Exploratory Study on UX Design Barriers: Enhancing User Experience for Children with High Functioned Autism Spectrum Disorder on Educational Websites

Dina Gamal Abboud
Professor, Faculty of Applied Arts, Helwan University, Cairo, Egypt
Dean, Faculty of Art and Design, EL Galala University, Suez, Egypt
Mona Emam Amin Aly Mohamed
Assistant Lecturer in Faculty of Arts and Design MSA University
Mohamed Mahmood Kamal Eldein Galal Eldein
Associate professor at the Department of Advertising, Faculty of Applied Arts, Helwan University, Cairo, Egypt

Abstract:

The present paper is a study that focuses on the Autism Spectrum Disorder (ASD) current nature of things revolving around improving and customizing the incorporation of the user experience design (UX) on educational websites to individuals with ASD. Specifically, the research emphasizes the necessity of recognizing the specific needs and consequences of the users in this particular group in order to develop more inclusive and user-friendly digital learning environment. In this study, the key issues in UX design are uncovered to address the needs of individuals with ASD including experiencing sensory overload, complicated navigation and social interaction difficulties. Similarly, it explores how these hurdles make a difference in an individual's level of interaction with online educational sites. This study explores UX design barriers through different methods: semi-structured interview, thematic analysis, survey and experiment on specialists, observation and selected example experiment.

Moreover, the research reveals some design tactics to overcome those obstacles, like one-column design, uniform navigation, and targeted content. The main goal is to increase the usability and effectiveness of websites which are visited by autistic children. The outcome of this study emphasizes the critical role and the stuff to be done by both UX designers and instructors when the process of creating media learning is on. This approach will materialize in more inclusive but a fair online space that will carry on efficient learning, and also provide equal chances to everyone. The aim, however, has the potential to lead to a rather significant improvement in this field.

Introduction:

American Psychiatric Association (2013) characterized autism spectrum disorder (ASD) as a type of neuro developmental disorder indicated by problems in languages ability/communication and social interaction (Valencia et al., 2021). More specifically, the American Psychiatric Association (2013) offered the following official diagnosis criteria: often, reduced and repetitively performed patterns of communication, interests and activities; a persistent lack of social communication skills in different circumstances; they should be present earlier in childhood development (although they might not become evident until the social demands are more than someone's abilities and may be covered by other children or adults later in life), secondary symptoms such as ID, low tolerance, problems with the language, motor and others may or may not be present .Diagnostic and Statistical Manual of Mental Disorders (DSM-5) Fifth edition of the book noticed that there are 3 levels of severity for ASD, each level basing on the level of support needed from "requiring support" to "requiring very substantial support". However, this group of people shows diversity in their talents in such as a way that some can enjoy productive and independent lives with varied support levels, while others have serious problems that last for their whole. On the other hand, according to recent figures, prompt detection and appropriate therapy, in addition to other therapies, can make autism symptoms fade away or even reduce functional limits for many individuals affected (Kumm et al., 2021).

Jones et al. in Aguiar (2022) claimed that the above discussed symptoms of ASD most probably are a result of the complicated relationship between predisposition of a neurodevelopmental vulnerabilities and the child's environment, changed by compensatory skills and protective variables.

Literature Review:

Barriers in User Experience Design for ASD Websites

According to ISO 9241-210 user experience is defines as a "user's perceptions and responses that result from the use and/or anticipated use of a system, product, or service." Additionally, the standard defines user experience (UX) as "users' perceptions and responses include the users' emotions, beliefs, preferences, perceptions, comfort, behaviors, and accomplishments that occur before, after, and during use." More specifically, the ISO 9241-11 standard defines usability as the "extent to which a system, product, or service can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use."

"Barriers to inclusion" is a highly complex issue that encompasses numerous interconnected contextual elements that must be tackled in order to avoid exclusion. Blanck in Johansson, S. (2019) reinforced how many people with cognitive disabilities still experience these challenges. They argued that "inclusion and active participation have always been the antidote to discrimination, which is the precepts contained in disability rights laws on equality and employment, housing, post-secondary education and independent living and economic independence." Some of these rights are as footed in the 2013 Declaration on the Rights of People with Cognitive Disabilities to Technology and Information Access. Firth, A. (2019) concluded that it is important to comprehend users' unique needs necessary to ensure that you address the challenges they face. There appears to be no apparent tangible spheres within the web environment that are impossible to access such as stairs; and unlike the barriers within printed data, accesses to data over the web have significantly improved; but just like any other environment the web too has its fair share of accessibility hindrances. Not only do accesses restrictions apply to the learners themselves but all persons with such impairments (Brewer, 2011). As stated in the Internet Society concerning digital accessibility guidelines, people with disabilities face difficulties using the Internet, and the level of those difficulties differs depending on the type of disability. Older patients with possible dementia resulting from diseases like Alzheimer's or perhaps just aging patients, are easily going to be confused by the various technologies, and internet services. These problems may be addressed by incorporating usability and accessibility the user experience design to ensure that usability and accessibility to a product or service.

Aguiar et al. (2022) also noted that while digital technologies can enhance the quality of lives of individuals with autism, they cannot be easily used because of challenges in personalizing uses of the programs. Autistic people use them at times in an improper manner. As pioneered by FIRAH's research on ASD participants/parents and autism scholars; the major concerns regarding technology by persons with autism were stated by the participants as follows and elaborated by the scholars as follows. As much as praise was noted on the elements of the software, criticism was made towards the design of the software. The participants pointed out that challenges like interruption of usage due to bugs, low battery or improper reaction time placed the users in a stressful situation brought about behavioral crises. According to the study conducted by Yaneva, (2016), it was found that online users who have high-functioning autism experience the following barriers when searching for information within web sites as deduced from the capability of such clients to locate the required information on the pages. This conclusion means that as changes in performance were noted between web users with mere degrees of autism, the volume of challenges that fully autistic web users experience to comprehend web pages ought to have been considerably more extreme. Accordingly, Kirschner in Aguiar (2022) said that adaptations may pertain to functionality, interaction components, or interface design for the purpose of catering to the users' learning ability and developmental progression. Consequently, other sorts of commitment can be supplied which match their aptitude and motor coordination. There is also the anticipation that cognitive stress can be avoided by breaking down a task into sub-tasks. Based on a survey in Valencia et al (2021), ten design guidelines were offered and organized into four categories: These are graphical layout, the manner of navigation and the arrangement, language, and interactivity. The building of the system was carried out following human-centered design principles and the acceptability and usability of the system was measured by means of 8 post-hoc interviews, a SUS survey of 12 phrases, and finally design principles and open-ended questions were also asked. Internet Society declared in digital accessibility guidelines that for people with cognitive impairment anything that causes confusion, distraction or otherwise difficulty in the content of the website is considered as accessibility barrier to them, and it stated some examples of those barriers as: complex navigation and page layouts Fig. (1), lack of context-reinforcing graphics, graphs as Fig. (2), or illustrations, inability to pause or turn off moving, flashing, or flickering content e.g. Fig. (3), inability to disable background audio and visual page designs that cannot be customized using style sheets.
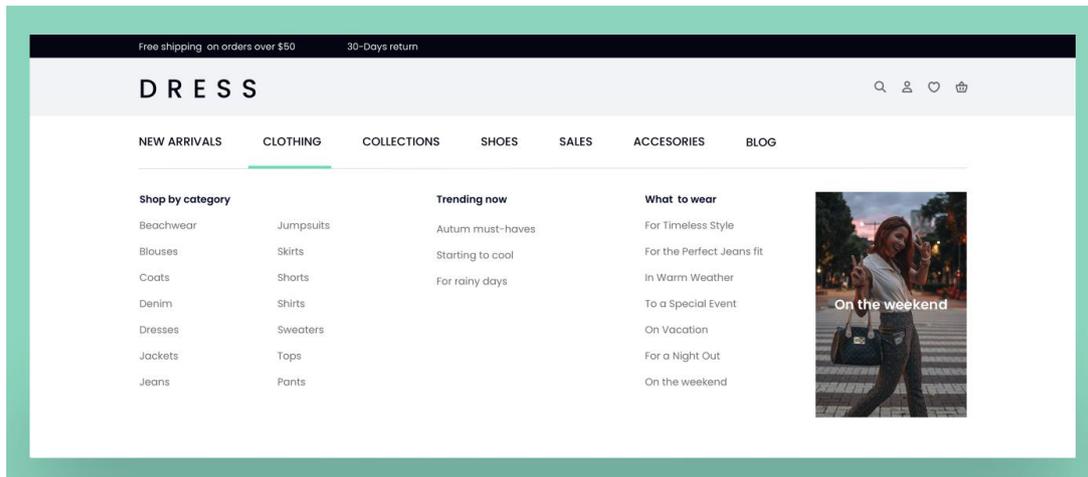
Fig. (1): Example of a complex yet clear navigation menu on a large website (Neb, V. (2023) 9 simple ways to make your website easier to navigate for your users, Kurieta. Available at: https://kurieta.com/make-your-website-easier-to-navigate-for-your-users/ (Accessed: 10 September 2024).
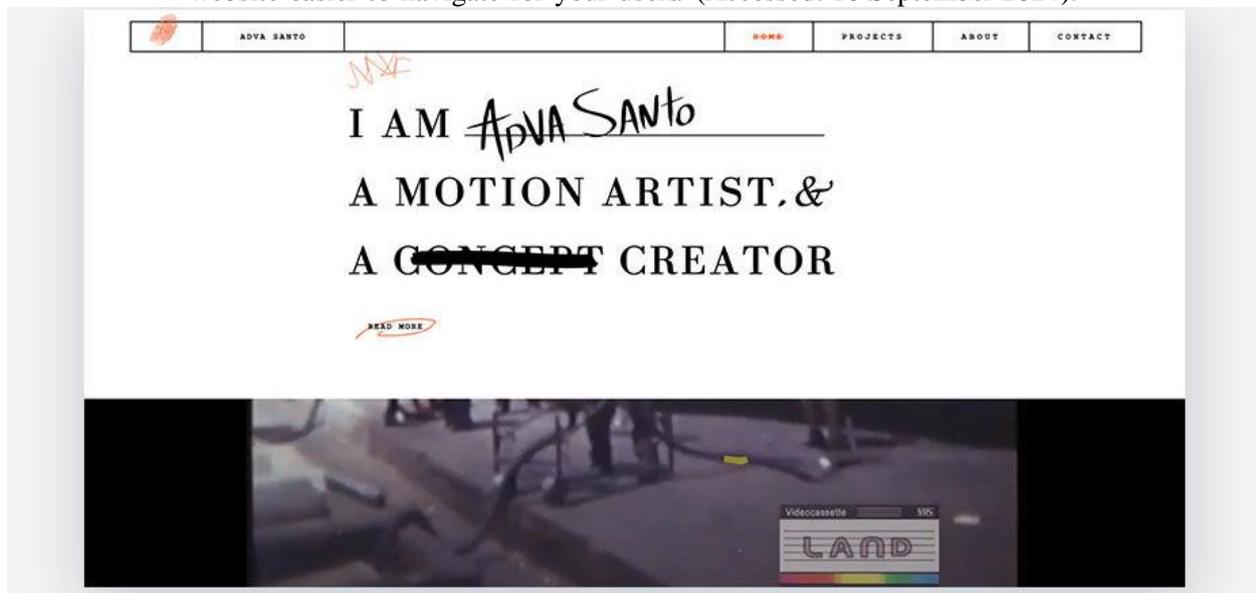

Fig. (2): Example of website that has a lack of context-reinforcing graphics (Sernoff, L. (2024) Website menus: 10 outstanding examples, Wix Blog. Available at: https://www.wix.com/blog/website-menus (Accessed: 10 September 2024).
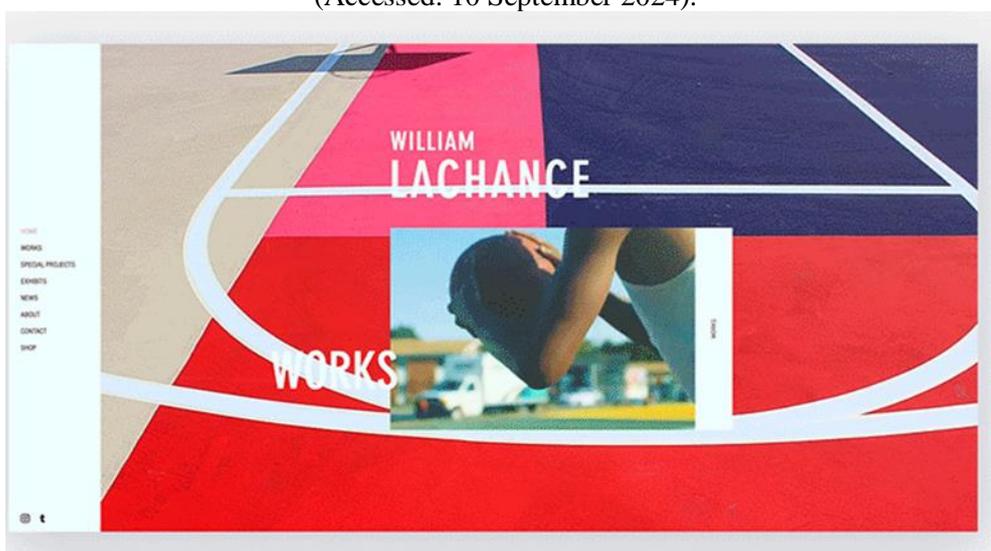

Fig. (3): Example of a website that contains moving, flashing, or flickering content (Meir, D. (2024) Best graphic design websites for Impactful Inspiration, Wix Blog. Available at: https://www.wix.com/blog/graphic-design-websites-inspiration (Accessed: 10 September 2024)

Contributing to understanding of digital inclusion Perez-Escolar & Canet (2022) discovered that digital inclusion is much more than having and using Internet and technologies.

As stated by Tsatsou & Panayiota (2020), persons with disabilities are generally lower, and they require more individualization, training, and support in order to use IT effectively and for their benefit. In general, Yaneva (2016) established that individuals with AS experience difficulties in reading and understanding text and consequently, in their academic performance, employment opportunities, and social integration. Johansson et al. (2021) emphasized that designers should to have a more profound understanding of which conditions persons with cognitive disability have to fulfill to become a member of the digital society. This knowledge may be attained by increasing the designers' interaction with the users with cognitive restraints. Authors may require changing the processes of design as well as defining a set of tools and methods that will allow introducing adaptations for people with CIs. This is the kind of design that is suitable when a person employs a particular digital commodity. It is also pertinent to design in support and instructional systems so as to achieve effectiveness. A good example of critical systems which need to be developed and maintained is called a sentencing system for criminal matters such as the type used in Canada. Current disparities mean that it is highly probable that new and creative approaches will need to be developed for designing for inclusion. While regulations and rules governing web designs have been established helping the impaired, individuals including those with ASD, understanding the ASD users' perceptions to web designs and standards remains difficult (Murrietta et al., 2018). Therefore, Rezae et al. (2020) pointed out that the UI guidelines for users on the autistic spectrum include the autism-specific attributes. Members of the autistic spectrum are characterized by their cognitive impairment for example executive dysfunction, poor central coherences and slow processing speed. Dattalo (2016) illustrated that some features need to be discussed when interacting with particular clients with particular challenges, for instance, ASD. It has been mentioned previously that difficulties that people with ASD face include restricted attention, issues with hypersensitivity, reduced ability to learn and respond to utterly different ways, and problems with poor comprehension of texts, for instance, they do not understand metaphors.

Bridging the Gap: Overcoming UX Design Barriers

Conole (2018) posited in creating good digital solutions there is need to first establish the target user. Beyond generic characteristics, it is vital to invest time getting to know the specific users of a digital solution: Their family, community, and culture; the working environment; the needs and sensitive areas; and the drivers. Drew et al. (2018) argued that web designers who are unaware of the features of the most important web design aspects and how to manage these parameters may accidentally create sites that are difficult for persons with ASD to use. This makes it hard for a person to know whether they are browsing a potentially unsafe site. Some integrated inputs concerning auditory and visual modes can have a negative impact on an ASD person, thus making the website either non-accessible or totally irrelevant. Moreover, the web sites were not checked using specially developed web crawling tools or contrasted with functionally related attributes associated to the GUI of the autism friendly web site.

Tardif et al. (2018) indicated that participatory design (PD) and/or user-centered design (UCD) are used in Human-Computer Interaction (HCI) to reduce the difficulty that designers have in putting themselves in the shoes of the users, given that their perceptions and experiences (cognitive, motor, sensory, etc.) are frequently incompatible with the target users'. This is especially true when these potential users have specialized requirements, such children, adults, and people with impairments, Yaneva (2016) added that People with autism are very excellent visual thinkers, therefore inserting image may be a method to harness their skills in visual thinking to compensate for their challenges in reading.

Chung and Ghinea (2022) suggested combining images with text, and the majority of studies on creating designs for people with cognitive impairments highlighted the need of utilizing straightforward language. Even though the prototype attempted to utilize simple terms that most people could understand, autistic children might not understand what to do when they read a few letters (such as "camera" and "collect"). Considering the benefits of child-centered play, visually appealing components in interface design may be important. This could be the result of their exceptionally poor ability to understand meaning depending on the context. It is therefore necessary to strike a balance when it comes to a system's goal. Children with strong functioning abilities tend to like realistic photography, whereas children with low functioning tend to favor simpler imagery. In the table below describes each accessibility guidelines for ASD people previous studies.

Table (1): ASD accessibility and usability guidelines (Adapted and compiled from ((Dattolo et al., 2016) (Dattolo & Luccio, 2017) (Rezae et al., 2020) (Chung & Ghinea, 2020) (Johansson, 2019)).

Category	Guidelines
Interface design	• Limit the text to very few, simple sentences, and add many images in a PECS-like style so to describe concepts and actions through sequences of images, i.e., the copious use of images throughout the site, in order to transmit all messages. • Repeat concepts, and in the homepage write a sentence that let the user feel it navigates in its "own" site, Screens should not be cluttered. • Each screen should display as few elements (e.g., buttons, icons, texts) as possible, be very simple (avoid background images, transparent images, pop-up elements and scrolling). • The general design and the structure should be simple, clear and predictable, secondary content that distracts the user should be avoided. • The number of features available at any time instant should be limited. • The content should be predictable and should provide feedbacks.
Navigation & Structure	• Use simple and sketchy symbolic pictures. • If the site is directed to a group of young users, add, when possible, some simple games to involve the user, and also to check his/her level of attention, have a simple and logical navigation (easy to access, use consistent style), Even the first time, the user should be able to easily navigate inside, and should remember the navigational information even at successive visits or uses. • Minimize scrolling so that users do not assume what information might be on the page, make content as short as possible without sacrificing precision and specificity, provide consistent navigation and similar in every page/section to increase usability. • Add navigation information and navigation buttons at the top and the bottom of the page. • Efficiency and availability, if the site is directed to a group of young users, add, when possible, some simple games to involve the user, and also to check his/her level of attention.
Fonts & Colors	• Write sentences in bold, of big size and uppercase. • Concentration and focus can be facilitated by avoiding bright colors and pop-up, use eligible font type and size (use clear, sans serif font, font size between 12&16 with pictures and size 16 alone), • Choose right colors (consider to use soft, mild colors, contrast foreground and background colors but not too much). • Use plain sans-serif font to ease readability. • The text should be with pictures. • It should be clear, simple, and short (at most one sentence on a line); should be in a big font (14), in plain Sans-serif style (e.g., Verdana), in a mild color. • Headings and titles should be used.
Images& Icons	• Visual stimuli, icons or images, should accurately describe the given context, Common icons, frequently seen in other mobile applications, should be favored over new designs to reduce uncertainty, Icons and texts, when used together, should communicate the same message. • In other words, icons should be an accurate interpretation of the referent text and vice versa, provide images for better understanding (each idea needs both words and pictures; pictures and words go next together), use icons/symbols familiar to users' context (utilize real life metaphors), complement texts with images and icons. Pictures should be copiously used together with redundant representation of information. • Pictures can be drawings, photographs, symbolic images, should be easy to understand, should not go in the background, should be in a sharp

	focus. Background sounds, moving text, blinking images and horizontal scrolling should be avoided.
Language	• Use simple and minimal sentences, and illustrate concepts through images, and not though the written text, • Texts should be brief and concise, to support reading comprehension, sentences should be as short as possible, expressed in easy or common language, provide concrete examples to help with understanding abstraction and generalization, be specific and precise in language use, Acronyms and abbreviations, non-literal text, and jargon should not be used.
Interaction	• Use clear, large buttons with both icons and text (easy to figure out; recommend at least 2x2 cm touch targets, give consistent and predictable interactions (e.g., swiping, tapping and dragging), give short instructions for every step.
User Interface design	• UI design should be consistent, visual cues have been demonstrated to be effective in facilitating communication and learning in persons on the autism. Rich multimedia interfaces, however, should be avoided as it causes further challenges in usability. • User interfaces that contain few elements are much easier to use and appreciated by these users, use simple interfaces to ease understanding. • The interface should be responsive. • Allow customization, try to engage the user, make adaptive the interaction with users, considering their interaction history, their preferences, requests, and needs. • Decompose the tasks into simple subtasks, the number of errors should be limited.

Table (2): Guidelines for Improving Text and Web Accessibility for People with Autism (Yaneva, 2016)

Image Accessibility categories	Guidelines suggested
Insertion of Images	• Illustrate the main ideas in text paragraphs through the insertion of images relevant to the meaning of the paragraph. • Illustrate the complex words in the text through the insertion of images relevant to the meanings of words. • Even if a text does not contain complex words, it is still good practice to include images, as they have been shown to have a positive impact on how well autistic people perceive their comprehension and memorization of the meaning of the text. • For texts containing many complex words, images should be accompanied by other comprehension aids such as dictionary look-up or the inclusion of definitions, where possible. This is needed because even though images have been shown to have a positive effect on the subjective perception of comprehension and recall among individuals with autism, they have not been shown to improve them objectively.
Types of Images	• Photographs and symbols are equally suitable, so data sets from both domains could be utilized. However, refrain from using symbols which are too abstract or whose understanding requires substantial prior knowledge in a certain area. • If a relevant image is unavailable or the idea of the text is too abstract to be depicted as an image, do not put anything. An irrelevant image has the potential to affect autistic readers' comprehension and reading speed. • Do not insert logos, advertisements or any other visual information, which is not directly relevant to the meaning of the text.
Positioning of Images	• If an image has been used to illustrate a complex word, position the image as close as possible to the word, preferably above the word or on the right-hand side of the word.

	• If an image has been used to illustrate the meaning of a larger portion of text, insert the image as close as possible to the sentence or groups of sentences it refers to. • Images should be positioned in a way that aids the natural segmentation of the text, as opposed to segmenting the text again and, in so doing, interfering with meaning and cohesion.
Supporting comprehension	• Use texts written in Plain English, (See Plain English guidelines for a more detailed information on how to write for people with cognitive disabilities). • A general rule of thumb is that the text should have a score higher than 65 according to the Flesch-Reading Ease formula. • Allow re-reading of the text as some readers might need to read it several times in order to comprehend and memorize it fully. Reinforce prior knowledge on the subject by asking a few questions about the topic before the text has been read. Reinforce comprehension by asking inferential questions after the text has been read.
Supporting memorization	• Supporting memorization through various means is necessary due to the fact that the between-group difference in memorization was more dramatic than the between-group difference in comprehension. At the same time, it was shown that image insertion does not affect memorization objectively, which is why we propose the following practices: • Reinforce memorization of important information in the text by presenting a summary of it after the text has been read. • In the case of instructions, reinforce the information by displaying the relevant chunks of previously read text while the user is taking the required action.
Reading Speed	• Allow readers to skip through pages at their own pace, as their reading time may be longer compared to the general population. • Reinforcing important information by presenting a summary of it at the end of the text will increase text length and will also have an impact on the overall reading time. • This needs to be taken into account in situations such as online gaming or videos, where the trade-off between quality of comprehension and speed of comprehension is important. In the case of videos, allow longer for the users to read the text or captions and to process the visual information.

Methodology:

The research follows qualitative method which examined the response of highly functioned autistic children on three educational ASD websites to explore the digital barriers the highly functioned autistic children may face. The researcher studied two main barriers according to (references) the previous studies which are navigation and structure and graphical elements and stated them into statements to measure it.

The study was conducted in different autistic centers in Cairo on psychologists and autism development skills specialists and also to validate the results, the experiment was applied on four children diagnosed with highly functioned autism spectrum disorder. The researcher chose these category of autism as recommended by therapists specialized in treatment of children diagnosed by ASD, they stated that it is better to choose children who are highly functioned on ASD as it is easier to

deal with them and obtain accurate results. They added that children who are low functioned on ASD spectrum are easily distracted, and their cognitive abilities are different than children with high functioned ASD, thus the results will be inaccurate. As the research data collection process is challenging, the researcher applied five methods:

1- Semi-structured interview: The researcher performed semi-structured interview with clinical psychologist for special needs and autism skills development specialist through open ended questions to achieve deep results not superficial ones.
2- Thematic analysis: The researcher conducted an analysis based on the interviewees transcripts and drive them into themes.
3- Survey and experiment on specialists: The researcher put survey statements to the themes of design asked and concluded the results into

done or not done on 13 autism skills development specialists.

4- Observation: The researcher observed the performance of the research example selected while navigating the websites.

5- Selected example experiment: The researcher applied the experiment on four children that are diagnosed with highly functioned ASD to ensure the answers of the interviewees.

The researcher analyzed the interview of the specialists Dr. Mansour Naeem Gad (Lecturer and PhD holder in Clinical Psychology, Department of psychology Cairo University) of open-ended questions into thematic analysis to conclude their answers into themes as in the following table:

Table (3): Thematic analysis of the interview of the clinical psychologist for special needs (designed by the researcher)

Interface Design	• It is better for highly functioned ASD children to have like buttons into split page dividing main categories rather than scrolling down pages.
Fonts	• It is preferred to write the sentences in short and large size fonts.
Text	• It is recommended to write the text in a sentence maximum in a sentence and half. • If the text existed, it would be better to put above it a symbol or photo that is commonly known.
Images	• It is suggested that images existed without text or the words put to have an obvious interpretation. • It is not recommended to put text over the images either above it or under the image. • Images should be used for a reason to emphasize meaning not for decoration. • It is advocated to use images rather than text.
Voice	• It is preferred that the website to use volume control feature in order to control the volume of the voices. • If the voice used is not played suddenly or it increasing gradually, it will be appropriate for high functioned autistic people.
Buttons	• Buttons are better to be in a big size, if there is info targeting parents it should be gathered in a button targeting them.
Video	• If there is an interactive game in the website or a video, it would be better if there is a tool that gives feedback if the answer is right to show like a moving person encouraging them or clapping for them.
Structure & Navigation	• Navigation should be consistent and unchangeable • It is better to decrease the scrolling in the page • The website should go to the activities first to grab the attention of autistic child and create the motive to continue navigation in the website.

Limitations:

The research tools used in the experiment is observation and video recording as the highly functioned ASD people collaboration with this method is better as asserted in Aguiar et al. (2022) among other common participatory design features, it is challenging for people with ASD to participate in this setting. Furthermore, participant fear and anxiety often necessitate the cancellation of usability test sessions. This may be an indication of the reluctance to change that prevents persons with ASD from adjusting to atypical circumstances (such as a recording device, an unfamiliar person present, or a usability laboratory setting). It is discovered that autism user participation in active co-creative process design is typically restricted to children's observations, psychologists and specialists' interviews, and is less expressive than during the evaluation phase. Moreover, it is very complicated to obtain the sample group for the experiment in Egypt as the autistic parents are very sensitive, they refuse applying any kind of experiment on their autistic children.

Results and discussion:

The researchers implemented the experiment on 3 different educational ASD websites shown in the figures (4,5,6) on two categories: the first category is 4 highly functioned ASD children, the second category is 13 autism skills development specialists and the results are demonstrated in the tables (4 &5).

Fig. (4): Website 1Tafawq.ai is an educational ASD website in Algeria
(Https://web.facebook.com/tafawak.education/ (2022) Tafawak. Available at: https://tafawak.io/ (Accessed:
10 September 2024).

Fig. (5): Website 2 adaptedminds.com is an educational ASD global website for learning difficulties (Learn
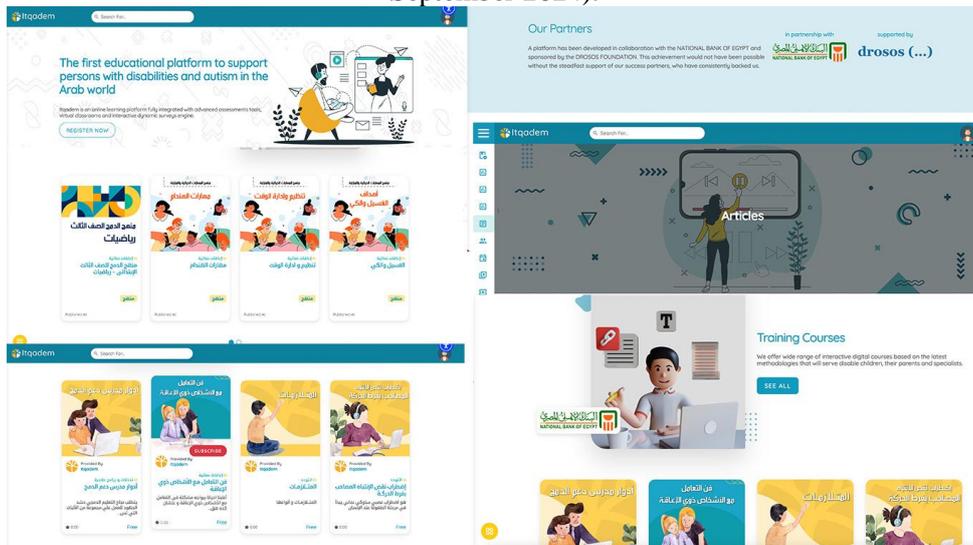K-6 math and reading (no date) AdaptedMind. Available at: https://www.adaptedmind.com/ (Accessed: 10
September 2024).

Fig. (6): Website 3 itqadem.com is an educational ASD website platform in Egypt (المنصة التعليمية الأولى لدعم
ذوي الإعاقة و التوحد في الوطن العربي(اتقدم (no date). Available at: https://itqadem.com/ (Accessed: 11 September
2024).

There is a difference between some results comparing the results of ASD children and autism skills development specialists especially in the dimension of interface design regarding website 2 in the statement of interface design is simple is 61.5% agreed on the simplicity of the interface design of the website while the result of the ASD children is 100%. 53.8% of autism skills development specialists saw that the first website contains few elements while all of autistic children saw that the first website contains few elements. While observing the sample of autistic children, the researchers found that they were not totally distracted by the presence of rich multimedia, yet the autism skills development specialists 15.4% added that it might distract them in website 1, 46% of them saw that rich multimedia is distracting in website 2, while 69.2% saw that presence of rich multimedia in website 3 is distracting to ASD children.

There was a slightly convergence in results of the dimension of images especially in the first two statements while the rest of the statements in this category is slightly different as 69.2% of autism skills development specialists saw that the second website background image is distracting and 46% in the first website saw them also distracting, while ASD children didn't see it distracting, Dattolo & Luccio (2017) recommended when using drawings, symbolic images and photographs it should be easy to understand, shouldn't go to the background and should be in a sharp focus. In the statement of transparent images are distracting 61.5% of autism skills development specialists in the first website saw them distracting, while ASD children saw it undistracting at all. It was observed that in both ASD children and specialists, it was preferred that images displayed as drawings than photographs. As in website two, the ASD children got attracted to drawings rather than photographs. On the contrary, Yavena (2016) asserted that photographs and symbols are equally suitable, so data sets from both domains could be utilized. However, refrain from using symbols which are too abstract or whose understanding requires substantial prior knowledge in a certain area.

In the dimension of fonts, there was an obvious variance in the results of statement "Moving text is distracting" as ASD children refuted the distraction of moving text, whilst the specialists saw that it was distracting as emphasized by Dattolo & Luccio (2017) that moving text should be avoided. The result of the statement "text is short "in website one and website two is a bit different from the results of the specialists. In the dimension of color, no apparent difference between the results of ASD children and specialists.

In the dimension of structure and navigation, there was agreement on the statement of ease of accessibility between ASD children and specialist, while there is a slight difference of the results in the statement of scrolling and content is minimized as in website 3 the scrolling took place in many pages. Specialists refused that interaction was consistent and predictable especially in website 2 and 3. The specialist thought that the user remembered the navigation information was 75% of users remembered it only. ASD children revealed that navigation information and buttons is at the top and at the bottom while half of the specialist refused that the buttons were at the top and the bottom mainly ion website 3.

The researchers observed that it is hard to get concrete and accurate results by applying experiments on highly functioned ASD children without the assistance of autism skills development specialists or caregivers or psychologists specialized in autism as it is hard to get what is distracting to them as they are lacking eye contact and facial expressions related to attention, In addition that they got distracted easily and they exerted a great effort in selected attention if they lose interest in the content and added that if the sentences are long they suffer to read it fast and comprehend it quickly so it is recommended to use visual elements as an assistive tool for comprehension and vision attraction.

Table (4): Answers of High functioned ASD Children in the experiment who see the statements are right (designed by the researcher)

Graphical Layout Dimensions	Statement	Website 1	Website 2	Website 3
Interface design	Interface design is simple	100%	100%	75%
	Interface design contains few elements	100%	100%	50%
	Presence of rich multimedia is distracting	0%	0%	0%
Images	Images with text exist together	100%	100%	75%
	Icons/ Images describe the context	50%	100%	50%
	Font with image is clear	100%	100%	25%

	Statement	Website 1	Website 2	Website 3
	Background images is distracting	0%	0%	50%
	Transparent image is distracting	0%	25%	50%
	Images in a sharp focus are clear	100%	100%	100%
	Images preferred to be drawing	75%	100%	75%
	Images preferred to be photographs	25%	0%	25%
Fonts	Font type/size is clear	100%	100%	50%
	Moving text is distracting	0%	0%	0%
	Headings and titles existence is clear	100%	75%	25%
	Text is short	50%	75%	50%
Color	Bright color is distracting	25%	25%	25%
	Soft tone colors are calming	100%	100%	100%
	Mild tone colors are soothing	100%	100%	100%
	Color contrast is simple	100%	100%	75%
Structure and Navigation		**Website 1**	**Website 2**	**Website 3**
Website is easy to access		100%	100%	25%
Content is minimized in the page, scrolling is minimized		100%	100%	100%
Buttons with icons & text are clear & large and easy to figure out		100%	100%	25%
Interaction is consistent & predictable like tapping, dragging, swiping		100%	100%	25%
The user remembers the navigational information		75%	100%	50%
Navigation information & buttons at the top & the bottom		75%	75%	100%

Table (5): Answers psychological specialists in ASD in the experiment who see the statements are right
(designed by the researcher)

Graphical Layout Dimensions	Statement	Website 1	Website 2	Website 3
Interface design	Interface design is simple	84.6%	61.5%	77%
	Interface design contains few elements	53.8%	84.6%	77%
	Presence of rich multimedia is distracting	15.4%	46%	69.2%
Images	Images with text exist together	92.3%	100%	100%
	Icons/ Images describe the context	23%	77%	38.5%
	Font with image is clear	92.3%	61.5%	69.2%
	Background images is distracting	46%	69.2%	38.5%
	Transparent image is distracting	61.5%	53.8%	53.8%
	Images in a sharp focus are clear	100%	84.6%	84.6%
	Images preferred to be drawing	77%	46%	53.8%
	Images preferred to be photographs	38.5%	38.5%	30.7%
Fonts	Font type/size is clear	84.6%	61.5%	46%
	Moving text is distracting	92.3%	61.5%	61.5%
	Headings and titles existence is clear	100%	84.6%	100%
	Text is short	84.6%	53.8%	77%
Color	Bright color is distracting	15.4%	15.4%	46%
	Soft tone colors are calming	100%	100%	100%
	Mild tone colors are soothing	77%	100%	100%
	Color contrast is simple	100%	100%	100%
Structure and Navigation		**Website 1**	**Website 2**	**Website 3**
Website is easy to access		92.3%	69.2%	38.5%
Content is minimized in the page, scrolling is minimized		77%	77%	30.7%
Buttons with icons & text are clear & large and easy to figure out		84.6%	61.5%	23%
Interaction is consistent & predictable like tapping, dragging, swiping		100%	69.2%	46.2%
The user remembers the navigational information		92.3%	100%	53.8%
Navigation information & buttons at the top & the bottom		100%	92.3%	53.8%

Conclusion:

This exploratory study is groundbreaking research in Egypt, it has highlighted the critical importance of tailoring UX design to meet the unique needs of children with high-functioned ASD on educational websites. By identifying and addressing key barriers such as sensory overload, complex navigation and social interaction difficulties, this research mentioned the necessity for inclusive and autistic friendly digital learning environments. The proposed design strategies, including simple layouts, consistent navigation and targeted content, aim to enhance usability, enjoyment and effectiveness of users with ASD. The findings emphasize the pivotal role of UX designers and educators in creating accessible and inclusive educational online platforms. By adopting these inclusive guidelines, we can foster a more supportive and engaging learning experience for children with ASD, ultimately contributing to their academic success and social integration. This study not only advances our understanding of UX design for ASD people but also sets the stage future research and development in this vital area. It is recommended in the future to cooperate between the designers, educators and the ASD specialists in order to enhance the effectiveness of the technologies applied in education.

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