The platform meets WGAC accessibility standards

H11 - The platform is secure

When considering requirements for technology projects, it is important to take into consideration the needs of the end user. Research by Khurum, Uppalapati and Veeramachaneni indicates that a triage approach to survey design is recommended in order to get the best outcome (2012). The approach is compared to medical triage where doctors categorise patients by three categories, those who will recover without help, those who will likely not recover with or without help and those who will likely recover with assistance. They focus efforts on the last group. When applying this to technology projects, the basic functional requirements known along with features that are superfluous should not be discussed; prioritisation should be on discussing the unknown requirements users want but are not obvious to developers. As such the requirements for success identified in the preceding literature that are concrete will not be directly surveyed in order to gain the most valuable information from participants.

SURVEY VARIABLES

Hypotheses 1 through 4 are basic functional requirements of the web platform and as such these will not be explored in the survey. Hypotheses 7 and 11 are qualities which are obvious as requirements for any piece of software or web platform, security and ease of use are always an important factor. Hypotheses 10 is also an important factor due to the focus on additional needs children, accessibility standards are going to be important. This leaves hypotheses 5, 6, 8 & 9 as the focus of the survey. These are more abstract, do not clearly define what exactly needs to be done to achieve success and would benefit from back up by parents in a survey.

These 4 hypotheses have been broken down into factors relating to the parents perceived usefulness of a platform. They have been further broken down into factors and variables which the survey questions relate to. The table in appendices A shows the variables matched to the survey question they are associated with.

When looking at these factors in relation to intention to use the below diagram, see figure 3, has been created. This demonstrates how the survey results will be looked at in order to see what factors most affect the individuals perceived usefulness of a platform. This was influenced by the TAM3 model (Venkatesh, 2008).

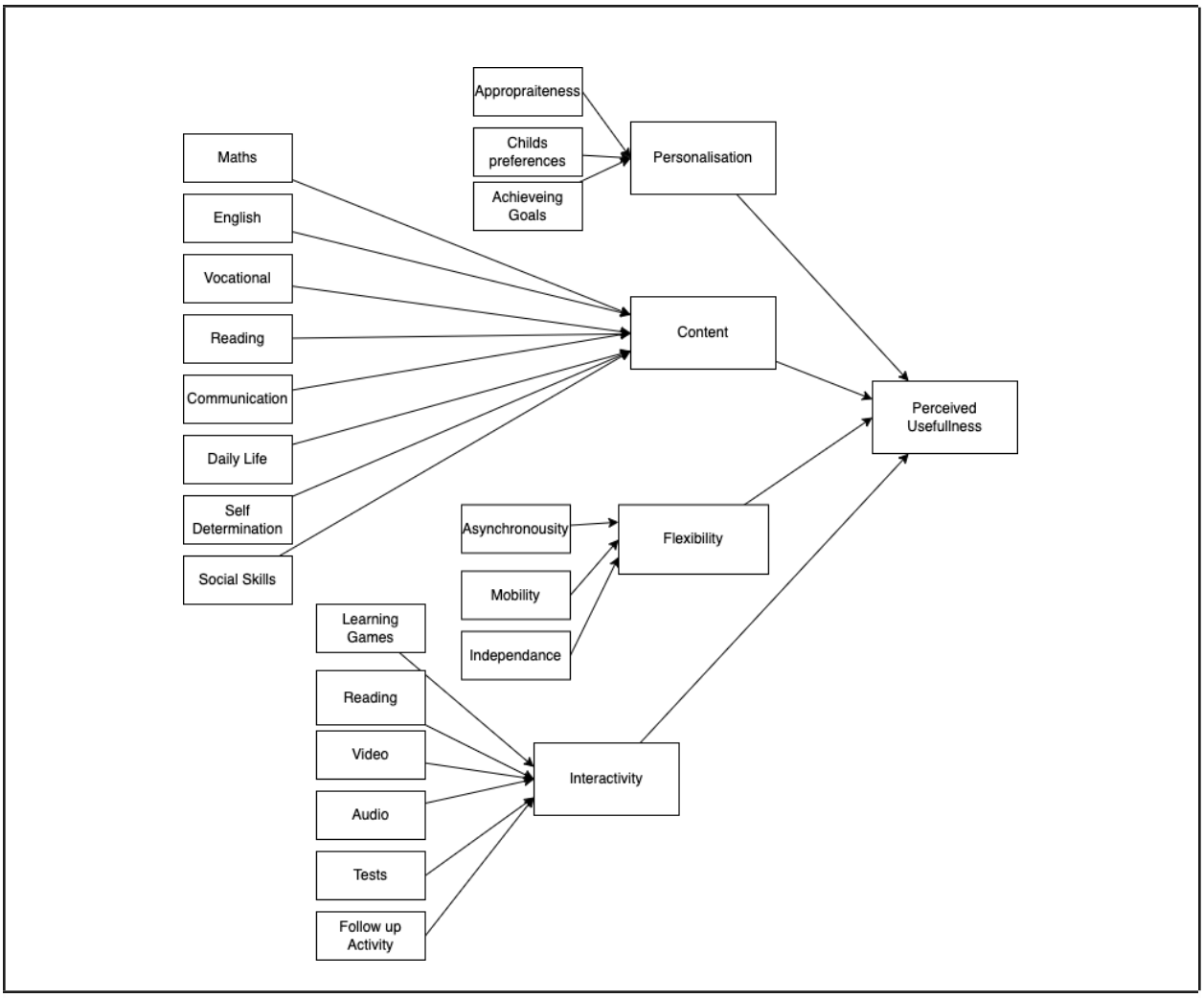

Figure 3 - Diagram showing all the variables related to their factors

Each main factor has been determined from the 4 hypotheses: flexibility, interactivity, personalisation and content. Flexibility (see figure 4) here refers to the ability of the platform to be accessible in different locations, devices and time periods. Asynchronicity refers to the ability of users to be able to use the platform at any time. Mobility refers to the location users can use the web platform in and the ability to use it on a mobile device.

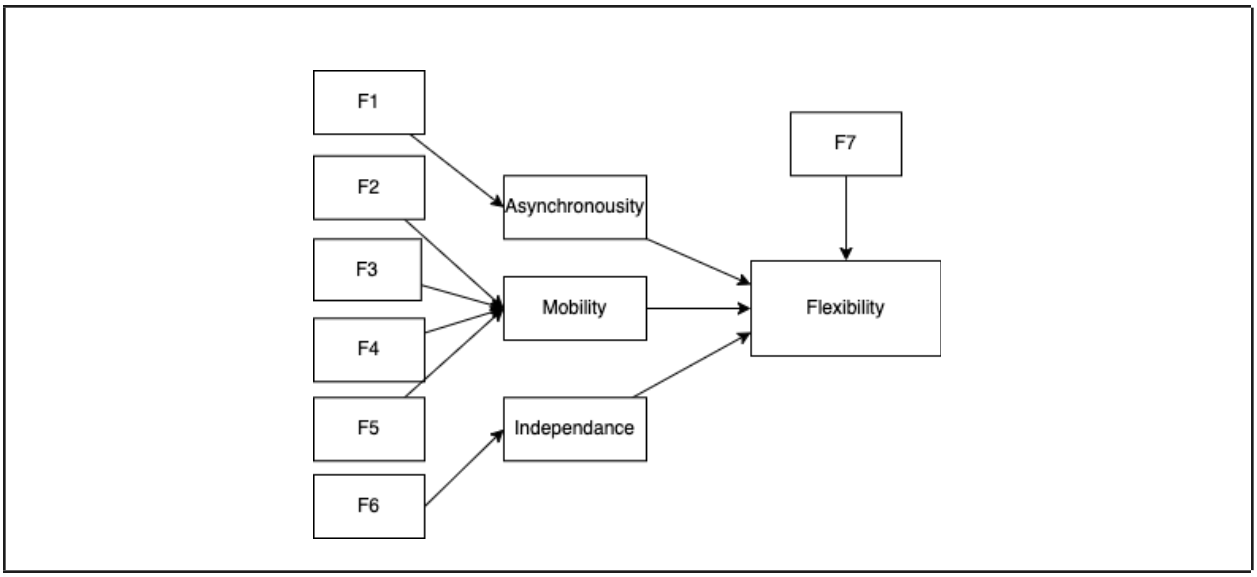

Figure 4 - Diagram showing the flexibility variables related to their factors

Interactivity explores to what level the activities on the platform need to be interactive (see figure 5). This factor explores if gamification is wanted by parents, if testing is desirable and if activities after learning are beneficial. The positives of reading, audio and video content is also surveyed in order to compare to the more interactive content.

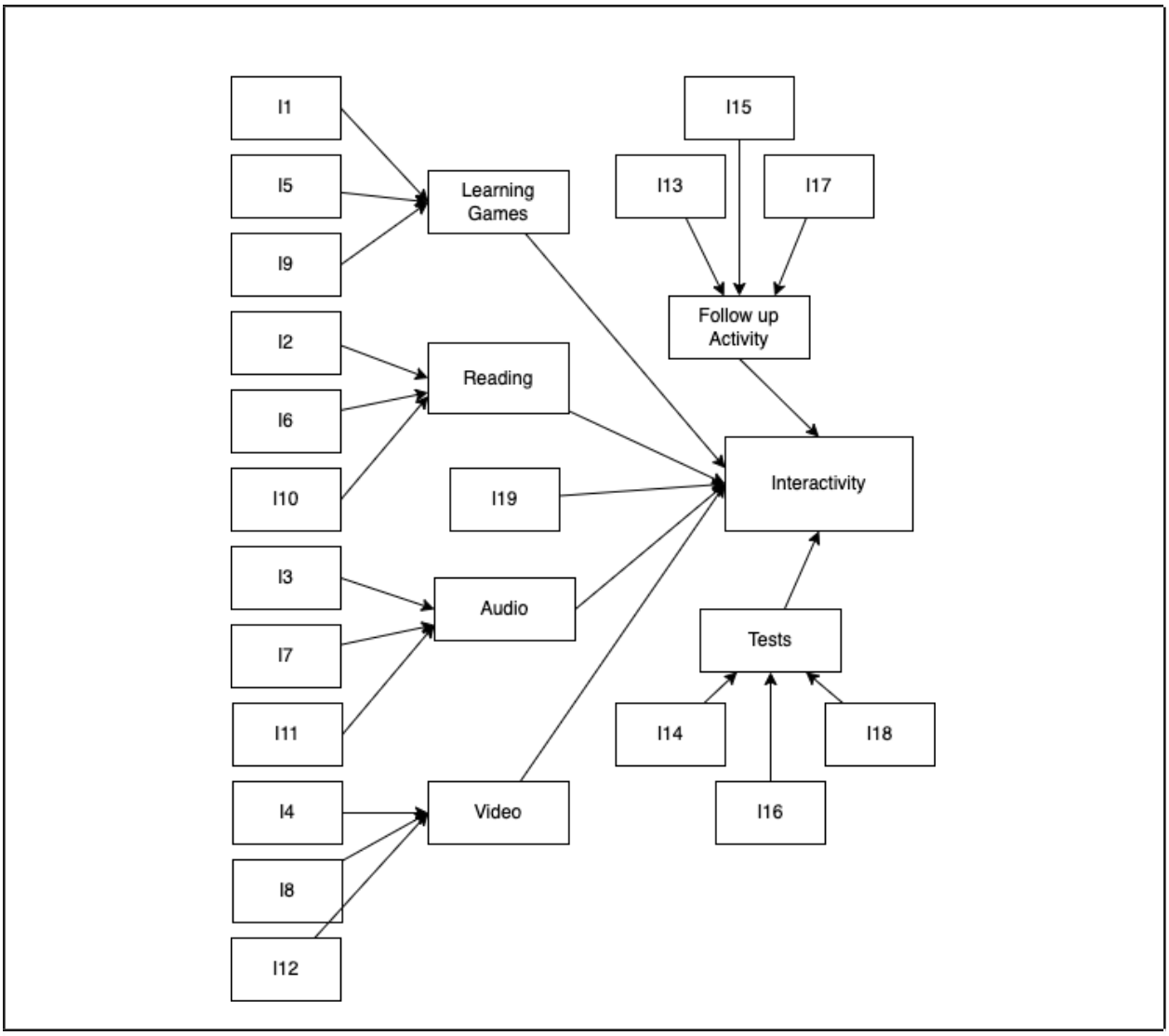

Figure 5 - Diagram showing the interactivity variables related to their factors

Content refers to the type of content in terms of skills and subject area (see figure 6). Maths, English, vocational reading, communication, daily life, self determination and social skills are surveyed in order to see what type of content parents want to see. Variables C1 through C8 ask about one of the subject areas and the C10 variable asks the user to rank the content in order of importance so these can be compared to each other and determine which is more important. C9 directly asks about the importance of content.

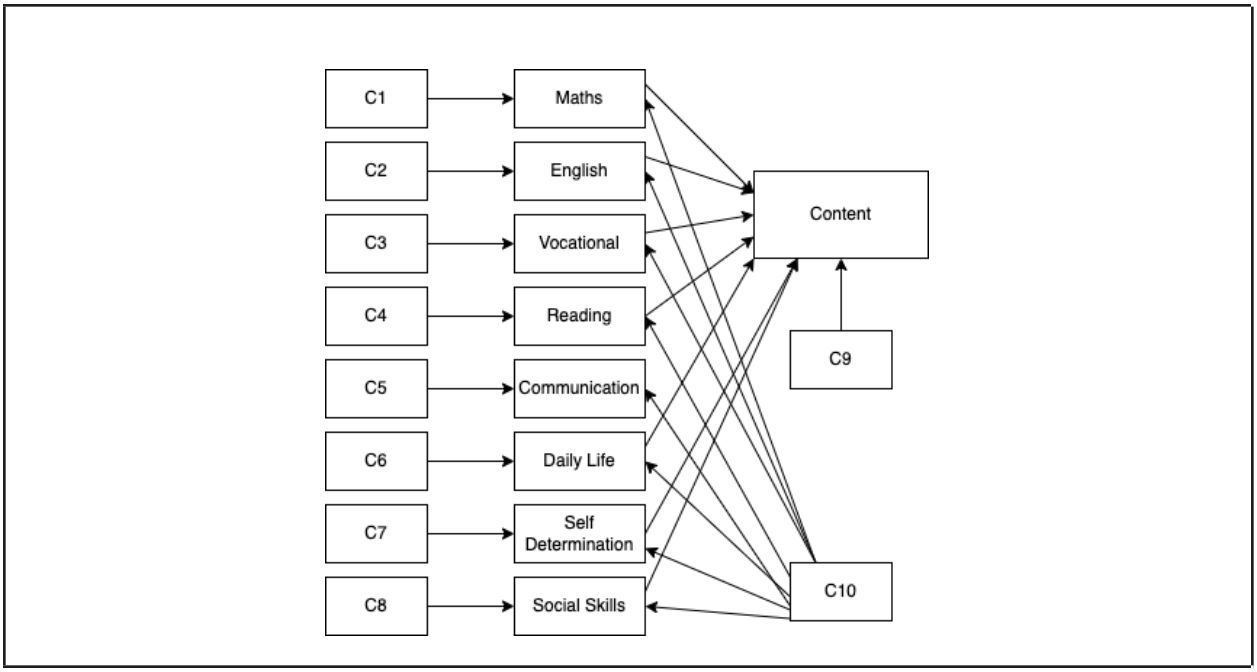

Figure 6 - Diagram showing the content variables related to their factors

Personalisation (see figure 7) refers to customisation of the learning experience for the child's enjoyment and academic benefit. This includes changing preferences on the platform and goal setting. P1 to P4 relate to appropriateness of content in terms of age, skill and needs. Variables P5 to P8 look at preferences of the child to change their learning experience and if they dislike content. While P9 and P10 look at goal setting and if it is important to parents.

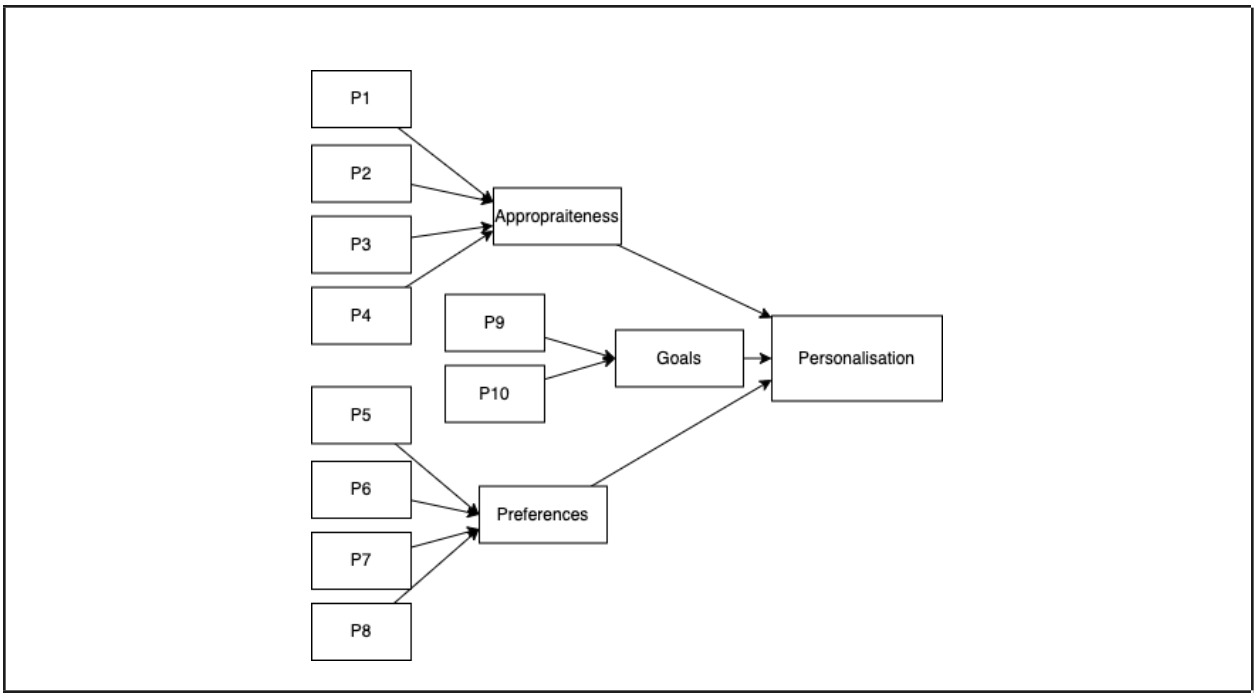

Figure 7 - Diagram showing the personalisation variables related to their factors

LIKERT SCALE

Likert scale items were used as the main section of the survey that will be analysed. The survey asks a respondent not just if they agree with a statement but how strong their opinion is on a numbered scale (Robinson, 2014). This allows for the data to be analysed to see trends easier than with a qualitative approach or a binary yes or no question. Each variable for the factors has a likert scale associated with it. This data has then been plotted into charts in order to represent the responses to the survey visually and show a positive, negative or neutral lean in responses.

RESULTS

POPULATION

SURVEY POPULATION	
TOTAL PARTICIPANTS	10
CHILDREN AGE DISTRIBUTION	
Under 5	2
5 - 7 years	1
8 - 10 years	2
11 - 13 years	4
14 - 17 years	0
18 or over	1
ADDITIONAL LEARNING NEEDS	
Any	8
Visual Impairment	0
Physical Impairment	1
Hearing Impairment	0
Cognitive Impairment	1
Autism Spectrum Disorder	5
Social Difficulties	1
Difficulties Reading	4
ADHD	1
EDUCATION TYPE	
Mainstream	8
SEN School	0
Home Educated	2

Figure 8 - Table showing survey population details

LIMITATIONS & BIAS

When surveying it is important to try to limit bias. The population targeted in the study was primarily parents of additional education needs children. However, the survey covered a wide range of disabilities, impairments and difficulties. Selection bias can occur if a study does not closely match its population of interest (Popovic and Huecker 2022). With such a small sample size, the survey cannot represent the views of the target population. This study has a limited size of only 10 people and as such the results may not be indicative of the target population. No parents of 14-17 year olds responded and as such the research does not represent this age group at all. In addition those with visual and hearing impairments are also not represented. Only 20% of the population were home educated children and 20% also responded as having no disability or additional education needs. As the study was conducted online any participants uncomfortable with using technology may also not be represented.

FLEXIBILITY

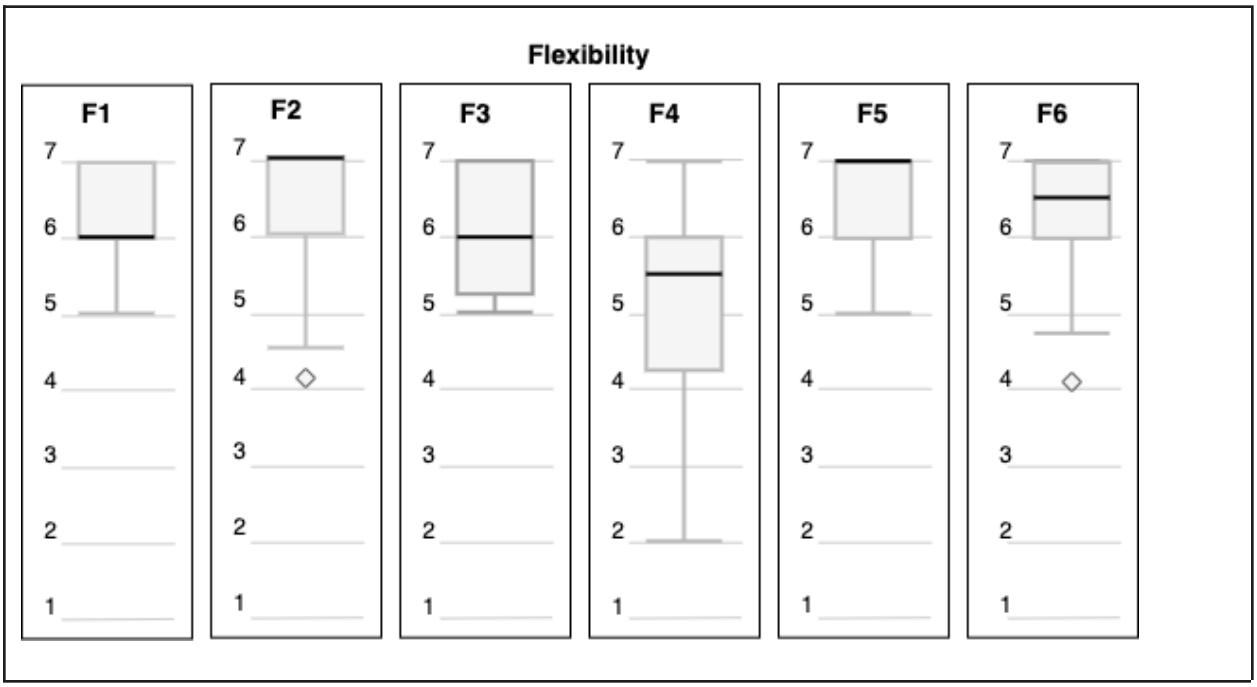

Figure 9 - Diagram showing survey results for variables in box plots

Generally participants had a positive view on all the flexibility variables with most participants choosing the upper end of the scale. The F4 variable, as seen in figure 9, relates to the question "It is important that my child can use the web platform at school." This variable seems to have more variance in its answers than the other variables and this does not correlate as might be expected with home educating parents seeing using the platform at school as less important as the trend also occurred within the rest of the participants.

F2 aimed to see the views of parents on learning from home, most participants thought it was very important but some participants felt less strongly, the outlier here is caused by a less strong opinion than the main group's feelings. F6 asked participants, ``It is important that my child can access the resources independently (without assistance from a caregiver or teacher)." Generally participants said they strongly agreed with the statement but some participants had a more middling view causing the outliers here. These variables with outliers do not seem to show any correlation with the information gathered on participants about how their child is educated or their child's additional needs. A larger sample size may show more indication of why these outliers exist.

INTERACTIVITY

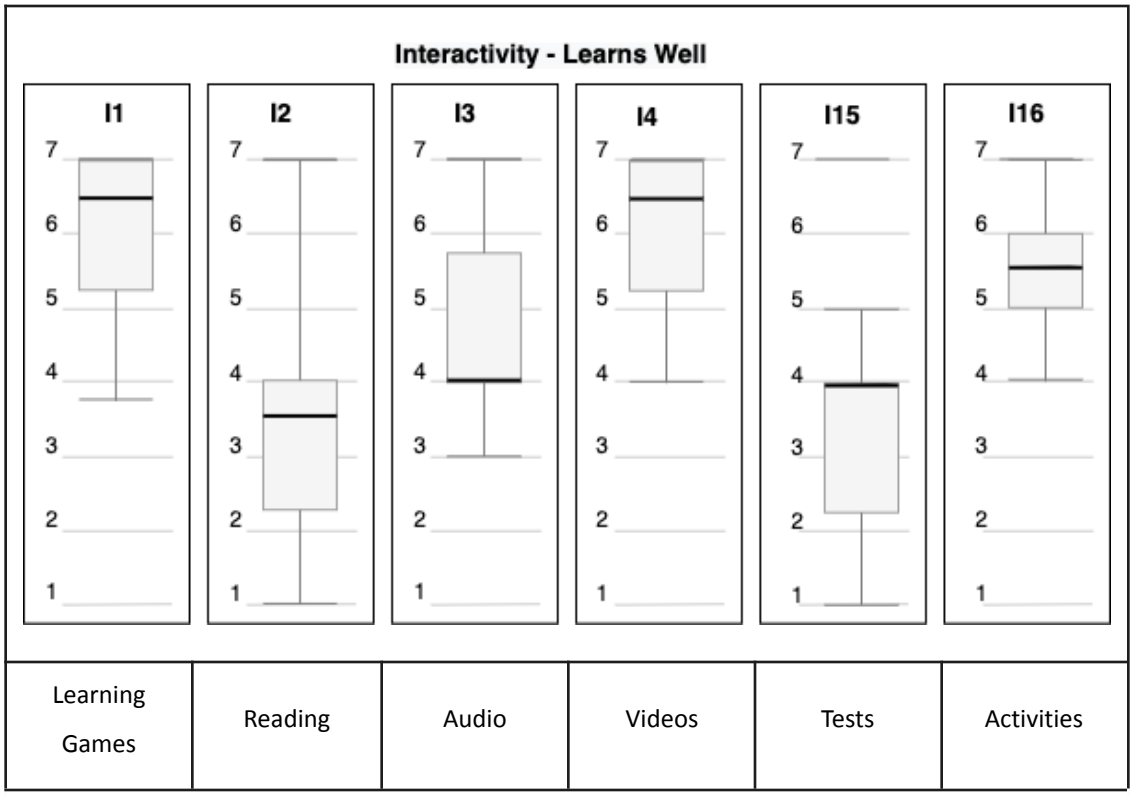

Figure 10 - Diagram showing survey results for interactivity variables relating to how well the child learns via the learning method in box plots

These results shown in figure 10 above, have more variance than the other factors with a wider distribution of opinions. I13 has a trend to the lower numbers. This variable is associated with the question "My child learns well when tested". There is also a negative trend with I2 which is associated with learning via reading. The other variables, although not as strong as other factors, are generally positive but have a larger interquartile range (IQR) meaning there is not as solid of a response as with previous variables. I16 seems to show the most agreed on

variable, "My child learns well when they apply the information learnt to an activity." There seems to be a smaller IQR indicating a more cohesive response from participants centred around the median value of 5.5. I1 and I4 medians indicate that both videos and learning games are viewed as being useful for the children's learning. It is therefore clear that parents surveyed thought their children did not learn as well from tests or reading but did enjoy the more interactive learning methods of video and learning games.

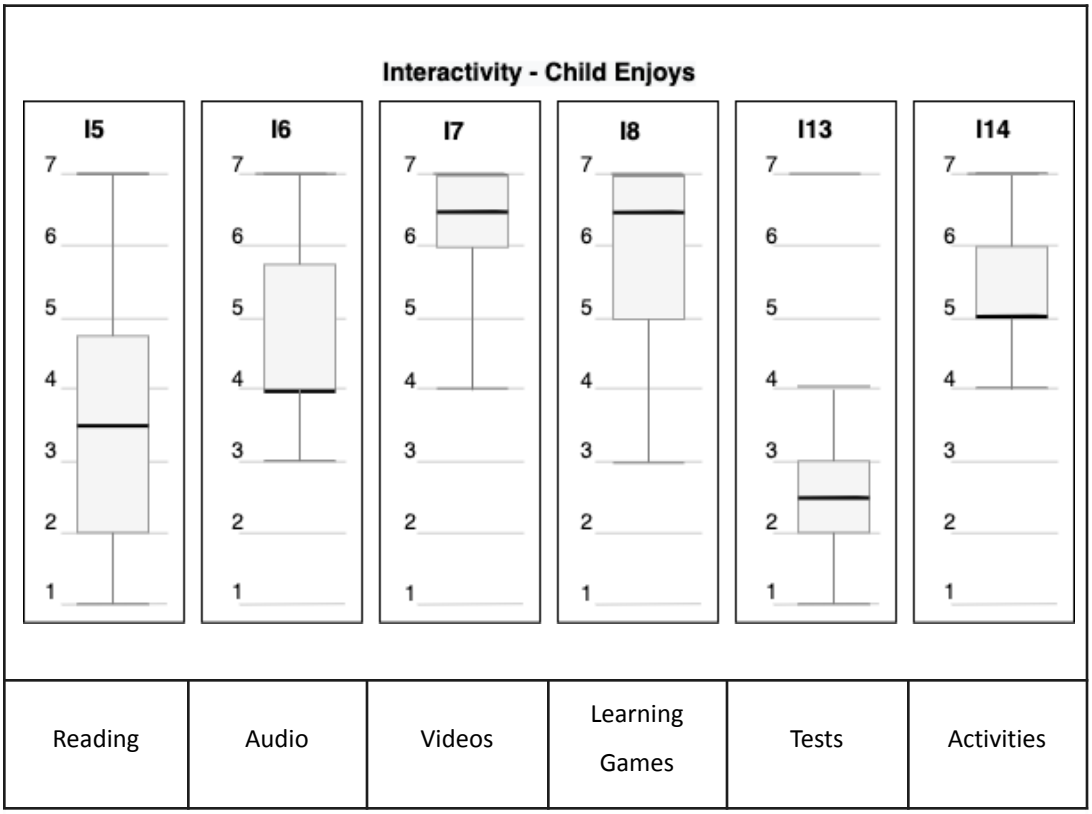

Figure 11 - Diagram showing survey results for interactivity variables relating to how the child enjoys learning methods in box plots

I13 as seen in figure 11, asks parents how much their child enjoys tests; there is a clear response here with a small IQR and a median of 2.5, parents clearly believe their children do not enjoy tests. I5, which refers to enjoying learning via reading, also leans more to the lower values with a median of 3.5 however, the IQR is less precise and the maximum and minimum values indicate much more variance in answers. An interesting observation was that those who reported their child as having ASD or a cognitive impairment correlated with the lower value answers in this section. I7 is correlated with the higher numbers with a small IQR indiciating parents agree that video is a learning method their child enjoys. Learning games are also responded to positively, although with more variance than learning via videos, I8 still has a median average of 6.5.

This indicates that parents think their child most enjoys video content, learning games and applying skills learnt to an activity after but dislikes being tested and learning via reading. Particularly parents of children with cognitive impairments or ASD seemed to report their child disliking reading more so than the other participants.

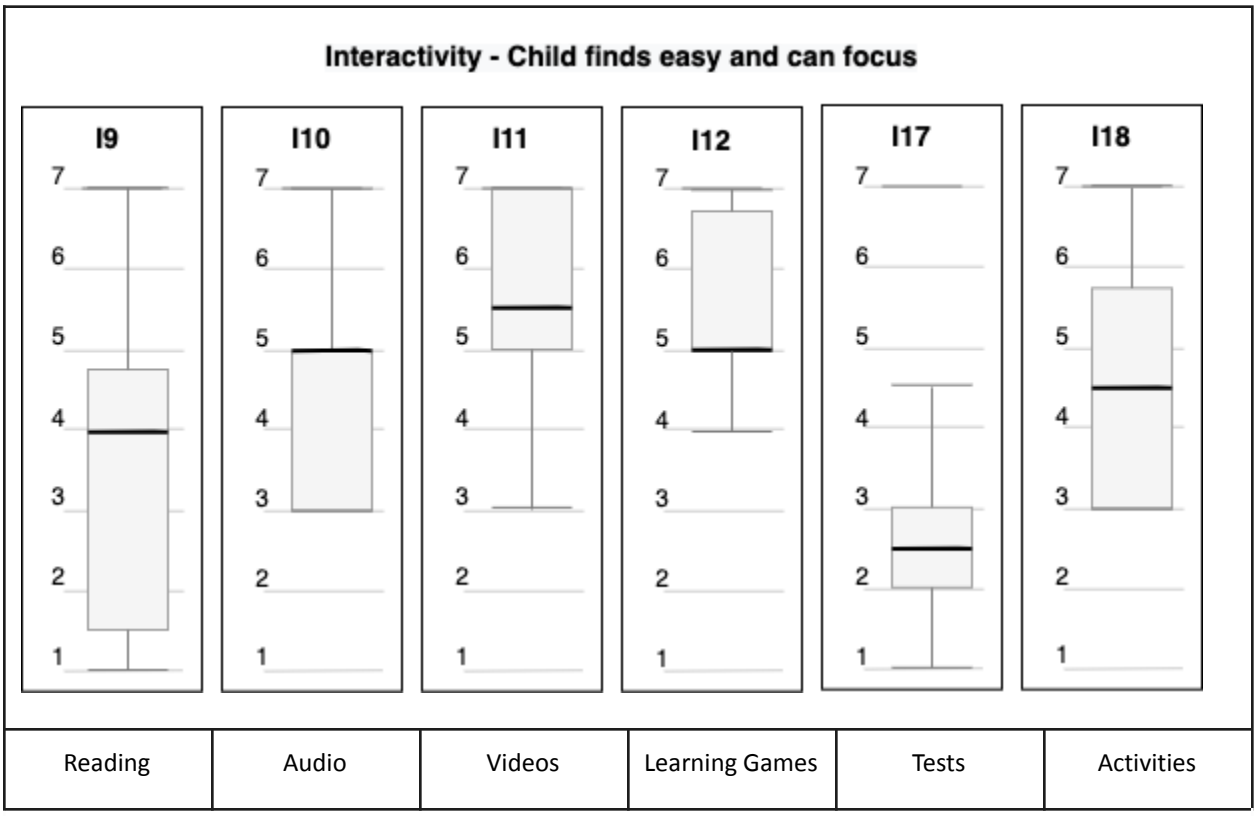

Figure 12 - Diagram showing survey results for interactivity variables relating to how easy it is for the child to focus on the learning method

Finally when discussing interactivity the child's ability to focus and ease of using the method were considered. Parents indicated that testing was not something their child found easy. As seen in figure 12, I17 has lower values and is centred around a median of 3.5 with a small IQR indicating little variance in responses. I9 also indicates children struggle partially to focus and learn via reading however, there is much less variance and the median indicates a more middling response than that towards testing. Variables I11 and I12, seem to be more agreed with. I11 has a median of 5.5 and although there seems to be a range of answers it has the most overall positive response. I12 has a similar response to I11 with a median of 5 and some variance in responses.

This seems to indicate parents think their child struggles with focusing on reading and tests but seems to find learning games and watching videos easier to focus on.

CONTENT

VARIABLE	RANK	MEDIAN	UPPER PERCENTILE	LOWER PERCENTILE	IQR
Daily Life	1	2.5	4.75	2	2.75
Reading	2	2.5	4.75	2	2.75
Vocational	3	4	5	3	1.75
Social Skills	4	4.5	5.75	4	1.75
Communication	5	5	5.75	4.25	1.5
Maths	6	6	5.75	2.25	3.75
Self Determination	7	6	8	4.25	5
English	8	6.5	7.75	3.25	4.5

Figure 13 - Table showing data based on survey results for C10

When asked to rank the content, for survey variable C10 as seen in figure 13, parents ranked daily life and reading as the most important content, the IQR range indicates some variance with placement but the higher median indicates generally participants saw these as important. Vocational, social skills and communication were securely in the middle with smaller IQR and average medians; these are clearly important to parents but are not as important as the first two. Maths, English and self determination were placed in the bottom but the IQR are quite large indicating a lot of variance in their exact placements.

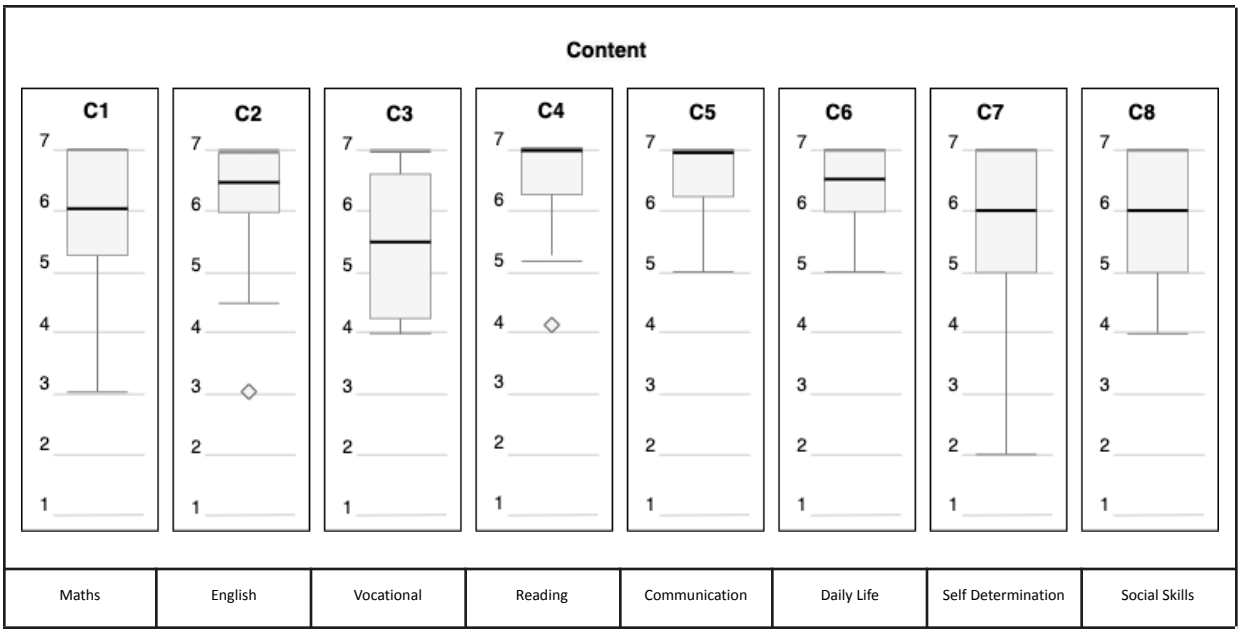

Figure 14 - Diagram showing survey results for content variables from likert scale questions

When comparing C10 (see figure 13) and C1 through C8 (see figure 14) the results are similar. Reading and daily life are still clearly important with respondents indicating strong agreement with a very high median of 7 for C4 and 6.5 for C6. However communication and English have also been shown as important to parents when asked individually and not ranked as in C10. This may indicate these variables are still important to parents but the other factors outweigh them when directly compared.

Overall these results seem to indicate that content to assist children with reading and daily life are very important to parents. Content relating to vocational skills, social skills, communication and english although not as decisively so are still seemingly important to parents. While self determination and maths are not priorities for parents.

PERSONALISATION

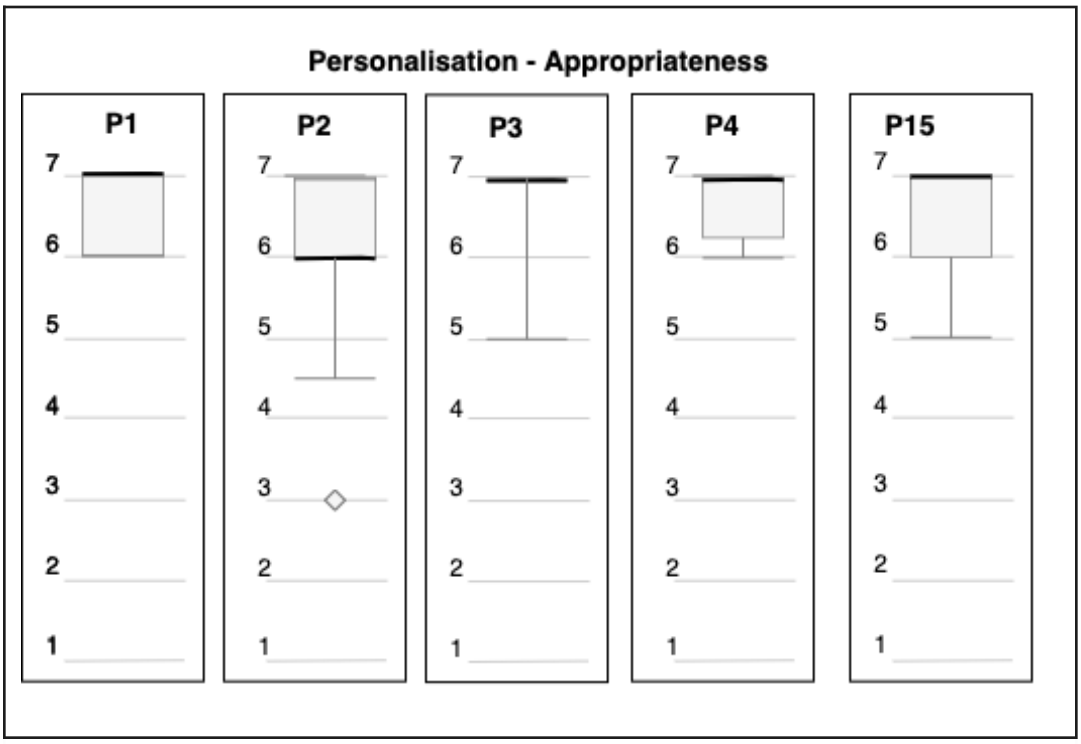

Figure 15 - Diagram showing survey results for personalisation variables relating to appropriateness

The results in figure 15 show that all variables relating to the appropriateness factor have larger median values and quite small IQR indicating a concurring response between participants. Appropriateness clearly seems to be something parents think of as important based on the data here. All the factors relating to age appropriateness, appropriate to a child's individual needs and skills indicate parents see this as important.

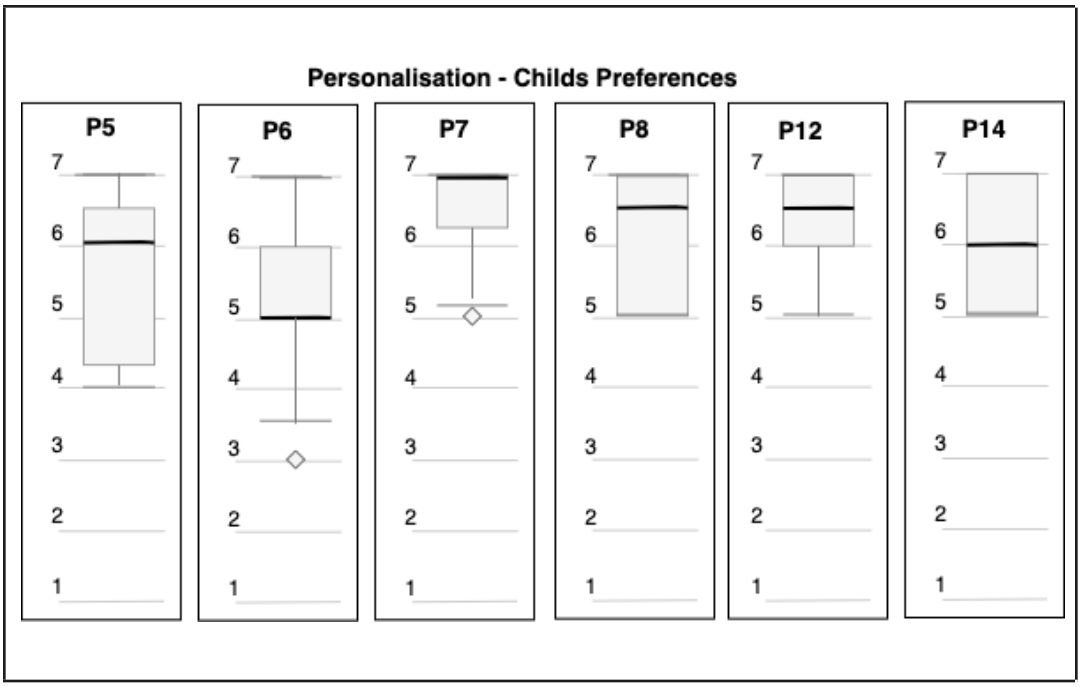

Figure 16 - Diagram showing survey results for personalisation variables relating to the preferences of the child

The results in figure 16 indicate that variable P7 is for the most part strongly agreed with, the media is 7 and only one outlier seems to disagree. This variable relates to the survey question "My child would enjoy being able to choose a learning method that suits them." This indicates parents agree that their child would enjoy switching between or choosing one learning method over another. P8 also indicates parents see this option as useful as there are generally higher values although more variance in response. P5 indicates parents were generally agreeing their child can become frustrated but there is more variance here than with other variables indicating this may vary child to child. It is also worth noting those who reported a higher value for their child becoming frustrated correlated with the parents who reported their child having ASD or a cognitive impairment while those reporting no additional needs gave a lower value for this variable.

These results indicate the ability to change preferences is important to parents for their child's ability to learn and also their enjoyment. The factor with least consistency was that their child can become frustrated with content, however those with ASD and other additional needs seemed to report more frustration than those reporting no additional needs.

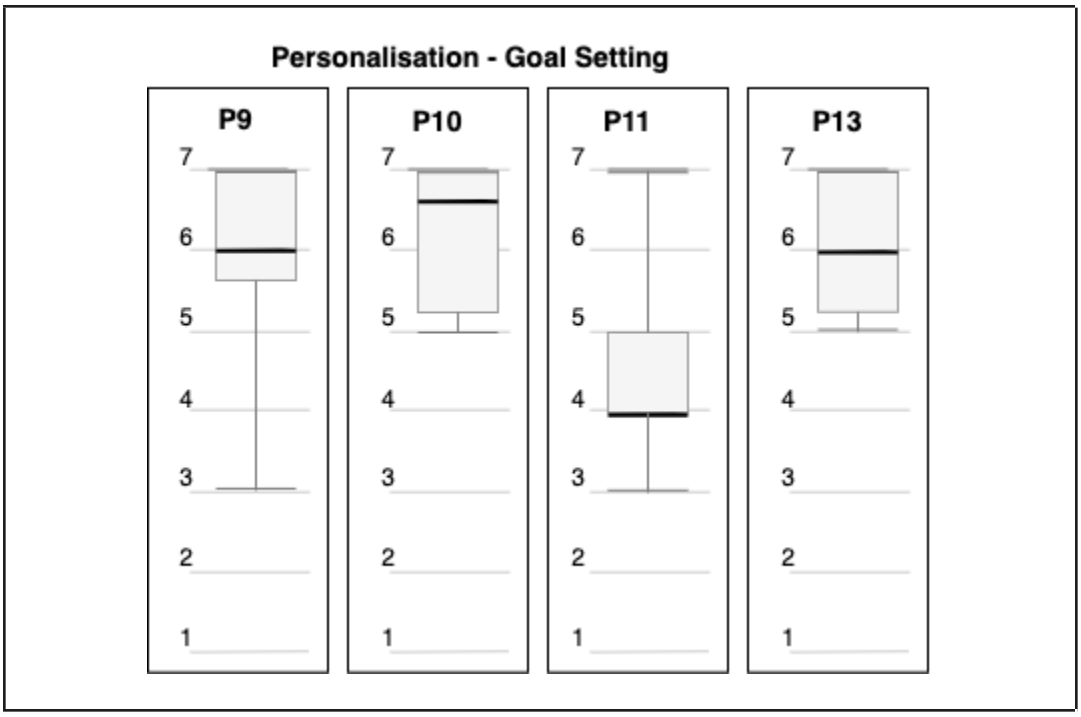

Figure 17 - Diagram showing survey results for personalisation variables relating to goal setting

As shown in figure 17 above, Participants seemed to respond lower values to P11 indicating that their child was not motivated by goals when learning, the IQR is also small here therefore this seems to be a shared response. P10 has a high median value and its minimum value does not go below 5 indicating this variable is important to parents. P10 is related to the survey question "Content selected to meet my child's goals is useful.";

These results indicate although parents do not see goal setting as directly motivating their child they do see goals as useful perhaps from a parent/teacher perspective allowing for goals to be set in the web platform may therefore be useful. These goals could then be used to recommend content for the child's next steps.

FACTORS AGAINST EACH OTHER

VARIABLE	RANK	MEDIAN	UPPER PERCENTILE	LOWER PERCENTILE	IQR
Content	1	1	1.75	1	0.75
Interactivity	2	2	2.75	2	0.75
Personalisation	3	3	3	3	0
Flexibility	4	3.5	4	2.25	1.75

Figure 18 - Table showing data based on survey results for PU1

The final survey question explores which of the factors of flexibility, content, interactivity and personalisation are the most important to parents. The results shown in figure 18 above seem to indicate that content is the most important followed by interactivity. Personalisation is very consistently placed in third position while flexibility comes overall last but some participants valued it more than others as its placement varied more than that of any other factor with it having the highest IQR of 1.75. There does not seem to be a strong correlation with the child having additional needs and the ranking of the content. The conclusion that can be drawn from this data is that parents in the survey valued content and interactivity over flexibility and personalisation regardless of type of education or additional needs.

SURVEY RESULTS DISCUSSION

This survey has highlighted a direction for further development of the web platform. Although few factors seemed to change based on the additional needs of the child there were stand out questions where it was clear those with ASD and cognitive impairments struggled more so than other children. This was when discussing reading for learning as well as frustration with content. This should be considered across the platform. Options for avoiding reading should be included for example, limiting the amount of text and replacing it with picture instructions or icons as well as including options for presenting information as audio or video instead of text where possible.

The type of content the web platform will focus on primarily is daily life and reading content due to the ranking of these items and expression of parents for their importance over other variables. Lower prioritisation will also be given for vocational, social skills, english and communication as these were expressed as important to parents but did not rank as highly as reading and daily life content.

The results relating to the interactivity factor indicate that the parents more strongly agreed with statements relating to interactive content such as learning games and videos. It was found that parents think their child will learn better, enjoy and for the most part be able to focus better on content that is presented as a video or learning game. Reading was expressed as a difficulty for many participants with most parents reporting their child disliked and struggled to read for learning. Therefore reading should either be limited where possible or options for text to be read aloud to the child should be included to assist them to learn other topics they could excel in despite porter reading abilities. In terms of assessment, testing seemed to be disliked by the children of the participants and parents also seemed to believe it did not help their child learn. Instead preferred way activities that applied the skill learnt as a follow up to the learning. Therefore, the platform should aim to present follow up tasks after learning in a non test format which applies the skill as opposed to testing them to avoid frustration and impacting their learning.

Flexibility was indicated as the least important out of the 4 factors influencing whether the platform would be useful to the parents. Therefore flexibility is not going to be prioritised when developing the platform; the focus will be on developing a browser version of the software that is functional. Mobile versions will be considered time dependent as this was a variable expressed as important by the parents.

Personalisation was not as important of a factor however a strong indication was given that parents would use goal setting in order to choose the next content for their child. Although children themselves may not benefit from motivation from their goals, parents indicated that goal setting is useful and certainly content recommended based on what the child is aiming for will be a useful feature of the platform. As well as this, the results seem to indicate

parents think their child would enjoy being able to choose a learning method, therefore alternative options of the same content presented in different learning methods should be a feature of the platform.

With this all in mind the below timeline and requirements analysis has been assembled in order to keep the development of the web platform on track. Testing phases will be vitally important to see if the platform is meeting the needs of its users successfully.

REQUIREMENTS ANALYSIS

The key stakeholders of the project are the parents/caregivers who will be providing the platform to their children, who are the end users, as well as teachers and private tutors who may also use the platform with the children. These stakeholders have been surveyed in order to find requirements for the project however more can be done going forward to improve the projects development and further understand the requirements. One on one interviews, focus groups and testing of prototypes will assist in further defining the success of the web platform.

FUNCTIONAL REQUIREMENTS

As a result of this report and preceding research the following functional requirements have been determined:

FRQ1 - The platform uses a search engine to access a database of courses
FRQ2 - The platform allows for communication between users
FRQ3 - The platform facilitates the sharing of knowledge and support resources
FRQ4 - The platform allows for creation of a user profile detailing users results, skills and completed courses
FRQ5 - The platform provides alternative options for those who struggle with reading
FRQ6 - The platform allows the child to choose a learning method
FRQ7 - The platform allows parents to set goals and recommends content based on this
FRQ8 - The platform is suited to content on daily life skills and reading skills

FRQ5 has been determined due to the evidence of learners with ASD and other learning difficulties struggling with reading more so than learners without any reported disability or additional needs. For a platform to allow learners with ASD and additional needs to excel, options should be included to reduce reading or aid reading; offering alternative options such as video or interactive content could help learners with additional needs to learn more easily. Accessibility tools such as colour filters, fonts designed for those who struggle to read and screen readers can also offer a way for the learner to find reading.

FRQ6 similarly has been determined due to the need of learners to avoid frustration and excel with learning. Providing alternative learning methods allows the learner to choose what works best for them and avoid content which they cannot access due to their disability; for example in the case of learners with hearing impairments they can avoid content using audio. This allows all users to excel and learn the information in their own way.

FRQ7 has been determined directly due to the results of the survey. Although respondents reported their child did not need goals in order to excel they saw the utility of this function as useful for communication with other parties such as teachers or personal tutors. The capability to set goals allows a teacher to communicate what areas the child needs to focus on from home. This function is not as useful for parents of children who are home educated but for students in mainstream or SEN schools this is a function which parents will gain utility from.

The learning topics determined from the literature search were surveyed and narrowed down based on parents' opinions on the most important content for their child. The parents determined the most important content to cover daily life and reading skills. Therefore, a successful accessible platform will cover these topics and FRQ8 Was determined.

TECHNICAL REQUIREMENTS

The technical issues as well as operational issues should also be considered in order to ensure the project goes smoothly. The database will need to be cloud hosted in order to allow users to add and view courses from home. In addition users should also have protection when entering details online and as such security should also be considered.

TRQ1 - The platform supports video content
TRQ2 - The platform supports learning games
TRQ3 - The platform can function in a web browser from the users home

The technical requirements have been determined due to the required functions. To be able to achieve the functional requirements video and learning games will need to be available on the platform. The platform should also function with ease from the user's browser to simplify the process for parents and learners not as technologically able. Although the literature search indicated access to learning via mobile devices was important for older learners with disabilities, flexibility was the lowest ranked in PU1 indicating where the platform can be used was not the most important factor for parents. Therefore, functionality with mobile devices for younger users seems to be less important for a home learning platform.

OPERATIONAL REQUIREMENTS

The following operational requirements were determined:

ORQ1 - The web platform is secure

ORQ2 - The web platform uses cloud services to provide users with content

Security is always an important factor regardless of the type of user but when users will be young vulnerable individuals it is even more important to ensure users data is secure. Cloud services will be needed in order to provide the database of courses for users to add their own courses and access courses created by other users.

Further testing of these requirements will be undertaken in order to determine their suitability going forward as seen in the timeline below, see figure 19.

TIMELINE

July 18th	August 5th	August 15th	August 30th	10th Sept	23rd Sept
Phase 1	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Phase 6**
Complete database and node architecture for the basic structure of the web platform Complete the basics of the website. Json and CSS to have a functioning platform users can upload and view records from.	Develop some simple learning games and video with the same content to present for testers Send to testers to try over upcoming weeks (until Send Initial impression survey.	Make changes based on the initial survey. Fix any major issues and make the new version accessible if necessary. Send a point survey.	Make changes based on midpoint surveys. Fix any major issues and make the new version accessible if necessary. Send a final survey.	Analyse results. Perform testing on websites functionality Decide on final changes to the product	Submit final thesis and the web platform

Figure 19 - Table showing planned timeline for development

ABOUT THE FOLLOWING CHAPTERS

RATIONALE

In order to answer the research question proposed in the pilot study, a platform was developed to test the requirements determined. The platform aimed to demonstrate an example of a platform which met the requirements in order for a sample of the target audience to beta test the platform and provide feedback to answer the research question. The following sections of this study cover the development phase, testing and analysis of results derived from the testing. The target audience focused on was elective home educating families with children with cognitive impairments and or ASD. This research aims to determine requirements of this specific niche due to the lack of reporting on this particular issue aiming to provide data for future technologies for EHE families to be developed with. The resulting data will be used to create a framework for creating technology for E-platforms tailored to EHE families with additional educational needs.

ABSENCE OF HOME EDUCATION LITERATURE

Research by Hartman and Huttunen indicates there is little coverage of home education as a research topic. The topic faces disapproval by educators and accurate data is difficult to find. Research has been undertaken covering parents' motivation to homeschool but studies focusing on methods to monitor education are non-existent. Research has mainly focused on maintaining the child's attention (2020). There is minimal research existing on home education statistics of families practising this in the UK. One study found data on home educating families known to authorities; 0.09% to 0.42% of the total school population in the areas were home educated in the 9 local authorities in the study (Hopwood et al., 2011). However, the extent to which the local authorities were confident in these numbers varied and authorities believed there were children unknown to them being home educated. The study also indicated the possibility for a national study was not possible due to lack of information.

CHAPTER 3 - DESIGN PHASE

METHOD

USE CASES

When designing the artefact, use cases were determined. A diagram was created (See Appendix D) along with use case texts (see Appendix C) to further clarify the processes undertaken by users using the learning platform. The platform will have two functions which must be performed before taking others. Login must be completed for either parent or child users before accessing the site's content. After this children can access only their assigned courses through a specific child's view of the platform which does not show forums or functionality to create courses. This will ensure security by ensuring users are validated before accessing any information on the platform satisfying **ORQ1**. It further ensures content children access is appropriate (an important factor for parents choosing a learning platform as derived in the survey) because the parents can have control of what the child can view from this user profile. Parents have further access to account management to add child users a profile where their courses and skills will be displayed and goals can be set satisfying **FRQ4 & FRQ7.** Parents may also create courses themselves; this was determined to make the software a collaborative community to support other parents and satisfy **FRQ3**. These courses can select various learning methods when created in order to accommodate different learning styles satisfying **FRQ5** & **FRQ6.** Parents should be able to view all courses on the database and add them to their child's profile to learn from, a search function will make this easier and satisfy **FRQ1**. They will further be able to post on forums for advice as well as plan and view events to further encourage and accommodate conversation and sharing of resources between home learners which satisfies **FRQ3 & FRQ2.**

DATABASE

A database was designed in order to store the required data for courses, users and content. Standard practice for database modelling has been followed with the appropriate design phases. A conceptual design was created initially then many to many relationships were resolved with the user_courses, account_users, courses_chapters and content_game tables. The logical design was then created adding the specific columns to the tables and establishing the relationships (see figure 21). Primary and foreign keys were assigned to the variables (see figure 22) and the database was made using SqlLite to the specifications and populated with sample data in order to test the website's functionality. A full ERD diagram of the database was created to show the relations and all tables and columns in the database (see figure 22).

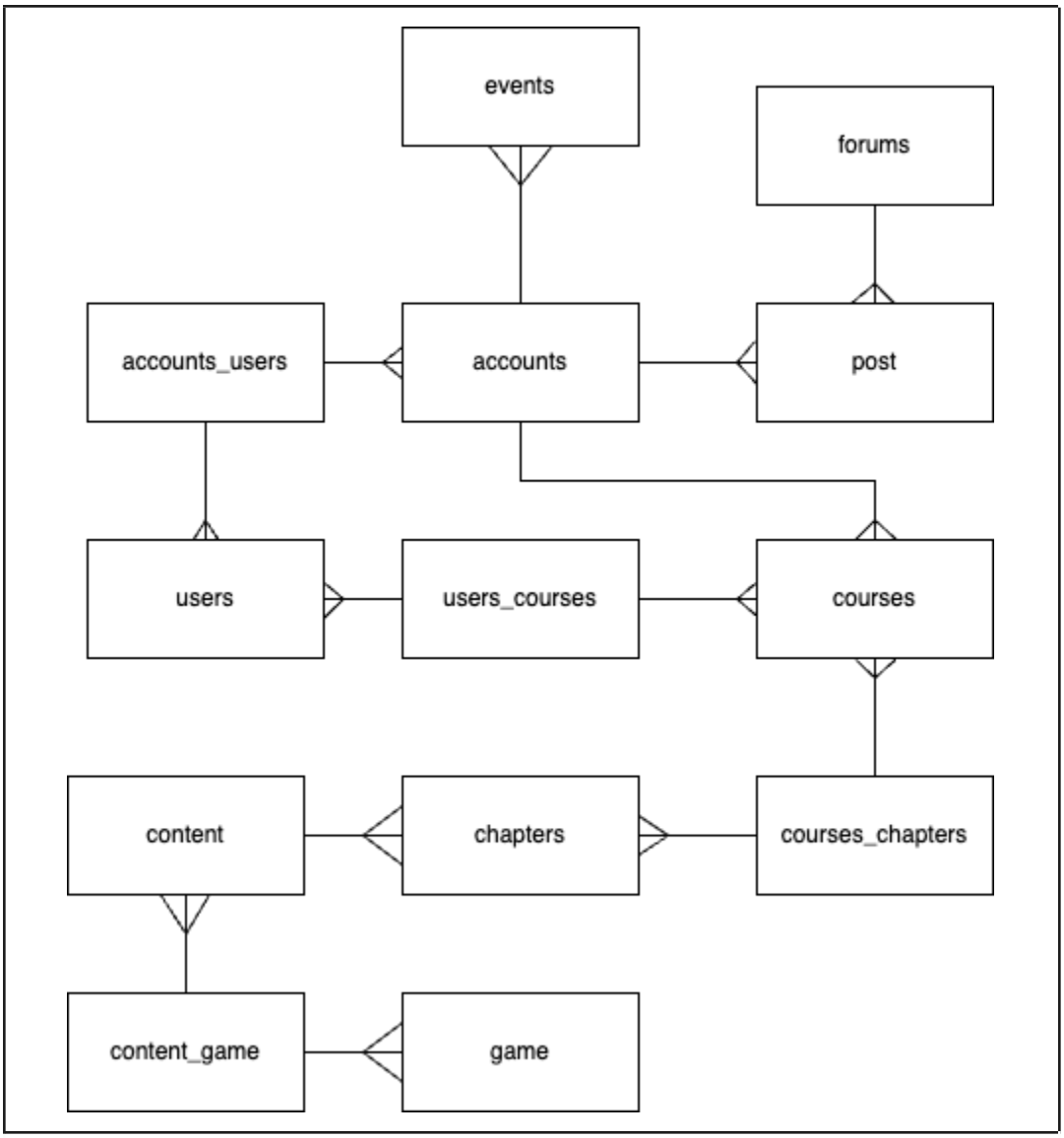

Figure 20 - Diagram showing logical database design

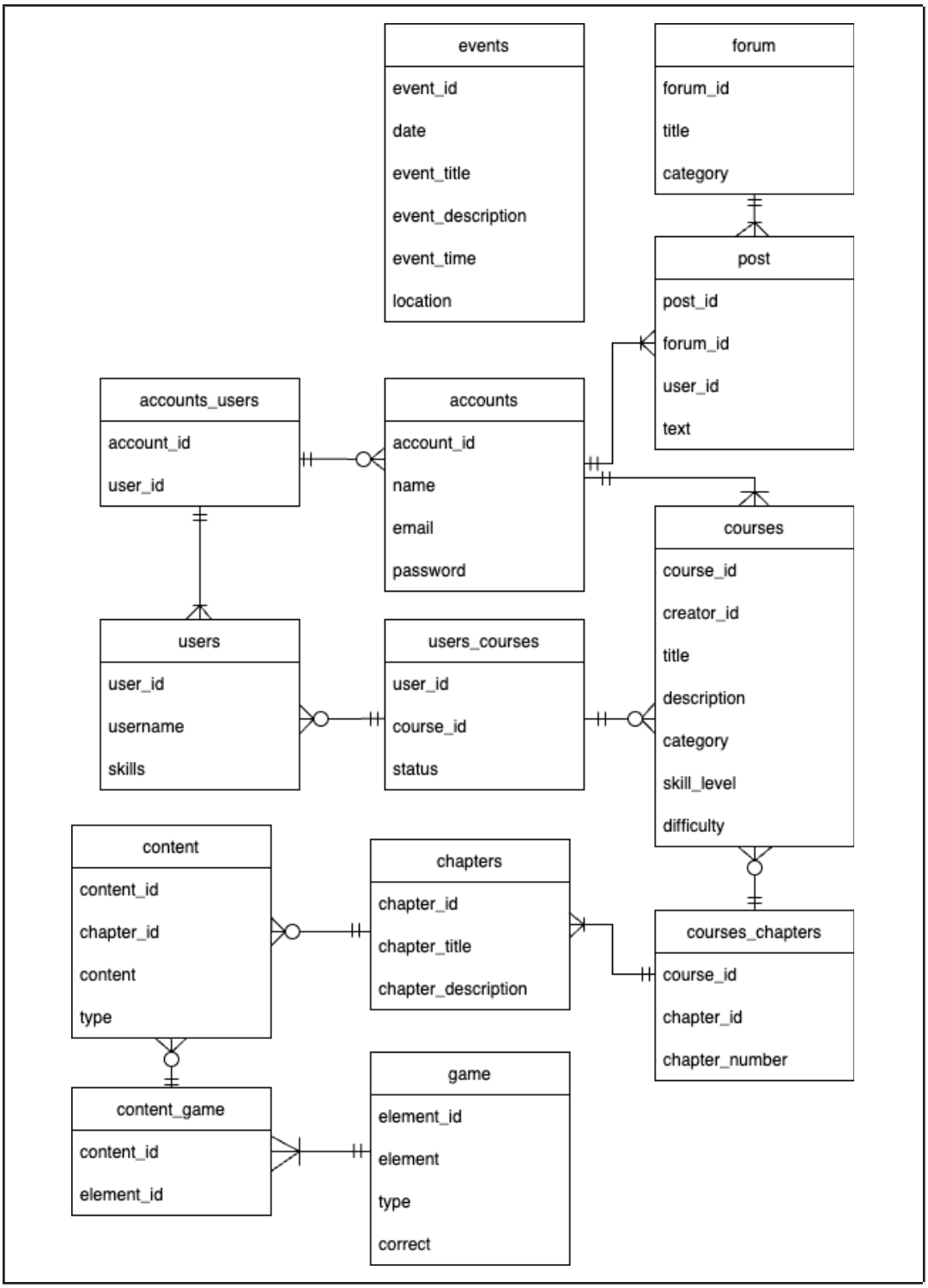

Figure 21 - Diagram showing physical database design

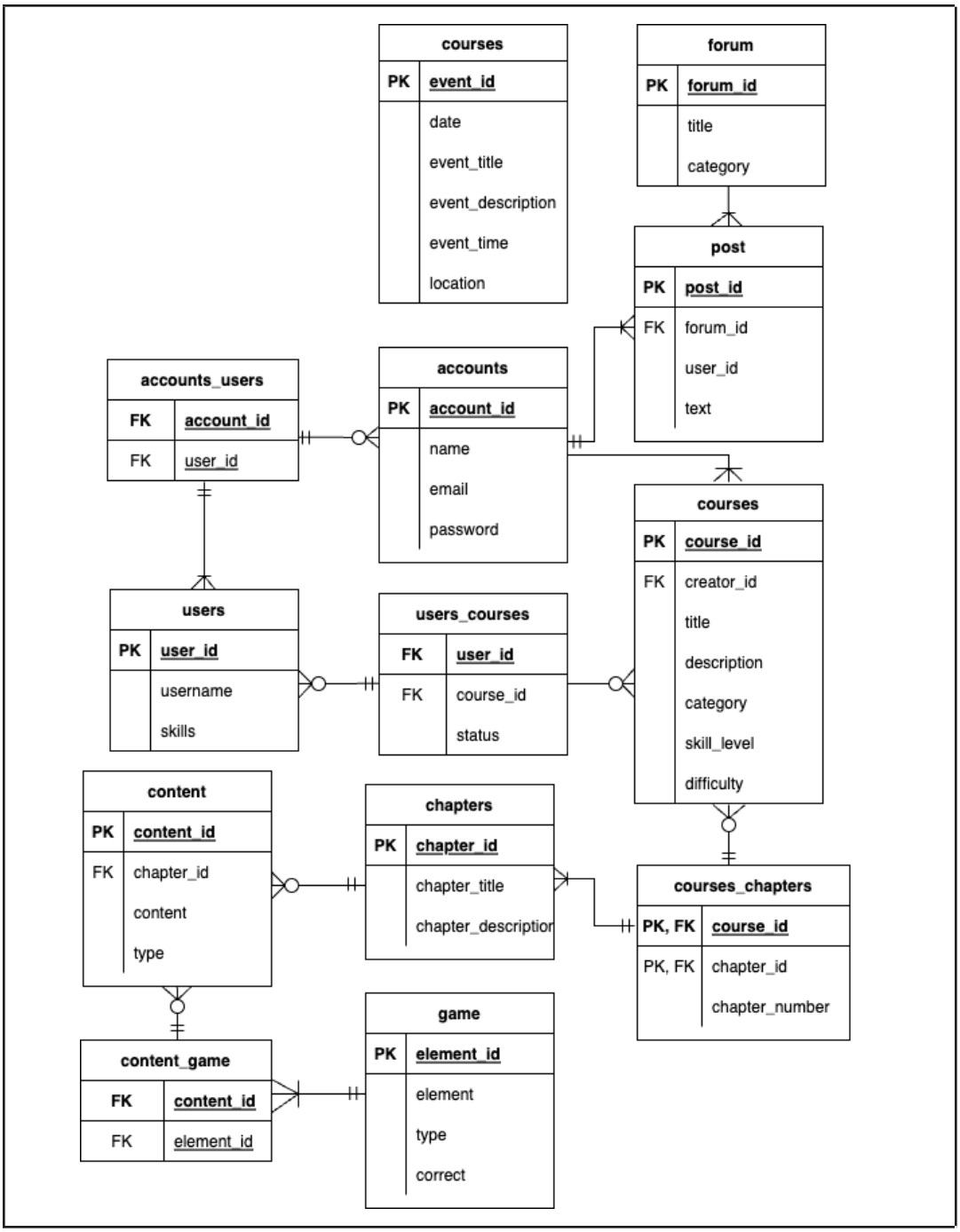

Figure 22 - Diagram showing whole Database ERD diagram

CHAPTER 4 - DEVELOPMENT & TESTING

DEVELOPMENT

The process of creating the E-Platform was documented in a log book (see appendices E). The platform was built using visual studio using coding languages css, html and javascript. The platform uses js node and session. The code uses the database to store the users data and content for the courses as well as hold the forums and events created by users.

The platform consists of a home page allowing login which allows access to the other pages via a navigation bar. A separate section of the site exists for child users with its own navigation bar. Users can browse the course, forums and events pages as well as add their own entries to these. The pages are retrieved using Node JS routes and are organised with routers to simplify the site's routes. EJS is used to display the data from the database alongside HTML. Delete routes are not implemented. Users can add content in a block to a chapter in the form of links to external sites such as Youtube. This allows for beginners to take resources from other places or upload their own content to a site and include it. This was the easiest solution to making the course customisable. The process of creating a course is relatively simple using step by step forms to allow users to understand.

TESTING

USE CASE TESTING

The platform was first tested against the use cases described (see Appendices C and D). The table below (see figure 23) shows the results of the use case testing. The use cases were all passed successfully.

USE CASE TESTING			
USE CASE	**TEST SCENARIO**	**EXPECTED RESULT**	**Status**
ACCOUNT			
Add Child as User	A: Adds username and submits form	S: Adds user with username specified to database	Pass
View Child Profile	A: clicks view profile for user_id 2001	S: Displays profile for user_id 2001	Pass
COURSES			
View Courses	A: clicks view profile for course_id 3001	S: renders course page for course_id 3001 with all details in database	Pass
Add Course to Child Profile	A: clicks button to add course 3001 to user_id 2001 profile	S: adds user_id and course_id to database and displays course in users profile	Pass
Post Course	A: submits form with course title, description and other details	S:adds course to database and displays new course in users created courses page	Pass
Add Chapter	A: submits form with chapter title and description for course_id 3001	S: adds chapter to database and displays the chapter in the course edit page and main course page	Pass
Account Login	A: submits correct username and password for account_id 1001	S: logs session and displays associated account page to id 1001	Pass
EVENT			
View events	A: clicks events button	S: displays events page with event details from database	Pass
Post Event	A: submits form with event title, description, date, time and location	S: adds event data to database and renders events page with new event added	Pass
FORUM			

View forum	A: clicks forums button	S: displays forum page with forums data shown	Pass
Post forum	A: submits form with title, description	S: adds forum data to database and displays in list of forums on forum page	Pass
Reply to Forum	A: with account_id 1004 submits form to reply to forum 4001	S: adds post data assigned to account_id 1004 and displays forum_id 4001 with new reply	Pass
CHILD PROFILE			
View Child Courses	A: clicks view courses button on child profile page with user_id 2001	S: displays my courses page with user_id 2001 data	Pass
View child course chapter	A: clicks on chapter_id 6001	S: displays chapter 6001 child page	
CHILD LOGIN			
Child User Login	A: clicks child user_id 2001 button	S: displays child profile page for user_id 2001	Pass

Figure 23 - Use case testing table

FUNCTIONALITY TESTING

The project pages were tested using the online W3C standards tool. Each page was run through and any errors were corrected beyond EJS elements of the code. Links were tested to ensure the correct buttons link to the correct pages. Furthermore, the functionality of the website was tested as per the requirements set out previously. See the below table (figure 24) for the results of the testing.

REQUIREMENT	STATUS	DETAILS
FRQ1	Fail	The user can access courses but a search function was not implemented.
FRQ2	Pass	Users can use forums to communicate
FRQ3	Pass	Users can upload content to courses and share resources
FRQ4	Partial	Users can add user profiles which shows users skills but currently skills cannot be changed manually or are changed by the completion of a course.
FRQ5	Pass	The platform allows for the addition of images and videos to limit reading.
FRQ6	Partial	Users can choose course suited to their child but currently no tags exist to identify content which has limited reading and no search function exists to allow theme to filter courses
FRQ7	Fail	Parents are not able to set goals
FRQ8	Pass	Content can be added which meets this type

Figure 24 - Functional requirements testing table

As can be seen in the figure above, the project did not meet the identified requirements. This is due to an overestimation of the scope able to be achieved with the skillset of the developer. Features which provided the best demonstration for users of the end project were prioritised over these requirements. However with additional development time these missing functionalities could be added. FRQ1 could be met easily with an express route set up to search the course tables for relevant keywords and return the appropriate courses. Similarly FRQ6 can be fully met with the same solution. Parents setting goals would require further columns in the database in order to achieve along with a route to add a new goal. To meet FRQ4 could be updated on completion of a course by adding a route to existing buttons to finish a chapter.

A further limit to the project's functionality is that learning games are not fully implemented. Simple multiple choice questions are included but for more interactivity and engagement for the child a more complex game would be preferable and probably return better satisfaction with the platform.

LIMITATIONS

Ultimately the project did not follow its planned course of development due to setbacks and as such more thorough testing would be preferable. Delete routes inclusion would be preferable as well as editing existing elements such as course titles, and content blocks. In addition the option to upload from the user's computer would make the platform more usable. Continuing from the study further development time will allow for better results.

CHAPTER 5 - BETA TESTING & INTERVIEW METHOD

RATIONALE

In order to determine the usefulness of the platform for the target users of parents educating children with ASD and cognitive impairments a further survey has been conducted. In order to test the platform's suitability to its purpose study participants were asked to attempt to use the platform. Participants were asked to approach the platform as if they were looking for a new learning tool for a child under their care to use. They were additionally asked to explore the pages, attempt to create a course, add a chapter and add content to their course. This was undertaken in person with the developer present to note any difficulties using the platform. The participants were then required to complete a survey on their experience beta testing the platform to gather quantitative data on the success of the platform. Participants were then asked to participate in an optional interview on their experience to expand on their opinions expressed in the survey providing qualitative data.

OBJECTIVES

1. Survey factors to identify success of developed platform with target audience
2. Interview participants to identify success, improvements and addition features
3. Analyse results
4. Determine the success based on the results and previously established requirements
5. Determine need for further research

SURVEY DESIGN

TAM3 has been utilised to design the survey (see figure 25). The TAM3 model is used to predict the likelihood a user will use the technology being tested (Chuttur 2009). Use behaviour is determined by behavioural intention which in turn is influenced by the perceived usefulness (PU) and perceived ease of use (PEOU) of the product being tested. Various factors hold weight to change these values and determine the usefulness of the product to its users.

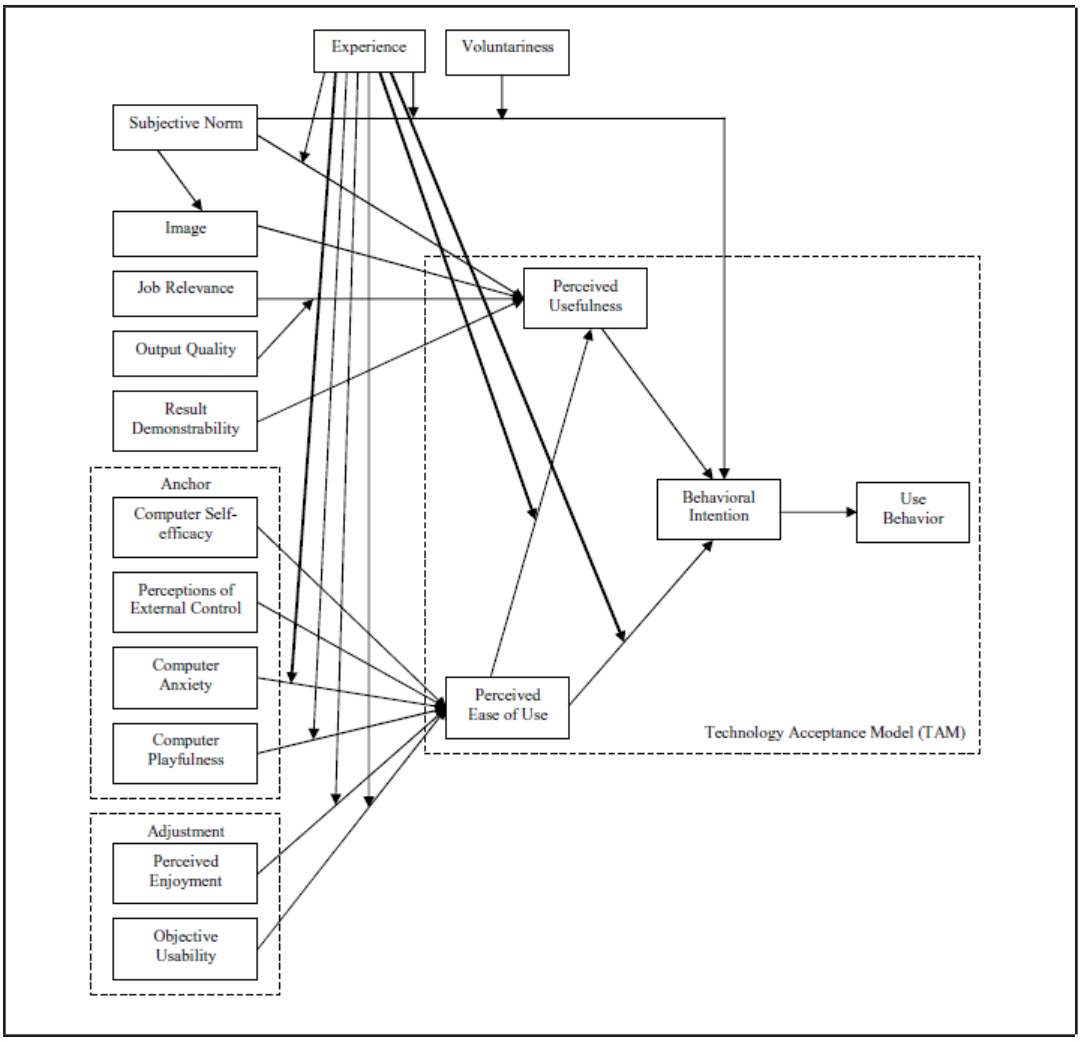

Figure 25 - Technology Acceptance Model (Venkatesh, 2008)

This model was adapted to better suit the studies specific focus. The perceived usefulness (PU) factor variable image from the original model image is replaced with peers perception; relating to the parents/carers perception of other caregivers in their situation. The PU factor variable job relevance is replaced with relevance to the child to examine how parents see the platform as fulfilling their child's specific needs. An additional variable, useful for purpose, has been added to the survey in order to look directly at how useful caregivers see the platform as for three different purposes, sharing resources, communication and learning. Three additional variables relating directly to behavioural intention were added for the three aforementioned purposes to measure how likely the respondents would be to use the platform for the specific purpose and get direct measurements of where the platform meets needs of home learners. The model has been split into 3 diagrams (see figures 26, 27 & 28) created to break down the new variables and their associated questions shown in a table with their associated variables (see figure 29).

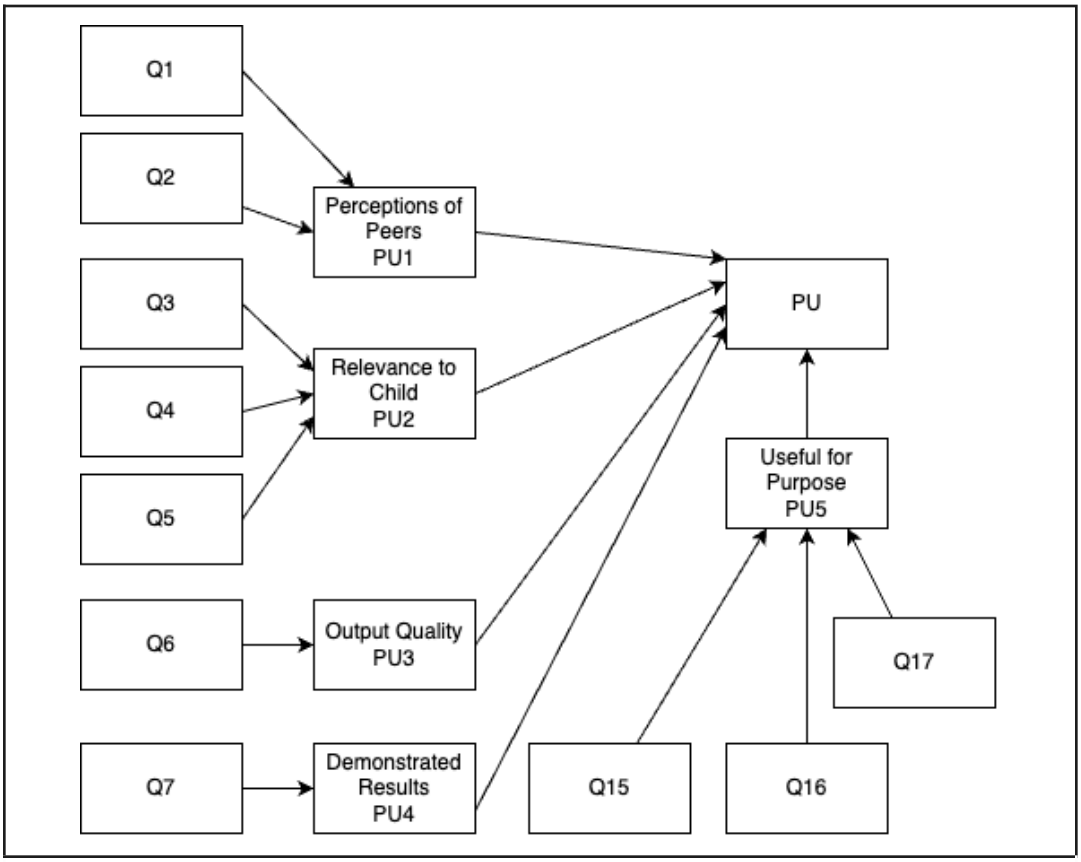

Figure 26 - Adapted TAM model for PU variables

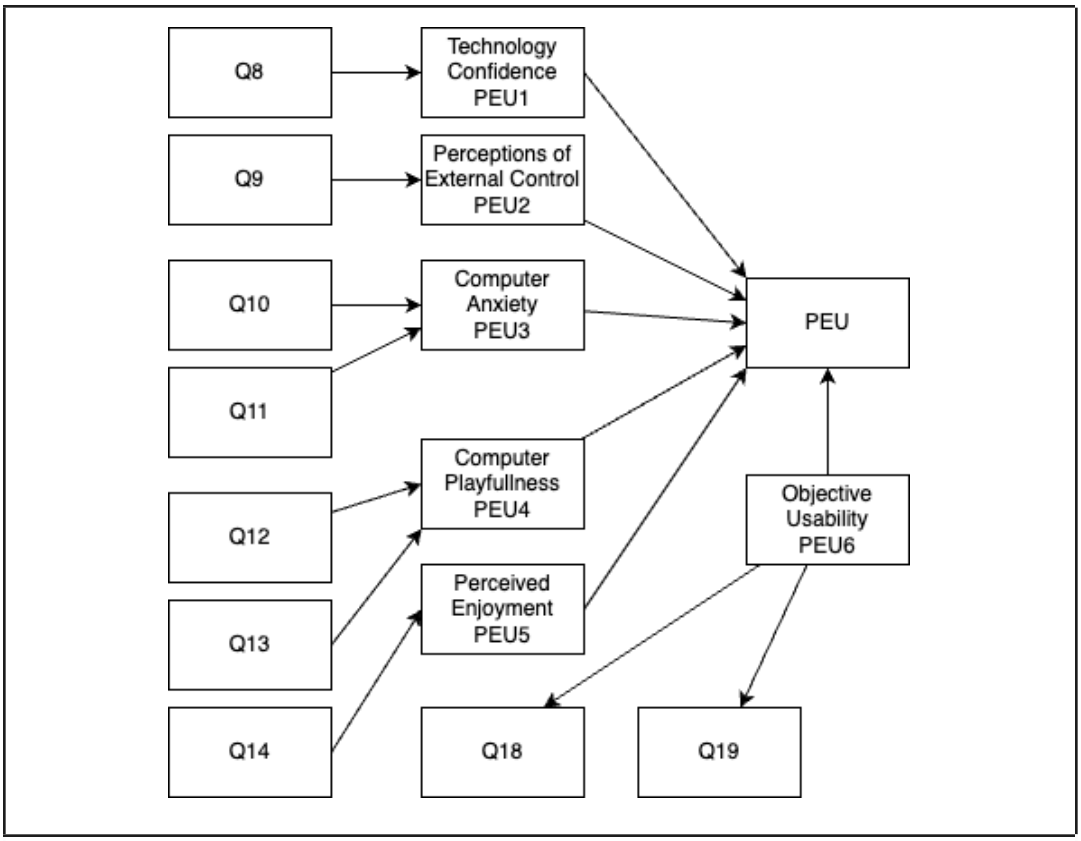

Figure 27 - Adapted TAM model for PEU variables

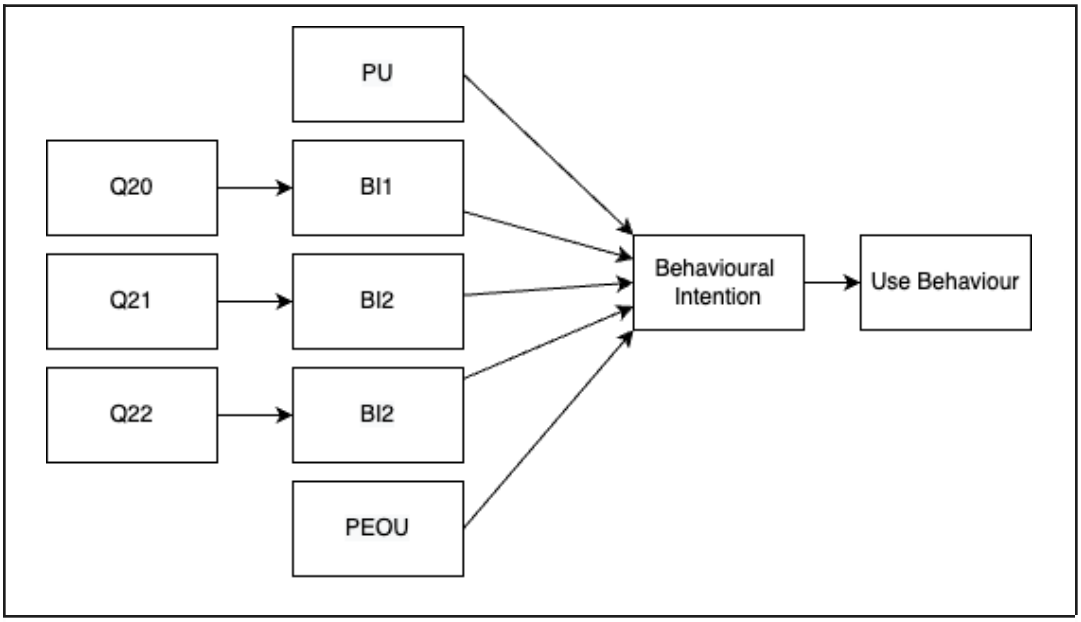

Figure 28 - Adapted TAM model for BI variables

SURVEY QUESTIONS

VARIABLE	QUESTION NUM	SURVEY QUESTION
PU1	Q1	I would recommend busy bees to friends/family/coworkers.
PU1	Q2	Other parents/carers in my situation would approve of Busy Bees.
PU2	Q3	Busy Bees would be suitable for a child under my care
PU2	Q4	Busy Bees would be suitable for a child with learning difficulties
PU2	Q5	Busy Bees would be suitable for a child with ASD
PU3	Q6	Busy Bees would help a child under my care learn
PU4	Q7	Busy Bees would appeal to me more if there were demonstrated results.
PEU1	Q8	I am experienced enough with technology to use Busy Bees
PEU2	Q9	I trust that Busy Bees could provide technical support to help me use the platform.
PEU3	10	I worry my skills with technology will make it hard to use Busy Bees
PEU3	11	I worry my a child in my care would not be able to use Busy Bees
PEU4	12	I enjoy using computers and will enjoy using Busy Bees instead of other learning tools to educate a child under my care
PEU4	13	A child under my care enjoys using computers and would enjoy Busy Bees instead of other learning tools
PEU5	14	A child under my care would enjoy Busy Bees.
PU5	15	Busy Bees would be a useful tool for communication
PU5	16	Busy Bees would be useful for sharing resources
PU5	17	Busy Bees would be useful for learning
PEU6	18	Busy Bees is easy to use.
PEU6	19	Busy Bees would be difficult to use.
BI1	20	I would use Busy Bees to help a child under my care learn
BI2	21	I would use Busy Bees to find resources to educate a child under my care
BI3	22	I would use Busy Bees to communicate with other parents/carers

Figure 29 - Survey questions and their associated variables

LIKERT SCALES

Likert scales were used as in the previous survey to measure the respondents agreement with the questions with quantitative data. This allows for trendspotting in the data more easily and accurately than with a binary yes or no response. This data has then been plotted to box plot charts to visually show the trend of responses to positive negative or neutral responses.

INTERVIEWS

Respondents were additionally asked to take part in an optional interview following completion of the survey. Guidance on conducting interviews for research were taken from existing research (Fox & Hunn, 2000). The interviews were semi structured utilising open ended questions allowing for participants to expand on answers and give the most useful qualitative data. Only subjects relevant to the research question were interviewed and personal opinions were avoided.

Respondents were asked if any elements of the platform confused them, if they thought the platform was suitable for their child specifically and if they expected to see any features which were not included in the platform (see Appendix F for full interview responses). Interviewing participants gives qualitative responses which can offer more insight to how well the platform works for the specific target audience in specific areas and not as a whole without overwhelming respondents with survey questions to avoid inaccurate responses as the survey goes on for too long.

CHAPTER 6 - BETA TESTING RESULTS & DISCUSSION

SURVEY POPULATION

The survey population contained 9 respondents who beta tested the platform. The 9 respondents were from the South England area and were part of a home education group. 8 respondents reported a child under their care having ASD and a further 4 reported them having dyslexia. Survey respondents were caregivers in some aspect of a child with additional learning needs that was home educated. A comparison to the population of home educated learners in the South of England is not possible as numbers are not held on the number of home educating families in the UK. The local council was contacted but responded that the statistics are not public information (Elective Home Education Department Southampton Council, 2022). Statistics from the Department of Health on prevalence of autism indicate in the South of England 55.4 in 10,000 children were given an autism diagnosis in the year ending March 2022. A further 82.5 in 10,000 were referred for diagnosis in this year but were not yet diagnosed as of the report (2022). The full survey results can be found in the appendices (see Appendix F).

LIMITATIONS & BIAS

The survey sample size is limited. Therefore, the views expressed by the participants may not fully reflect the population of ASD home educating families as a result. The survey also does not cover any families that may use the platform in addition to mainstream school and therefore the platform's benefits for this demographic can not be explored. The survey also only covers families from one home education group which may not reflect the views of all EHE families. A wider survey may produce different findings more conclusive of the needs of this niche demographic. Furthermore, the beta test was short, taking around half an hour meaning the results are not indicative of how the platform could be used over a longer period of time. Further studies could be undertaken to explore the benefits of the platform with a longer period of use.

SURVEY RESULTS

PERCEIVED USEFULNESS

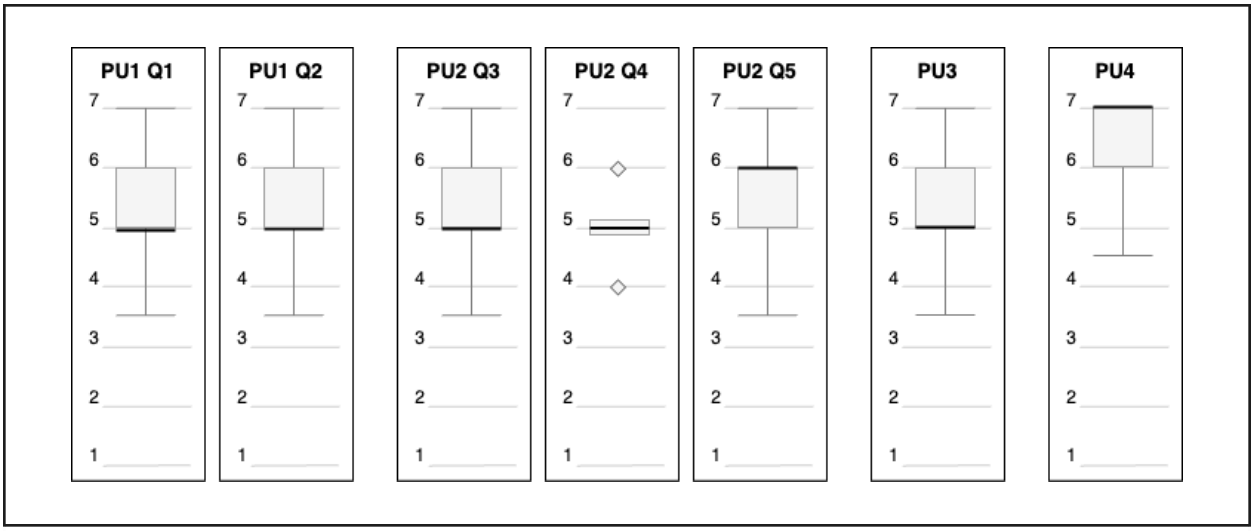

Figure 30 - PU results displayed as box plot charts

Participants reported generally positive responses to the usefulness of the platform. PU4 was most strongly agreed with; the associated question is "Busy Bees would appeal to me more if there were demonstrated results.". This indicated all caregivers surveyed would have more confidence in using the platform if there were demonstrated results to prove its effectiveness. PU2 Q4 had a very neutral response with participants responding strictly on the middle 3 values of the likert scale. The associated question is "Busy Bees would be suitable for a child with learning difficulties' ' . This indicates that the participants were unsure of the platform's ability to cater to those with special needs generally. However when asked about their own child (PU2 Q3) and children in general with ASD (PU2 Q5) they responded more positively. PU2 Q4 may be too general in its description as the term learning difficulties could cover a range of different abilities and needs so therefore this result may not be that insightful.

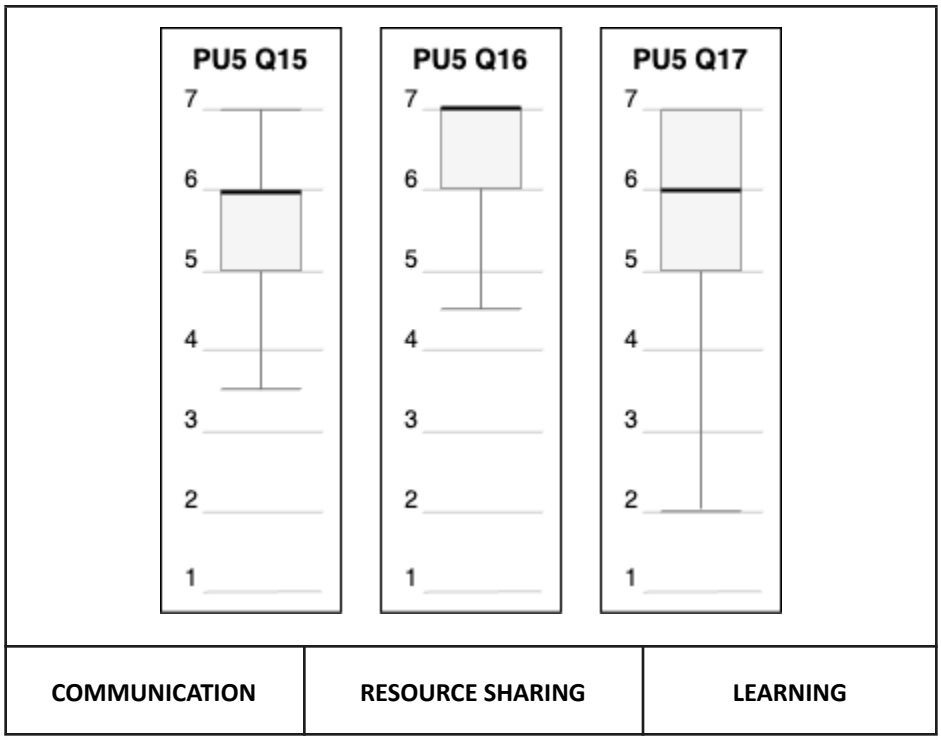

Figure 31 - PU5 results displayed as box plot charts

PU5 directly asked participants how useful the platform was for 3 different functions: communication (PU5 Q15), resource sharing (PU5 Q16) and learning (PU5 Q17). The response to PU Q16 is overwhelmingly positive, the median response was 7 and the low IQR of 1 shows the opinion is unanimous; this indicates all participants see the implemented features for resource sharing are effective and useful for educating their child. Although not as positive as PU Q16, PU Q17 trends towards the higher numbers. The platform was therefore seen as generally being useful for their child's learning however, there is a larger distribution of answers here with some users giving lower responses reducing the LQR and increasing the IQR of the data.

PERCEIVED EASE OF USE

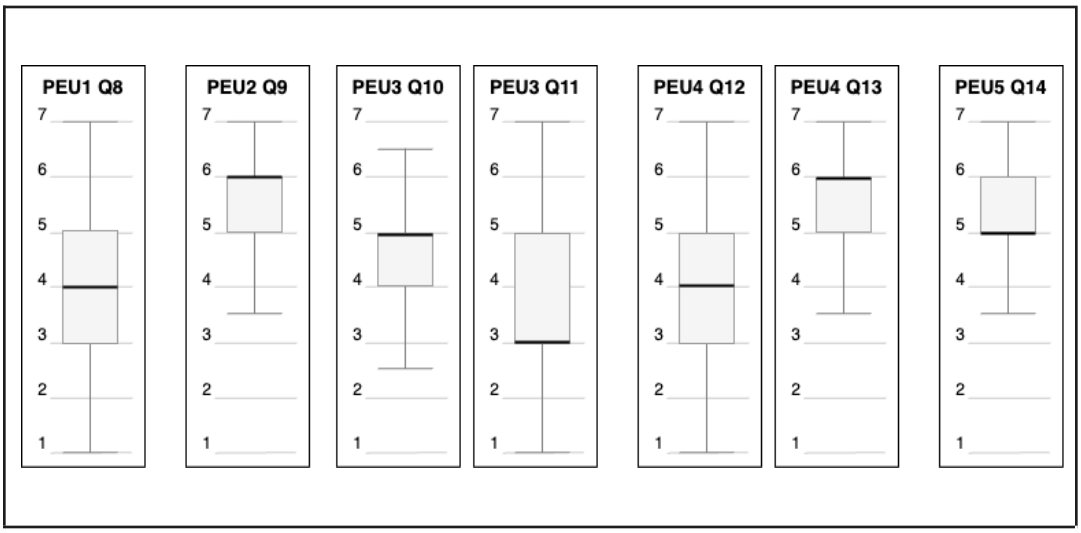

Figure 32 - PEU results displayed as box plot charts

Participants indicating varying responses to the PEU variables. PEU4 discusses the parent and the child's computer playfulness. Most participants reported their child would enjoy using the computer to use the platform while they themselves were less so inclined. The distribution of answers to PEU Q12 indicates a higher variance in how much the users enjoy using computers but PEU Q13 seems more certain in their child's enjoyment. This variable is useful in determining the intention of participants to use the platform; results indicate for their child the method would be enjoyable but their own unwillingness to use computers may limit how much they are willing to use the platform.

Similarly PEU3 looks at computer anxiety and PEU1 looks at computer confidence. Most parents reported a neutral response to thinking they would be skilled enough to be able to use the platform. However, responses to their child's ability to use the platform varied more and trended more negatively. The IQR of PEU3 Q11 is larger and responses range further along the scale here so the response seems to be dependent more on the individual child and therefore the trend is not concrete. A larger sample size may clarify if this is an issue with the platform itself or just a response that will vary widely from child to child. Respondents did however indicate they trusted the platform to provide adequate technical support (PEU1 Q9) therefore if they struggled due to their lack of computer skills they would feel they were supported.

The results of PEU indicate that reducing the complexity of instructions and interfaces on the platform would be beneficial to assist parents using the technology with less computer confidence. As well as adequate support resources available perhaps including a direct technical support chat.

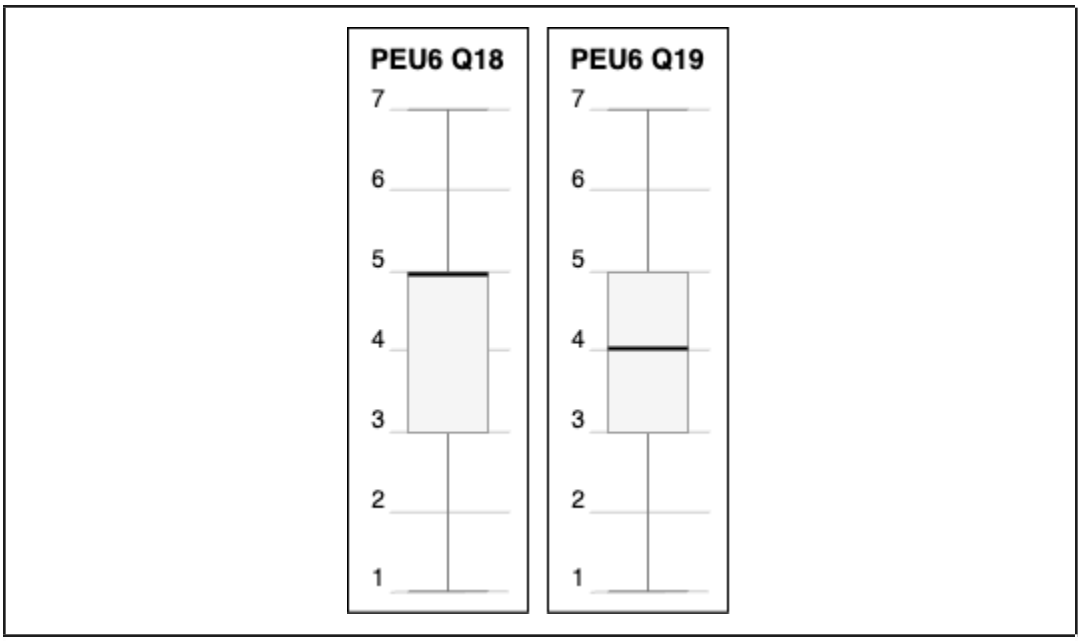

Figure 33 - PEU6 results displayed as box plot charts

PEU6 directly asks participants how easy (PEU6 Q18) or how difficult (PEU6 Q19) the platform was to use. The results indicate the participants found the platform overall easy to use as opposed to difficult as the median for PEU6 Q18 is higher than that of PEU6 Q19. However, both result sets are centred around the middle of the scale and therefore participants were generally more neutral in their responses. The IQR indicates the distribution of answers was wider here also so the platform's ease of use is subjective to the individual user.

BEHAVIOURAL INTENTION

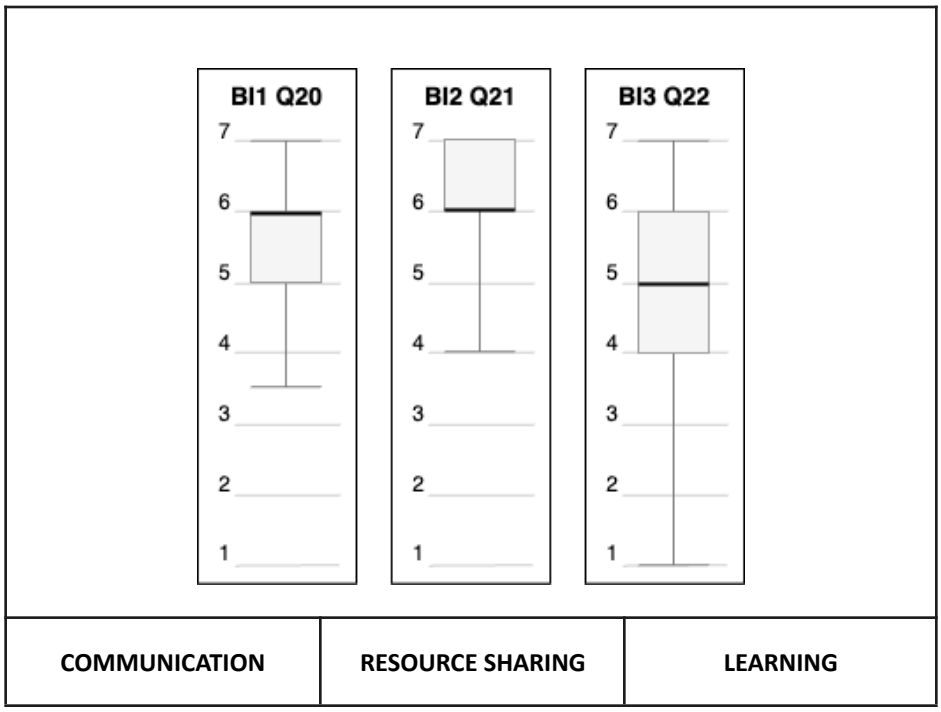

Figure 34 - BI results displayed as box plot charts

The BI variables look directly at behavioural intentions of participants to use the platform for communication (BI1), resource sharing (B12) and learning (B13). Respondents were more consistent in their responses to B12, the responses trend to the higher end of the scale and the IQR is small indicating they agreed the platform was very useful for resource sharing. Participants also responded positively to the other variables. The median of the BI1 data was more positive and the IQR was small so most participants concurred that the platform was useful for communication. B13 was more distributed in responses and does not hold much weight as the answers are so varied.

INTERVIEWS

The interviews conducted with participants following their completion of testing and survey gave further insight to the suitability of the platform and identified further areas for improvement. Participants wished to remain anonymous. The full interview comments are available in the appendices (see Appendix G).

Multiple participants expressed the benefits of the platform for finding resources. It was communicated that the possibility of a wide range of user created courses and the ability to create their own courses for their child which matched their child's interests would be very beneficial in motivating their child to learn; one participant said "The site feels home-ed friendly as it lets you put together courses on anything your child might want to learn about."(Participant E, 2022)

One participant discussed how their child would be less frustrated with the Busy Bee platform as the courses are quite short and broken up into chapters so children with shorter attention spans can focus on the course and get a feeling of accomplishment for completing a section and avoid the "feeling of failure they can often face on other platforms" (Participant C, 2022)

The forums seemed useful for the parents as multiple participants discussed the benefits of communication with other parents. One participant expressed how this could help their child improve social skills as parents could arrange meeting other families so they could meet other children in a similar situation who have the same interests. Research indicates that home education networks can act as a support network and that such communities can be diverse allowing for a variety of social interaction opportunities; networks allow parents to encourage and arrange positive social experiences like activities to facilitate interaction (Carvahlo & Skipper, 2018). A successfully implemented platform could therefore create a network such as this supporting the family and improving social opportunities for the children. Another participant said they would like more communication, for example a more direct communication method like a chat function to talk directly with other parents.

Some participants communicated difficulty with creating a course. The ability to embed content from youtube is a benefit expressed by one user as it's a way their child enjoys to learn and allows for easier creation of courses if parents want to use external resources not created by themselves. However the current method for embedding these is not easy for those unfamiliar with technology and could use refinement. Otherwise, the platform was described as clear and easy to use. This indicates the platform's layout and structure are appropriate.

One participant discussed how the platform could be further catered to home learners by including a journal feature. This feature would allow them to plan their child's learning, meetups and evidence the learning to local authorities as is sometimes required by home educators in the UK. Hartman looks at monitoring progress of home educated children in Finland; generally portfolios or blogs were considered appropriate methods for monitoring progress (2020). A journal feature would allow parents to demonstrate their child's progress with ease. Participation badges to collect on the online system were also a feature this participant discussed to give the child a sense of reward and accomplishment. This is backed up by the theory of interaction design by Chris Nodder called Evil By Design (2013). This theory describes how users of interactive content can gain satisfaction from the content in different ways; the relevant part of the theory here is greed which Nodder recommends as something users can collect in order to feel satisfied by the interactive content.

Another feature discussed by multiple participants was the ability to print off content like worksheets or courses to keep evidence built into the site. This feature could be implemented to allow parents to build a worksheet similarly to how they build content for the website. One participant discussed improved accessibility for other disabilities such as hearing and visual impairments. This could be implemented by ensuring the site is compatible with existing tools.

CHAPTER 7 - FRAMEWORK

METHOD

As a result of the study the following framework has been determined for creating technology for a successful accessible online asynchronous home education platform for children with additional needs which specifically meet home educating families expectations and needs. This can be used for future projects as a basis for development and for future studies as a baseline for surveys to find specific needs of target audiences with different needs or disabilities. The technology framework is based on the holistic E-Learning framework illustrated below (see figure X) This framework covers the whole E-Learning platform while the model created for this study focuses on only the technology sector of the triangle.

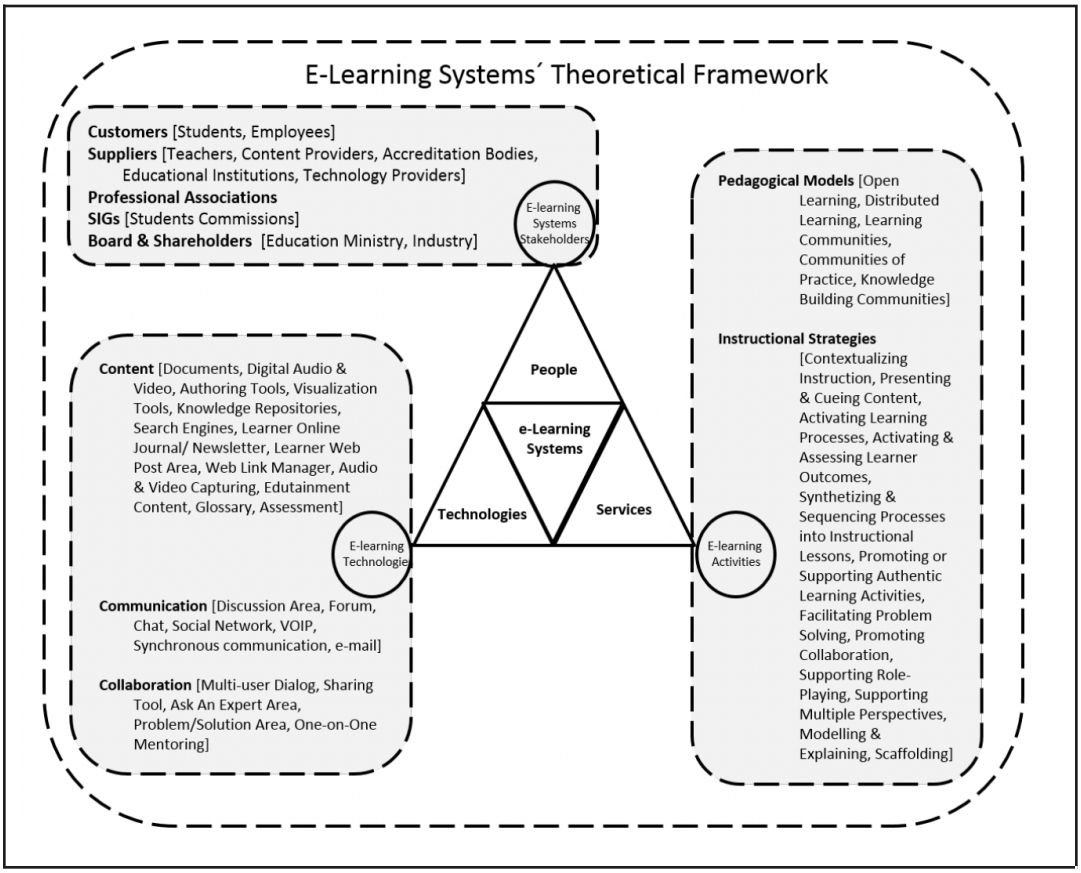

Figure 35 - Theoretical framework for E-Learning Platform Technology (Aparicio, Bação and Oliveira 2016)

E-PLATFORM TECHNOLOGY THEORETICAL FRAMEWORK

The various requirements determined in the pilot survey and literature review have been considered along with the additional findings from the beta test survey and interviews to create a theoretical framework to create a platform for EHE families to meet their specific educational needs.

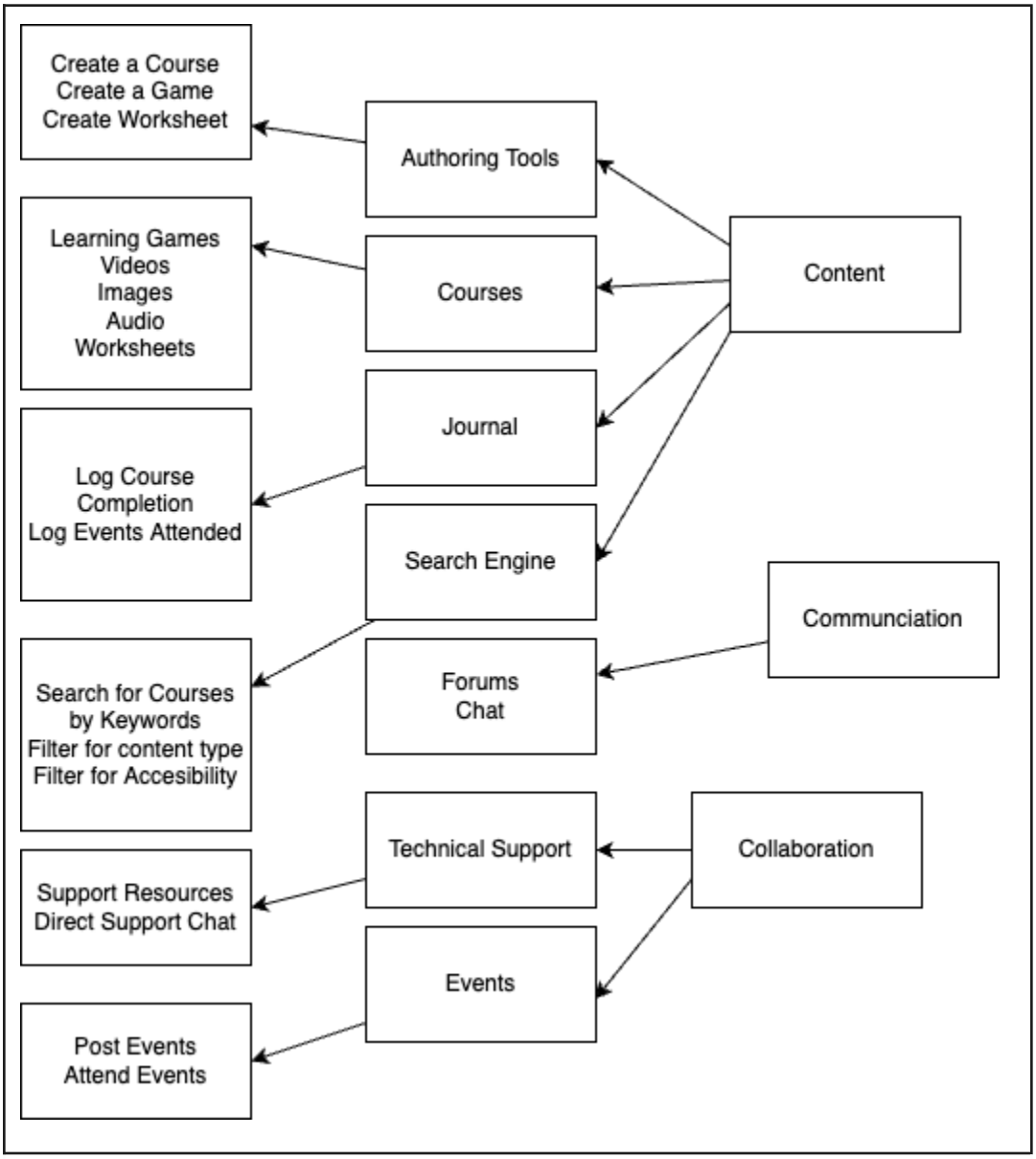

Figure 36 - Theoretical framework for E-Learning Platform Technology

The content, communication and collaboration requirements were determined by the original model and have been expanded on to be specific for the needs of EHE families. Authoring tools were determined due to the positive reception to creating courses in beta testing and the original requirement from the pilot study for the ability to share resources (FRQ3). The course variable was determined by the original literature and pilot study findings (H6, FRQ5 & FRQ8) with the addition of worksheets from the interviews conducted. Journals were added directly due to feedback in the interview stage; this seemed a logical addition for EHE families specifically to document their learning for their own records and to the local authorities. Search engine was determined from the literature review and pilot survey requirements (H1 & FRQ1) but has been expanded to specify the needed filters for accessibility from interviews and previous studies into accessible MOOCs (Webb, 2022). As well as, the ability to tailor a course to the learners preferred learning style by filtering by content type (FRQ6 & FRQ5). Communication which was determined as a requirement in the literature review and pilot survey (H2 & FRQ2) has been expanded to include not only forums but also to include direct chat as a result of interview data. Events have been added for EHE families to meet their needs to increase children's social skills as was expressed in the interviews.

CHAPTER 8 - CONCLUSION

In conclusion, this study has returned interesting findings for developing future home learning technologies for children with ASD and other learning needs. The results have contributed to the specific needs of EHE families with ASD children and to the field of home learning technologies as a whole.

The results of the pilot survey contribute to knowledge of what parents in general want from a learning platform and how to make a learning platform appeal to that demographic. Content was identified as the most important factor closely followed by interactivity; indicating a platform should focus on providing appropriate content for the target demographic and allowing for interactivity through games and video elements. Interactive content like learning games and videos were found to be a more enjoyable and successful method for their child to learn through. The pilot also identified important data for children with ASD and cognitive impairments. They were found to have more trouble with reading as well as becoming frustrated while learning more easily than children reporting no impairments.

The results of the target audience testing indicate participants found the created platform to be overall useful. Particularly the platform was perceived as useful for the purpose of sharing resources with other home educators by all participants. The survey also identified potential issues with the platform for users unfamiliar with using computers and therefore, indicates technical support resources should be implemented to assist users and course creation should be simplistic and user friendly. Furthermore, the survey indicates demonstrated results should be produced in order to encourage uptake of the platform. The platform was also perceived as enjoyable for children to use but less so for parents so improvements to the platform's functionality and layout to make the experience faster and more satisfying for parents should be included.

The interviews resulted in the identification of additional features which would make the platform more appealing including a chat function, reward badges and journaling. A journaling feature has been identified as a factor that may draw home educating users to a platform to allow parents to coordinate learning activities, courses and evidence for local authorities inspection. Additionally, it was found respondents found the ability to create their own courses useful specifically as a home educator of an ASD child to tailor content to their child's specific interests to encourage participation.

The platform in its current state has met the initial use cases determined but lacks many of the intended requirements set out initially as such requires further development in order to see its true benefit to home educators. However, the platform has served as a useful tool for the purposes of the study to demonstrate the

learning platform to the beta testers and determine areas for improvement previously not included in the features derived by the initial literature review or pilot survey.

The results have certainly contributed to the existing knowledge in the area of E-Learning for children and has provided insight to the specific demographic of home learners which currently has little contribution. The most important results of the study are the specific needs of EHE families that have been identified across the study and the framework created from these. The created framework can be used as a basis for defining requirements for further studies into home education technologies to expand this area of research.

LIMITATIONS & BIAS

Ultimately the project's time management could be improved. The milestones laid out earlier on were not met and therefore the project was delayed. The final artefact would be more complete had these milestones been achieved and therefore the studies findings would be more insightful. A more in depth testing process would have been preferable and have ensured the final artefact answered the research question more conclusively. Additionally meetings with the supervisor were not fully utilised; were more meetings attended further guidance would have benefited the development of the project and therefore the eventual findings. The sample size included across the study was limited and therefore the results may not be indicative of the general population; a survey with a larger population would clarify if the results are accurate of parents of ASD learners and home educators generally or only those of the specific participants. The main set back of the survey was finding participants willing to take part. With additional time to gather participants and conduct the surveys and testing, the research question may be answered more conclusively.

FURTHER RESEARCH

Further testing should be performed in order to determine if the artefact is suitable for its intended users. The product can then be improved based on this testing to make a more appropriate platform for learners with cognitive impairments and ASD. Additionally, benchmarking the platform against existing products would be beneficial to see the impact in comparison to platforms not designed with ASD & cognitive impairments in mind. This would evidence how accurate the findings of the study were and identify areas for improvements. A further study over a longer time period would be beneficial to see how home educating parents make use of the platform and find use for it to communicate and share resources over a period of 6 months. This would gauge better the impact this could have on the specific demographic. Implementation in a school environment would also be an interesting direction to explore how the platform could be used to communicate between home and school. Going

forward the platform will be updated based on the results of the testing phase. Then 3 separate surveys will be undertaken; one focusing on home educators, one focused on ASD learners and a final control study with parents of children in mainstream school with no learning difficulties or ASD. This study will aim to show a more conclusive measurement of the platform's utility to its target users with a larger sample size and more time spent using the platform to ensure the users get a true impression of the platform's utility.

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APPENDICES

APPENDIX A - Table showing survey questions and the variables they were designed to explore.

APPENDIX B - Survey data gathered in initial survey

APPENDIX C - Use case texts

APPENDIX D - Use case diagram

APPENDIX E - Development Log Book

APPENDIX F - Beta Test Survey Results

APPENDIX G - Interviews

APPENDIX A

Table showing survey questions and the variables they were designed to explore.

VARIABLE	SURVEY QUESTION
F1	It is important that my child can learn at any time of the day.
F2	It is important that my child can learn from home.
F3	It is important that my child can learn out and about in locations that are not school or home.
F4	It is important that my child can use the web platform at school.
F5	It is important that my child can access the resources on a mobile device or tablet.
F6	It is important that my child can access the resources independently (without assistance from a caregiver or teacher).
F7	Flexibility is important when choosing a learning platform.
C1	It is important that the content on the platform allows my child to learn maths skills.
C2	It is important that the content on the platform allows my child to learn english skills.
C3	It is important that the content on the platform allows my child to learn vocational skills.
C4	It is important that the content on the platform allows my child to improve their reading.
C5	It is important that the content on the platform allows my child to improve their communication skills.
C6	It is important that the content on the platform allows my child to improve their daily life skills.

C7	It is important that the content on the platform allows my child to improve their self determination.
C8	It is important that the content on the platform allows my child to improve their social skills.
C9	The content available is important when choosing a learning platform.
C10	Rank the type of content in order of importance.
I1	My child learns well using learning games.
I2	My child learns well by reading.
I3	My child learns well by listening to audio.
I4	My child learns well by watching videos.
I5	My child enjoys reading for learning
I6	My child enjoys listening to audio for learning.
I7	My child enjoys watching videos for learning.
I8	My child enjoys playing learning games.
I9	My child finds playing learning games easy and can stay focused on this type of content.
I10	My child finds listening to learning content easy and can stay focused on this type of content.
I11	My child finds watching learning content easy and can stay focused on this type of content.
I12	My child finds reading easy and can keep focused if presented with reading tasks.
I13	My child enjoys being tested
I14	My child enjoys applying the information learnt to an activity
I15	My child learns well when they are tested after.
I16	My child learns well when they apply the information learnt to an activity
I17	My child finds tests easy and can stay focused when being tested.
I18	My child finds applying skills learnt to activities easy and can stay focused when completing an activity.
I19	Interactivity is important when choosing a learning platform.

P1	It is important that resources that work for my child are easy to find.
P2	Resources being age appropriate is important.
P3	Resources being appropriate to my child's skill level is important.
P4	Resources being accessible to my child's specific needs is important.
P5	My child can be frustrated with content.
P6	My child only likes certain resources on platforms.
P7	My child would enjoy being able to choose a learning method that suits them.
P8	My child would learn better if they could choose a learning method that suits them.
P9	It is important that my child can have goals set for them.
P10	Content selected to meet my child's goals is useful.
P11	Goal setting motivates my child to learn.
P12	It is important that my child can change preferences to suit their needs.
P13	Support with goal setting would be useful.
P14	Support with helping my child choose preferences would be useful.
P15	Support with helping find appropriate content for my child would be useful.
PU1	Rank the importance of these factors when you choose a learning platform for your child.

APPENDIX B

Timestamp	What age category is your child in?	Does your child have additional learning needs?	How is your child educated?
6/30/2022 18:19:20	5 - 7 years	No	Mainstream School
6/30/2022 18:21:59	11 - 13 years	Yes	Mainstream School
6/30/2022 18:25:36	8 - 10 years	No	Mainstream School
6/30/2022 20:59:48	Under 5	No	Mainstream School
6/30/2022 20:56:12	Under 5	Yes	Mainstream School
7/4/2022 21:28:34	11 - 13 years	Yes	Home Educated
7/4/2022 21:35:20	8 - 10 years	No	Mainstream School
7/5/2022 20:28:16	11 - 13 years	Yes	Mainstream School
7/5/2022 21:51:17	18 or over	Yes	Mainstream School
7/5/2022 23:05:10	11 - 13 years	Yes	Home Educated

Does your child have any of the following?	Does your child currently use any of the online learning platforms, apps or software below to support their learning? Please add additional services not listed.
No	No
Physical Impairment, Autism Spectrum Disorder, Social Difficulties	No
Autism Spectrum Disorder	Twinkl
No	No
Difficulties Reading	Reading Eggs
Autism Spectrum Disorder, Difficulties Reading	Twinkl, Reading Eggs
Autism Spectrum Disorder, ADHD	Seesaw
Difficulties Reading	Reading Eggs
Cognitive Impairment, Difficulties Reading	No
Autism Spectrum Disorder	Twinkl

It is important that my child can learn at any time of the day.	It is important that my child can learn from home.	It is important that my child can learn out and about in locations that are not school or home.	It is important that my child can use the web platform at school.
7	7	7	7
6	6	6	6
5	7	5	4
7	7	7	7
7	7	7	5
6	7	6	2
6	5	5	5
6	4	6	6
6	6	5	4
7	7	7	6

It is important that my child can access the resources on a mobile device or tablet.	It is important that my child can access the resources independantly (without assistance from a caregiver or teacher).	Communication of progress with school or tutors is important.	It is important that the content on the platform allows my child to learn maths skills.	It is important that the content on the platform allows my child to learn english skills.
7	7	7	7	7
6	6	6	6	6
6	4	5	3	3
7	7	5	7	7
7	4	7	7	7
6	6	4	5	4
5	6	7	6	6
7	7	7	5	6
7	7	7	7	7
7	7	7	6	7

Does your child currently use any of the online learning platforms, apps or software below to support their learning? Please add additional services not listed.	It is important that my child can learn at any time of the day.	It is important that my child can learn from home.	It is important that my child can learn out and about in locations that are not school or home.	It is important that my child can use the web platform at school.
No	7	7	7	7
No	6	6	6	6
Twinkl	5	7	5	4
No	7	7	7	7
Reading Eggs	7	7	7	5
Twinkl, Reading Eggs	6	7	6	2
Seesaw	6	5	5	5
Reading Eggs	6	4	6	6
No	6	6	5	4
Twinkl	7	7	7	6

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It is important that the content on the platform allows my child to learn vocational skills.	It is important that the content on the platform allows my child to improve their reading.	It is important that the content on the platform allows my child to improve their communication skills.	It is important that the content on the platform allows my child to improve their daily life skills.	It is important that the content on the platform allows my child to improve their self determination.
7	7	7	7	7
5	6	5	5	5
4	6	6	6	6
7	7	7	7	7
4	7	7	7	7
6	7	5	6	2
6	4	6	5	5
4	7	6	7	6
7	7	7	7	7
5	7	6	6	4

Rank the type of content in order of importance. (If using mobile you may need to scroll to enter your response) [Vocational]	Rank the type of content in order of importance. (If using mobile you may need to scroll to enter your response) [Self Determination]	Rank the type of content in order of importance. (If using mobile you may need to scroll to enter your response) [Daily Life]	Rank the type of content in order of importance. (If using mobile you may need to scroll to enter your response) [Reading]	My child learns well using learning games.
1	3	2	6	7
5	8	4	1	5
4	8	1	2	5
8	6	5	2	7
8	3	7	5	7
3	8	1	2	7
1	3	2	4	6
4	8	2	3	6
5	6	7	8	4
4	2	3	1	7

My child learns well by reading.	My child learns well by listening to audio.	My child learns well by watching videos.	My child enjoys reading for learning.	My child enjoys listenting to audio for learning.
5	4	7	5	5
7	6	7	7	6
2	4	4	3	3
4	7	7	4	7
4	5	7	4	4
1	3	5	2	3
4	4	4	2	4
3	6	6	6	6
1	3	7	1	4
1	4	6	1	4

My child enjoys watching videos for learning.	My child enjoys playing learning games.	My child finds reading easy and can keep focused if presented with reading tasks.	My child finds listening to learning content easy and can stay focused on this type of content.	My child finds watching learning content easy and can stay focused on this type of content.
7	7	5	3	7
7	5	7	6	6
5	5	3	3	5
7	7	4	7	7
7	7	4	5	7
6	7	1	3	5
4	3	4	3	3
6	5	6	5	3
6	6	1	5	5
7	7	1	5	7

My child finds playing learning games easy and can stay focused on this type of content.	My child enjoys being tested	My child enjoys applying the information learnt to an activity	My child learns well when they are tested after learning	My child learns well when they apply the information learnt to an activity
7	4	6	4	7
5	3	5	3	5
5	2	5	2	5
7	4	7	4	7
7	3	7	4	5
6	2	5	5	6
4	2	5	4	5
5	2	6	5	6
4	1	5	2	6
5	3	4	1	4

My child finds tests easy and can stay focused when being tested.	My child finds applying skills learnt to activities easy and can stay focused when completing an activity.	Rank the learning method in order of usefulness to your child. [Audio]	Rank the learning method in order of usefulness to your child. [Videos]	Rank the learning method in order of usefulness to your child. [Learning Games]
5	6	5	6	4
2	3	3	1	4
3	3	3	2	1
4	7	2	1	3
3	5	3	2	1
3	6	5	3	1
2	3	4	5	6
2	5	5	4	6
1	4	5	6	4
1	3	3	6	4

Rank the learning method in order of usefulness to your child. [Reading]	Rank the learning method in order of usefulness to your child. [Follow Up Activities]	Rank the learning method in order of usefulness to your child. [Tests]	It is important that resources that work for my child are easy to find.	Resources being age appropriate is important.
2	1	3	7	7
2	5	6	7	6
5	4	6	6	6
5	4	6	7	7
4	5	6	7	7
6	2	4	6	3
3	2	1	6	6
2	3	1	7	6
2	3	1	7	6
2	5	1	6	7

Resources being appropriate to my childs skill level is important.	Resources being accessible to my childs specific needs is important.	Resources being accessible to my childs specific needs is important.	My child can be frustrated with content.	My child only likes certain learning resources on platforms.
7	7	7	4	5
7	6	7	6	6
7	7	6	6	5
7	7	7	4	5
7	7	7	4	5
5	6	6	7	7
6	6	6	7	5
7	7	6	5	7
7	7	7	7	3
7	7	7	6	6

My child would enjoy being able to choose a learning method that suits them.	My child would learn better if they could choose a learning method that suits them.	It is important my child can have goals set for them.	Content selected to meet my childs goals is useful.	Goal setting motivates my child to learn.
7	7	7	7	5
7	7	3	6	4
5	5	6	6	3
7	7	7	7	7
5	5	7	7	5
6	5	5	5	4
7	7	6	5	4
7	5	6	5	4
7	7	7	7	4
7	6	5	7	5

It is important my child can change preferences to suit their needs.	Support with goal setting would be useful.	Support with helping my child choose preferences would be useful.	Support with helping find approriate content for my child would be useful.	Flexibility is important when choosing a learning platform.
7	7	7	7	7
6	6	5	6	6
6	5	5	5	6
7	7	7	7	7
7	7	7	7	7
5	5	5	7	5
6	6	6	6	6
7	5	6	7	6
7	7	7	7	7
6	6	5	6	6

Interactivity is important when choosing a learning platform.	The content available is important when choosing a learning platform.	Personalisation is important when choosing a learning platform.	Rank the importance of these factors when you choose a learning platform for your child. (If using mobile you may need to scroll to enter your response) [Flexibility]	Rank the importance of these factors when you choose a learning platform for your child. (If using mobile you may need to scroll to enter your response) [Personalisation]
7	7	7	1	2
5	6	5	3	4
7	7	7	4	3
7	7	7	3	4
7	7	7	4	3
6	6	5	4	3
5	6	4	1	3
6	6	6	2	3
7	7	7	4	3
7	7	6	4	2

It is important that the content on the platform allows my child to improve their social skills.	Rank the type of content in order of importance. (If using mobile you may need to scroll to enter your response) [Maths]	Rank the type of content in order of importance. (If using mobile you may need to scroll to enter your response) [English]	Rank the type of content in order of importance. (If using mobile you may need to scroll to enter your response) [Communication]	Rank the type of content in order of importance. (If using mobile you may need to scroll to enter your response) [Social Skills]
7	7	8	5	4
5	2	3	7	6
5	7	6	5	3
7	3	1	4	7
7	6	4	1	2
6	6	7	5	4
5	6	8	5	7
6	1	7	6	5
7	1	2	3	4
4	6	8	7	5

Rank the importance of these factors when you choose a learning platform for your child. (If using mobile you may need to scroll to enter your response) [Content]	Rank the importance of these factors when you choose a learning platform for your child. (If using mobile you may need to scroll to enter your response) [Interactivity]	(Optional) Enter your email address for contact about participation for future studies in rreturn for free access to the platform upon completetion.
4	3	Excluded for privacy
1	2	Excluded for privacy
1	2	Excluded for privacy
1	2	Excluded for privacy
1	2	Excluded for privacy
1	2	Excluded for privacy
2	4	Excluded for privacy
1	4	Excluded for privacy
1	2	Excluded for privacy
3	1	Excluded for privacy

Are there any features not discussed in the survey which you think are important?	Any other comments
Will there be accessibility for the hard of hearing/visually impaired? Will the application have age appropriate learning but without restrictions for gifted children, so that it is not boring? Will software be able to determine key strengths	

and weaknesses and adapt and deliver content according to these?	
N/A	
Importance of learning support in schools and how that can impact a child's confidence within the classroom environment	Very insightful

APPENDIX C

Add Child as User		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects the add children as user option on the accounts page	-
2	-	System prompts user to enter the new username and details for the child
3	User adds the username and childs details requested	-
4	-	System checks this user does not already exist
5	-	System checks data is valid
6	-	System adds user to database
7	-	System shows new user on accounts page

View Child Profiles		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects the view childs profiles option	-
2	-	Systems retrieves data from database by the users ID

3	-	Systems displays users associated children profile data

Manage account details		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects the manage account details option	-
2	-	Systems retrieves account details from daabase
3	-	Systems displays current details and prompts user to change required details
	User edits the required details	-
	-	System checks validity of responses
	-	System updates database entry with the updated details
	-	System displays the new details

View Courses		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects the view courses option	-
2	-	Systems retrieves courses data from database
3	-	Systems prompts user to search for course key words
	User enters key words relating to course needed	
		System retrieves courses using the keywords entered by user from the database

		System displays relevant courses for user to select
	User selects a course	
		System retrieves specific course data from database
		System displays course data to user

Add Course to Child profile		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects to add course to childs profile	-
	-	System prompts user to select childs username
	User selects the relevant child	--
2	-	Systems retrieves course details from database
3	-	Systems retrieves user details from database
	-	System adds entry to user_courses to attach the course to the user
	-	System displays childs profile showing new course added

Post Course		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects post course option	-
2	-	System prompts user to enter course details
3	User enters course details such as title, description, difficulty and category	--

4	-	System creates course entry in database
5		System displays course

Add chapter		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects a created course and then selects add chapter	-
2	-	Systems prompts user to enter chapter details
3	User enters chapter details such as title and description	
4	-	System adds chapter to database and adds entry to courses_chapters
5		System propmts user to add content to the chapter.
6	User chooses the content type to add, video, activity or info.	-
IF user selects video		
8	-	system prompts user to choose to upload or link the video
9	User enters link or chooses file to upload	-
10	-	System adds new entry to chapter_video
IF user selects info		
8	-	system prompts user to enter a section title
9	User enters section title	-
10	-	System adds section entry to database

11		System adds entry to chapter_sections
12		system prompts user to enter section text
13	User enters section text	
14		system prompts user to add an optional image
15	User adds optional image	
16		System updates section entry with text and image data entered
17		system displays section
IF user selects activity		
8		System prompts user to choose an activity type
9	User selects	

Account login		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects login	-
2	-	Systems prompts user to enter username and password
3	User enters details	Systems prompts user to search for course key words
4		System retrieves username data
5		System checks password matches stored password
6		If valid system displays users account page

View events

STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects events page	-
2	-	Systems retrieves events data from database
3	-	Systems displays events data

Post event		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects post event option	-
2	-	Systems prompts user to enter event details
3	User enters event details including title date time location and description	-
		System adds new events entry to database
		Systems displays events data

Post forum		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects post forum option	-
2	-	Systems prompts user to enter forum title
3	User enters forum title	-
		System adds new forum entry to database
		Systems prompts user to enter forum text
	User enters forum text	

		System adds new entry to post with new forums associated id to database
		Systems displays forum data

View forum		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects forum page	-
2	-	Systems retrieves forum data from database
3	-	Systems displays forum data

Reply to forum		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects reply to forum	--
2	-	Systems gets forum database ID
3	-	Systems prompts user to enter reply
4	User enters reply text	-
5	-	System adds new entry to posts with associated forum ID

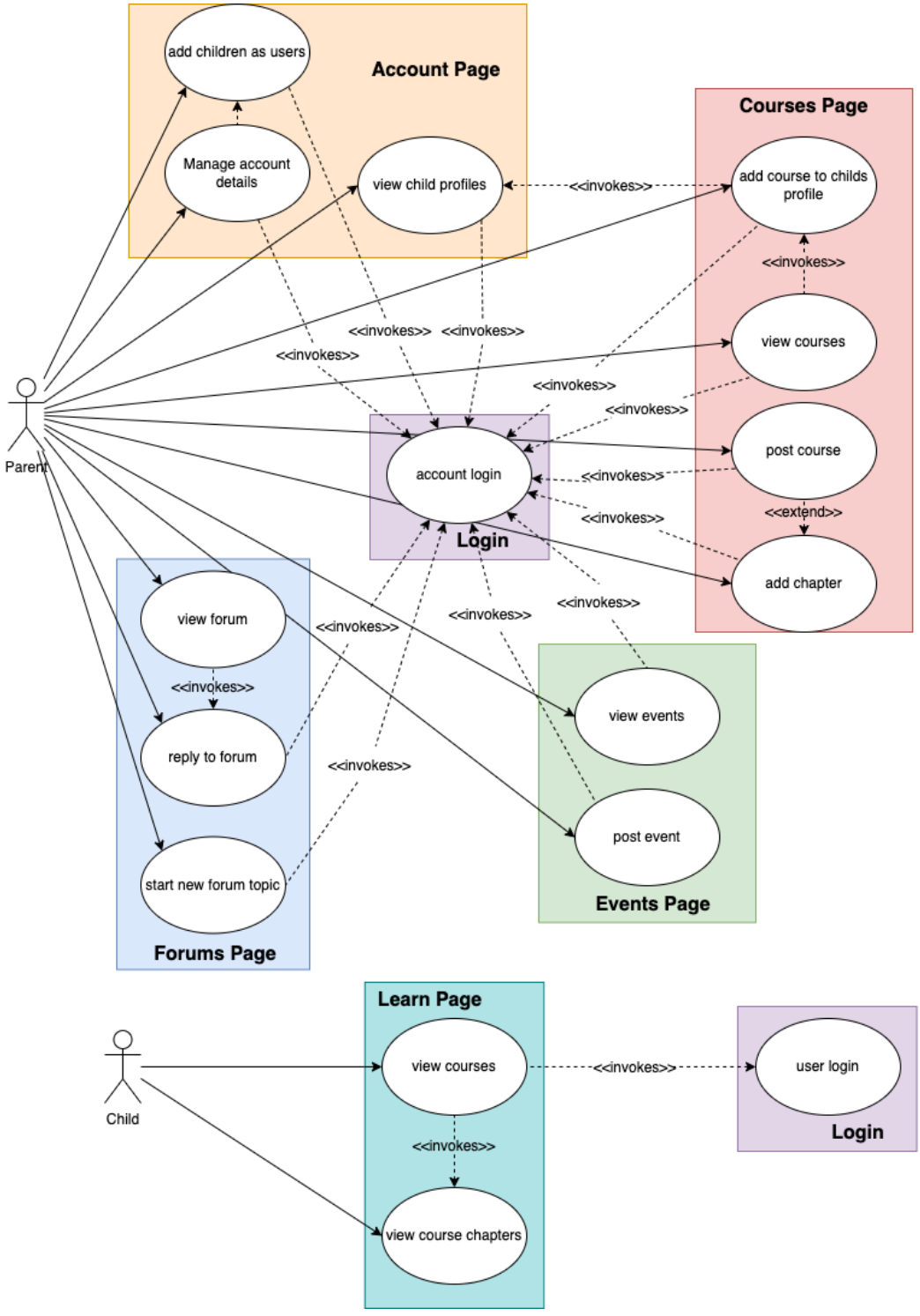
View Child Courses		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when child user selects the view courses option	-

2	-	System gets user_id
3	-	Systems retrieves courses_users data from database
4	-	Systems retrieves courses data where userid matches user_courses entry
5	-	Systems displays users courses

View Child course chapter		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when child user selects the view chapter option	-
	-	System gets chapter_id
4	-	Systems retrieves chapter data
5	-	Systems displays chapter

Child user login		
STEP	ACTOR ACTION	SYSTEM RESPONSE
1	Use case begins when user selects login as child	-
2	-	System prompts user to select child user
3	-	System gets user_id
4	-	Systems retrieves user data from database
5	-	Systems displays child users homepage

APPENDIX D



PARTICIPANT A

APPENDIX E

LOG BOOK	
18/07/22	Created html and css for initial pages home, account and courses
22/07/22	Created database and added user, account, courses, user_courses, account_users tables and functionality with node routes
25/07/22	Created forums and post tables and added functionality with node routes
26/07/22	Created events table and chapter table in database
29/07/22	Meeting with supervisor, created use case diagrams
01/08/22	Wrote use-case texts
08/08/22	Made avatar assets
10/08/22	Finalised database design and added required tables for content and game
12/08/22	Added more index page node routes
20/08/22	Added my courses and linked to profiles, started adding functionality to create a course
23/08/22	Meeting with the supervisor. Started creating routers and sessions for login.
01/09/22	Created .js files for routers to simplify routes
05/09/22	Worked on making all routes functional
15/09/22	Added course and chapter add functionality
16/09/22	Added routers for the routes to make more clean and understandable
17/09/22	Completed login functionality and added session account id as variable across necessary routes

18/09/22	Refined look of the platform changing css and layout of elements to be more clean and clear
19/09/22	Began creating content add functionality
20/09/22	Finalised adding content functionality for games
21/09/22	Beta Testing and HTML and CSS testing undertaken

APPENDIX F

		I would reccomed busy bees to friends/family/co workers.	Other parents/carers in my situation would approve of Busy Bees.	Busy Bees would be suitable for a child under my care	Busy Bees would be suitable for a child with learning difficulties	Busy Bees would be suitable for a child with ASD	Busy Bees would help a child under my care learn	Busy Bees would appeal to me more if there were demonstrated results.
9/21/2022 17:23:	ASD	6	7	5	5	5	6	6
9/22/2022 17:44:	ASD	5	5	5	5	6	5	6
9/23/2022 18:35:	ASD, Dyslexia	5	5	4	4	6	5	7
9/21/2022 19:04:	Dyslexia	6	5	7	6	6	6	7
9/21/2022 19:45:	ASD, Dyslexia	5	5	4	4	4	5	7
9/21/2022 20:30:	ASD	5	5	5	5	5	5	6
9/21/2022 21:42:	ASD, Dyslexia	5	6	6	6	6	5	6
9/21/2022 22:08:	ASD	6	5	7	5	6	6	7
9/21/2022 22:56:	ASD	7	7	6	5	5	5	7

I am experienced enough with technology to use Busy Bees	I trust that Busy Bees could provide technical support to help me use the platform.	I worry my skills with technology will make it hard to use Busy Bees	I worry my a child in my care would not be able to use Busy Bees	I enjoy using computers and will enjoy using Busy Bees instead of other learning tools to educate a child under my care	A child under my care enjoys using computers and would enjoy Busy Bees instead of other learning tools	A child under my care would enjoy Busy Bees.	Busy Bees would be a useful tool for communciation	Busy Bees would be useful for sharing resources
4	5	6	3	5	6	6	4	5
5	6	5	6	4	6	5	4	6
3	6	6	5	3	5	5	5	6
5	6	3	2	6	7	6	7	7
5	4	4	3	3	5	5	6	7
3	5	5	3	4	6	6	6	6
5	6	3	2	4	6	5	6	7
3	7	4	7	6	7	7	5	7
4	6	5	5	3	4	4	6	7

Busy Bees would be useful for learning	Busy Bees is easy to use.	Busy Bees would be difficult to use.	I would use Busy Bees to help a child under my care learn	I would use Busy Bees to find resources to educate a child under my care	I would use Busy Bees to communciate with other parents/carers
7	5	3	6	5	3
5	5	4	5	6	4
4	3	5	5	5	5
6	5	4	6	6	6
5	3	5	5	7	5
5	3	5	6	6	4
7	5	2	6	6	6
7	3	4	7	7	7
6	6	1	6	7	7

APPENDIX G

PARTICIPANT A
"I think it is a little bit basic and could be added to but what's there is useful. The idea of being able to add your own content for your child to learn from is good. I can imagine if it were used by a lot of people you could find good resources for lots of different topics your child liked. My child loses interest quickly if the topic isn't what he wants to learn about and seems school-like so I can imagine it could be a way to teach him about important topics but in a fun way themed around things he likes. I think more games and interactivity could help keep his attention.

PARTICIPANT B
"It would be more useful if the layout was clearer and there were more clear labels so I knew what to do. Adding content could be easier, maybe less on the page and more detailed instructions. Some extra thought for those with hearing and visual impairments would be nice like something that read out the text to you. More ways for parents to communicate like a direct message feature would be useful."

PARTICIPANT C
"The fact that busy bees can be tailored to an individual child appeals to me because my child often only wants to learn about his specific interests. It means I can select the type of content he wants to learn about. As a sharing platform for other parents it would be a way for families to arrange meet ups for socialisation to connect with others who share special interests improving the social skills of my son who struggles with making social connections. A good idea for children with short attention spans, as it's a fast way to get information in. Like they could just do one chapter at once and have a sense of accomplishment avoiding frustration and feeling of failure they can often face on other platforms. Easy to use the platform even people with basic technology skills can use the platform. Being able to print off worksheets to go along with work for example handwriting skills would be beneficial. An avatar or character would make it more enjoyable and make him more engaged. More colours would be good for younger audiences."

PARTICIPANT D
"I was a bit confused by the instructions on how to upload content. But, the page layouts were easy to follow. Very useful idea for a platform because you can personalise it to the child's personal interests. Youtube videos are a way my child likes to learn already so it would be useful. I'm interested to see how it develops further. "

PARTICIPANT E
"What would be really good is a participation badge system to reward children's progress like a little image on their profile for completing a course and the option to print a certificate to say they've completed the course would be nice to go in my records. A way to print PDF's of the content to show what the child has learnt for evidence of their learning to show the council would be helpful. A planner section for parents to log what their child has done each day like a journal is what it's missing really. A journal is a big niche missing for home educators, I don't

know any apps like that already. It could be really good if outside agencies could offer courses there such as a company offering training courses like St johns ambulance or local authority endorsements like the old sure start centre or the NSPCC. Twinkl lets you add your own lesson plan as a banner on the side so I like the ability to create the course. The site feels home-ed friendly as it lets you put together courses on anything your child might want to learn about."