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THE IMPACT OF SMART VISUALS SCHEDULER BRACELET AS AN INTERVENTION FOR CHILDREN WITH AUTISM SPECTRUM DISORDER-DESCRIPTIVE LITERATURE REVIEW

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The impact of Smart visuals scheduler bracelet as an intervention for children with autism spectrum disorder.

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Abstract

The thesis's focus on the integration of technology in helping autistic children, gives a gateway for other innovations to be made. The use of manually operated tools, or equipment prove to be tedious and not friendly to both autistic children and their caregivers. Before the inventions were made, monitoring and caring for children with Autism spectrum disorder was quite a challenging ordeal. Manual tools used were not friendly to children with autism spectrum disorder, hence the invention of smart visual scheduler bracelet was timely to bring the much-needed help. The aim of the study was to find ways in which the smart visual scheduler bracelet is useful to children with Autism Spectrum Disorder, and establish the benefits reaped.

In getting facts for the study, a sample of twenty articles was made in reference to the chosen topic. The application of descriptive literature review was applied in analysing the sampled articles and extract the relevant information entailed. As part of the findings, it was noted that in today's era, the application of Smart Visual Bracelet Scheduler is becoming a norm, when monitoring and caring for children with Autism Spectrum Disorder. The research is timely, due to its focus on the application of smart visual scheduler bracelet and how it is used in helping autistic children. Through the study, references can be made on the benefits of using the smart scheduler bracelet, unlike the manual systems, hence, enabling interested parties to understand the technological attributes applied.

FOREWORD

The completion of this thesis would not have been a success without the tremendous help and inspiration from many individuals who have contributed in one way or the other.

Firstly, I would like to express my sincere gratitude to my supervisors for constantly chastising, guiding, supporting and understanding me all through this research. You impute at every stage of this report cannot be overstated.

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1 INTRODUCTION

Autism is a developmental disorder which impacts the nervous system, leading to difficulties in communication, obsessive interest, social interactions and repetitive behaviours (Lofland, 2016, p.34). Children are the most vulnerable, hence there is need to come up with better ways of handling them. Children with Autism Spectrum Disorder, need help and assistance in their daily activities be it at home or in hospitals. They need to be shown love and care as a way of maintaining their self-esteem. In line with technology, many innovations have been made aiming to help autistic children manage their diversified conditions. Being abreast with innovations will be of great advantage to caregivers, nurses and even parents in custody of autistic children. The thesis based its focus on a descriptive literature review concerning the impact of smart visuals schedule bracelet are to children with autism spectrum disorder.

The electronic tool (smart scheduling Tool) can help the children to be more organized and independent, hence, reducing the workload of nurses, caregivers and parents. The tool is a wearable visual representation of daily tasks in a form of pictures, numbers and words. ASD can make it difficult for children to be aware of an environment, to understand and follow a daily routine task, especially complex tasks that require planning and staying focused. It is always tough for children with autism spectrum disorder as they struggle to manage their time, not understanding what comes next (Weir, Allison, & Baron-Cohen, 2020, p. 23). The integration of wearable devices with mobile applications has a promising potential for healthcare in general, and for behaviour change in particular, thus increasing a child's proficiency to self-help. In most case caregivers and parents spend their time organising visual conventional schedules, thereby affecting ASD children to lose their attention. Smart visual bracelet schedule can be convenient and efficient when changing and updating pictures unlike the manual tools, which are difficult to use.

Smart Visuals schedule has proven to be effective enabling children to manage their time, to organise and maintain (Weir, Allison, & Baron-Cohen, 2020, p. 25). The literature review was conducted, by finding relevant articles, related with autism, and the use of smart scheduler bracelet. Research method applied was descriptive literature

review. This entailed the review of relevant literature based on the previous researches related to the topic. Data was extracted from published scholarly articles, which were within the range of ten years that is from 2010 to 2020. The study embraced the descriptive literature method whereby information extracted from these articles was subjected to elaborative analysis. The useful nature of assistive technology whereby the smart visual scheduler bracelet is among the many tools provided a gateway of knowing how autistic children benefits.

1.1 Research Objectives

In this thesis, finding the impact of smart visual bracelet scheduler have children with autism spectrum disorder was the main target and other subsidiary aims outlined below followed suit.

(i)   To find ways in which the smart visual scheduler bracelet is useful to children with Autism Spectrum Disorder (ASD).

(ii)   To establish the benefits yielded when using the smart visual scheduler bracelet in handling children with Autism Spectrum Disorder.

(iii)   To find out how far the smart visual scheduler bracelet has been implemented.

1.2 Research Questions

Research questions provide a general outline on the type of data required as per the set topic. The questions get framed from research objectives. The study will apply the research questions stated below.

(i)   What are the ways in which the smart visual scheduler bracelet is useful to children with Autism Spectrum Disorder (ASD)?

(ii)   What are the benefits of using the smart visual scheduler bracelet in handling autistic children?

(iii)   How far has the smart visual scheduler bracelet has been implemented.

1.3 Problem Statement

Autism Spectrum Disorder has for the long-time affected children, with no permanent solution or cure found. The condition is categorised as a disability and needs to be well managed. In most cases, parents with autistic children get overwhelmed in caring for them an instance which forces some to seek an alternative at social care homes or in hospitals. These children need to be monitored carefully as per each one's condition, hence, the need to seek help. For a long time, manual systems have been in place in providing care or in monitoring the autistic individuals. This is tedious and problematic based on the attention each suffering child needs as explained by Melmed and Cubells (2016). Nurses, caregivers and even parents find it hard to always sit and monitor autistic children or even affected adults by applying manual procedures. With the advance of technology innovation has been the backbone in which devices, apps and automatic systems are being introduced. Autism Spectrum Disorder is not left behind as the introduction of smart visual scheduler has brought light in monitoring and caring for anyone with the ASD condition. This research enlightened the importance, and the effective uses of smart visuals schedule, the impact of these kinds of technologies and the need of designing assistive technologies to be utilised to their fullest in effecting independence in autistic children.

1.4 Relevance and Importance of the Research

The research's focus on the integration of technology in helping autistic children, gives a gateway for other innovations to be made. The use of manually operated tools, or equipment prove to be tedious and not friendly to both autistic children and their caregivers. Before the inventions were made, monitoring and caring for children with ASD, was quite a challenging ordeal. In today's era, some of the homes, and hospitals still apply manual procedures in monitoring autistic children. The research is timely, due to its focus on the application of smart visual scheduler bracelet and how it is used in helping autistic children. Through the study, references are made on the benefits of using the smart scheduler bracelet, unlike the manual systems, hence, enabling interested parties to understand the technological attributes applied.

Moreover, the study gives an insight to why centres taking care of autistic children need to be abreast with the advance of technology. It is always vital to know what is trending as far as caring for autistic children is concerned. The ASD condition requires extra care and being keen, all the time. This is the nature in which autistic children are in, hence, the caregivers and nurses should be ready to adhere to the call.

The research illustrates how the use of technology through the application of smart visual scheduler bracelet can help in ensuring the nurses or caregivers can monitor these children without being physically present. According to Weir, Allison, & Baron-Cohen, (2020), the use of technology has resulted in many parents, instead of taking their autistic children to social care homes they can use the smart scheduler to monitor them at home. The study provided viable benefits of having the child at home. Some of the benefits elaborated include; getting parental love, able to instil proper diet and also learning on how to live with the condition.

1.5 Theoretical Framework

The theory behind the study emanated from previous research on visual schedule interventions for children with ASD as well as a picture exchange communication system (PECS) is an augmentation communication. PECS is a theoretical and practical aspects from the areas of applied behaviour analysis (ABA) and speech and language therapy. Different models have been used over a long period to guide autistic children by helping in cognitive impairment.

Hence the mandate to promote tools to the assistance of caregivers is increasingly being recognized as a significant factor of care for children with ASD. With assistive technology the ASD children are able to practice all aspects of liberty and to access excellent quality, which is culturally reasonable health and social care, as it promotes recuperation. This leads to attaining the highest possible level of health and participating fully in society and at work, free from stigmatization and discrimination.

The meaning of Visual Activity Schedules and the difference between the paper visual and smart visual will be enumerated. For instance, the importance of visual supports, types of behaviours addressed using visual schedules. The study will enumerate previous studies on the uses of smart visual bracelet intervention as against the traditional picture therapy, whether there is an improvement in independence with the use of this intervention.

2. REVIEWS ON THE IMPACT OF SMART VISUALS SCHEDULER BRACELETS ON CHILDREN WITH AUTISM SPECTRUM DISORDER

Autism, is disability condition which affects the nature of communication and interacting. Children or adults suffering from such a condition gets it tough to carry out normal activities alone. They need care and close monitoring all the time. The use of technology can be of good help so that the monitoring can be done from any location without being close to the individual.

The Autistic spectrum disorder, can be termed as a developmental disorder due to its impact on the growth of children (CDC, 2016). It is obvious that with increased use of manual systems in managing and caring for autistic children, the nurses, parents and caregivers experience many challenges prompting to disorient their daily programs. In a recent review about the global prevalence of Autistic spectrum disorders, by Centres for Disease Control and Prevention, the estimation of children diagnosed with ASD is one in every sixty-eight. With the prevalence to be 1·5% increase in developed countries (CDC, 2016). According to current finding done about (1 in 59) increase in the diagnosis of Autistic spectrum disorders in United States. Which is estimated to 62 out of 1000 in the spectrum (CDC, 2016). Due to the increasing prevalence of ASD, it has become imperative for it to be classified as a public health emergency and the need for effective intervention for this. In often time children with ASD usually experience difficulty dealing with daily information challenges during the processing of

information, organising, planning and managing the transition to multiple tasks daily routine. However, because of the increasing number of children being identified as having ASD in various countries all over the world, it is apparent that the need for effective intervention for ASD to be examined, so that appropriate support services will be given (Sait, et al. (2019). With the development of assistive technology and visual possibilities, it may help change autistic children's lives and transform how they think hence increasing their independence (Weir, Allison, & Baron-Cohen, 2020). It is always great to have a conducive environment where, these children can be happy without being subjected to any external stress. Sait, et al. (2019) presents an interesting example on how technology is fruitful in handling children with autism spectrum disorder.

The advance of technology has facilitated an upsurge of wearable and mobile inventions helping to monitor and care for autistic individuals, especially children. Frauenberger, Good, & Pares, (2016), article gives an insight on the use of technology to help people with ASD. The authors point out that in coming up with an invention or innovation to help autistic individuals, it is proper to focus on their functional limitations. Every autistic child has a different disability hence there is a need to have diversified attentions, whereby, the wearable and mobile technologies developed should focus on the particulars.

In developing assistive technology for Autistic children, adults Abdallah, et al. (2019), points out to the user-centred design (UCD) and the vocal communication tool (VCT). The article illustrates that the user-centred design is applied to Autistic children, whereby an interactive platform is created between these children and caregivers, parents, teachers or any interested party. With the vocal communication tool (VCT), the authors point out that, an adult with autism spectrum disorder can be able to communicate with his or her family or caregiver, hence making it conducive for any form of sharing. All these portrays the innovations made in support of individuals with autism spectrum disorder.

3. METHODOLOGY

Methodology refers to research steps right from data collection, analysis to report presentation (Mohajan 2018). Various methods, procedures and processes are also part of showcasing how raw facts gathered get changed to meaningful information. In the section, detailed steps are outlined portraying how the research was handled.

3.1 Research Strategy

Literature review is one of the many methods applied in extracting varied facts from secondary sources to conceptualize surveys and research areas prior to conducting a study. There are different methods which can be used in conducting the literature review, they include; narrative review, meta-analysis, and descriptive review. Each of the methods above has its own merits and demerits as far as data extraction and presenting is concerned as portrayed by Mohajan, (2018).

The narrative review method is considered to be the oldest and it skews towards qualitative interpretation of literature. Past studies, and articles, get verbally described under this method even though there is no standard procedure applied. Narrative review depends on the researcher's preference thus making this method to be vulnerable to subjectivity. Meta-analysis method focuses on analysing quantitative facts which have been collected statistically. More specifically meta-analysis gears towards examining how dependent and independent variables relate to each other. And lastly descriptive review focuses on interpreting and drawing insights from existing literature. This method has a systematic procedure which is applied to get the much needed facts. The procedure begins with searching for the articles, filtering and then lastly classifying (Mohajan, 2018).

Based on the targeted facts concerning how useful the smart visual scheduler bracelet is to ASD children, a descriptive literature review method was of value. Articles and databases were scheduled to be searched and filtered in getting the right data for the topic under investigation.

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3.2 Search Protocol

The search for literature about ASD and the use of technology was done through Finna (Finnish database), Science Direct, PubMed and ProQuest. The search entailed articles within the range of seven to ten years counted from the current year. The use of smart visual scheduler bracelet is a current trend and it has come due to innovations and brainstorming on ideas. There is a possibility that it never emerged long ago, but it has happened in recent years. The use of assistive technologies on people and children living with ASD condition is the main target defined in the research. Keywords and abstracts formed the main features to consider, when finding relevant articles as far as ASD and the use of smart visual bracelets were concerned. The search of articles in these databases made the use of keywords such as smart visual bracelet, assistive technology to ASD individuals and wearable technology. Articles were reviewed to assess if they had the much needed information.

3.3 Filtering Process

The combination of Finna, ScienceDirect and ProQuest databases made it possible to come up with the relevant articles as per the topic. In addition, the PubMed database was also applied in finding articles with information concerning the impact of smart visual scheduler bracelets to children with autism spectrum disorder. The number of articles sampled was twenty-five. All of them were subjected to filtering processes and only twenty remained for analysis.

The filtering processes was conducted in two rounds to find the most appropriate articles befitting the study. In the first round, the article titles were manually scanned to get rid of irrelevant ones which did not align or relate to "How Useful Smart Visuals Scheduler Bracelet are as an Intervention for Children with Autism Spectrum Disorder". In this case one article was excluded and twenty four remained. In the second round the abstracts and full text of articles were manually scanned with the intention of excluding those which did not address the issue of useful nature of smart,

visual scheduler bracelets to ASD children. A total of four articles were excluded. Only twenty articles which remained as they passed the criteria set for filtering.

After the filtering process, the articles were classified based on the study focus and information they contained. The information gathered was stored awaiting analysis.

3.4 Research Design, Methods and Ethical Considerations

Research design is a strategy applied in a study to coherently and logically integrate collected and analysed data with an aim of yielding the deeper meaning as depicted by Mohajan, (2018). This research made use of qualitative method, whereby the focus was on secondary data sources, which included article and databases. This was done by applying the descriptive review method.

The study employed qualitative research method in which secondary data sources, (published articles) were the main target. The use of qualitative method was fit for the study due to the nature of focusing on previous researches, databases and articles, for data extraction. Taking a notch on secondary data, was because research had already been carried out and credible conclusions made, hence, it was easier to extract facts and it saved time.

The research embraced high levels of ethics so as to avoid legal problems. Based on the focus on published articles, referencing them was made to avoid plagiarism instances. Without paying attention to referencing these articles, violation of the research standards was to be recorded and thus attract fines, making the whole study to fail.

4 RESULTS

4.1 Distribution of articles by purpose and method

The sampled articles with information on the usefulness of smart visual scheduler bracelets were subjected to data extraction. Meaningful facts were obtained and then elaborated to give the thesis a base. This section entails the analysis of the extracted data and how relevant it is to the ASD children and their caregivers. A total of twenty articles were analysed based on the year of publication, primary contribution, and publication outlet. The table 1 below gives an outline of the sampled articles.

Table 1. Distribution of articles

Author/s	Publication Year	Purpose of the article	Methods used
Abdallah, W., Vella, F., Vigouroux, N., Van den Bossche, A., & Val, T.	2019	Gives details about Assistive Technology for People with Autism Spectrum Disorder	Qualitative interviews of conference attendees.
Artoni, S., Bastiani, L., Buzzi, M. C., Buzzi, M., Curzio, O., Pelagatti, S., & Senette, C.	2018	Technology-enhanced ABA intervention in children with autism: a pilot study	Qualitative Interviews of ABA experts and parents of autistic children.
Frauenberger, C., Good, J., & Pares, N.	2016	Autism and technology: beyond assistance & intervention	Weigh opinions from interviewing those who were present in one-day workshop
Haroon, M.	2019	Interventions for Autism in Children and Adults.	Quantitative research

Koumpouros, Y. and Kafazis,	2019	Wearables and mobile technologies in Autism Spectrum Disorder interventions:	Descriptive Literature Review
Lofland, K. B.	2016	The use of technology in the treatment of autism	Summarising qualitative interviews of IT experts
Mohajan, H. K.	2018	Qualitative research methodology in social sciences and related subjects	Qualitative extraction of views from secondary sources such as articles
Sait, M., Alattas, A., Omar, A., Almalki, S., Sharf, S. & Alsaggaf, E.,	2019	Employing Virtual Reality Techniques in environment adaptation for autistic children	Descriptive studies
Waseem, M. M. V. E. J., Afzal, B., & Ashraf, S. F. T.	2019	A case study: impact of Internet of Things devices and pharma on the improvements of a child in autism	Summary from the Case study
Weir, E., Allison, C., & Baron-Cohen, S	2020	Autism in children: improving screening, diagnosis and support.	Interviewing medical practitioners
Shukla, J., Cristiano, J., Oliver, J. and Puig, D.,	2019	Robot Assisted Interventions for Individuals with Intellectual Disabilities: Impact on Users and Caregiver	Summary of opinions from qualitative interviews on caregivers

			making use of robots
Goodall, C.,	2019	Understanding the Voices and Educational Experiences of Autistic Young People	Summarising reviews from interviews carried on young people (respondents)
Sharmin, M., Hossain, M.M., Saha, A., Das, M., Maxwell, M. and Ahmed, S.,	2018	Informing the design of autism support smart technology.	Interviewing of attendees of CHI(Conference on Human Factors in Computing Systems)
Melmed, R.D. and Cubells, J.F.,	2016	Autism spectrum disorder. In Health Care for People with Intellectual and Developmental Disabilities across the Lifespan	Quantitative extraction of data from secondary sources.
Britto, J. and Kalbande, D.R.,	2017	Analysis of technological advances in autism.	interviews of participants in the International Conference on Inventive Computing and Informatics (ICICI)
Grynszpan, O., Weiss, P.L., Perez-Diaz, F. and Gal, E.,	2014	Innovative technology-based interventions for	Facts from a meta-analysis.

		autism spectrum disorders	
Knight, V., McKissick, B.R. and Saunders, A.,	2013	A review of technology-based interventions to teach academic skills to students with autism spectrum disorder	Qualitative data extraction from Autistic journals
Shane, H.C., Laubscher, E.H., Schlosser, R.W., Flynn, S., Sorce, J.F. and Abramson, J.,	2012	Applying technology to visually support language and communication in individuals with autism spectrum disorders	Qualitative data extraction from Autistic journals
Reed, F.D.D., Hyman, S.R. and Hirst, J.M.,	2011	Applications of technology to teach social skills to children with autism	Interviewing caregivers and parents
Lahiri, U., Bekele, E., Dohrmann, E., Warren, Z. and Sarkar, N.,	2012	Design of a virtual reality based adaptive response technology for children with autism	Quantitative data extraction of analysed facts on articles and databases

Based on the table above, the sampled articles were organized in such a way that it was easy to extract the much needed information. These articles were drafted as a result of; empirical studies, collecting opinions from attendees of conferences, summary of interviews, meta-analysis and descriptive literature reviews. The authors centered their focus on autistic children and the application of technology to simplify the work of caregivers, parents and even teachers. Also, the table entailed the name of authors, year of publication and the method of applied in getting facts for the articles.

4.2 Publication Year and Outlet

The inclusion criteria for sampling articles was that they should have been authored within 2010 to 2020 (current year). This period was seen as appropriate since many of the technological trends were being witnessed. The inception of developing smart visual smart scheduler bracelet came by as a result of the challenges encountered by caregivers of autistic children. Moreover, the year between 2010 and 2020, was when there was active involvement in finding out how technology is applied to enable ASD children perform tasks independently. The figure 1 below gives an illustration of the articles sampled and the year they were published.
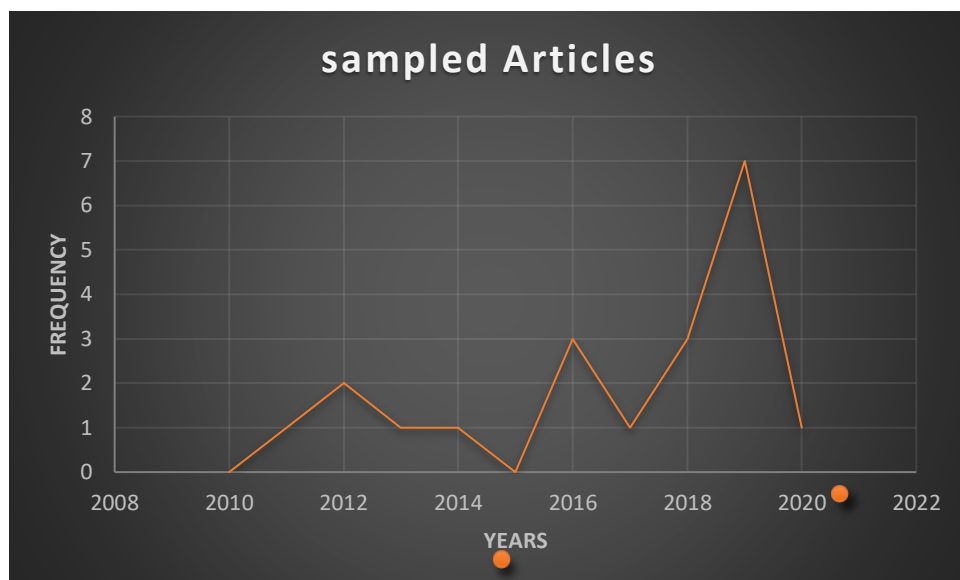

Figure 1. Bar chart portraying the year sampled articles were published.

Based on the bar chart displayed above, as per the analysis done, the number of articles reviewed in 2019, echoing the use of technology in trying to come up with a solution to help autistic children was high. As per the chart, 7 articles published in 2019 were selected, followed by 2016 which had 3 articles, 2012 with two articles, and the rest of the years had 1 article each except 2010 and 2015 which had none selected.

The publication outlets of articles were analysed. Based on the information gathered, the articles were chosen from scientific journals, conference proceedings, workshop reports and case studies reports. As per the findings, 8 articles were from journals

translating to 40%, conferences had 7 totalling to 35%, case study reports were 2 articles reflecting 10% and 3 were from workshops repots totalling to 15%.

4.3 Ways in which smart visual scheduler bracelet is useful to children with autism spectrum disorder

The use of assistive technology in people with various disabilities is becoming common, hence the development of the smart visual scheduler bracelet is listed to be among the many. Children with Autism Spectrum Disorder do not understand the surrounding environment; hence, it is difficult of them to make valid and sound decisions (Weir, Allison, & Baron-Cohen, 2020). But with the help of assistive technology, they become more aware of the environment and can respond appropriately depending on the device being used. Based on Abdallah, et al. (2019), assistive technology proves to be of great value as individuals with disability are able to carry out tasks which in normal cases are considered for people with no physical or mental challenges. The application of technology is closing the gap of categorising people with disability as not being fruitful.

According to Koumpouros, & Kafazis, (2019), there is need to utilise wearable and mobile technologies in coming up with applications targeting ASD-related interventions. The authors depict the need to focus in finding solutions for the real world and not controlled environments. The application of artificial intelligence and credible computing adds value in line with the inventions made to help children affected with autism spectrum disorders.

4.4 Benefits of Smart Visual Bracelet Scheduler

As per the Frauenberger, Good, and Pares, (2016), it is evident that the smart visual bracelet scheduler is of great value to autistic children. The bracelet is a wearable device with which the ASD children always put on. The great extent of keeping a close eye on them is no longer of much concern. Caregivers, parents and even nurses have freedom to engage in other duties since the smart visual bracelet simplifies much of

their work (Shukla, et al. 2019). The mobility and wearable nature of this bracelet brings forth an aptitude of them being easy to carry and at no point the children be perturbed while doing their daily activities. Caregivers, parents and nurses need not to be present with autistic children but rather monitor their movements. Whenever there is a problem, there is a signal sent to the caregivers or parents smartphones and immediately, the location details are follow making it easy to offer help. Technology has proved to be of value to children with ASD an instance which brings long term solution to the hard task of manually monitoring them. The innovation part of it as described by Grynszpan, et al. (2014), gives room for other assistive devices to be made with an intention of helping children with ASD cope up with the surrounding environment and also be aware of themselves.

Increased independence among children with Autism Spectrum Disorder is another way the smart visual scheduler bracelet will remit. According to the information by Goodall, (2019)., technologically innovated devices give hope to ASD children who in turn do not require much assistance in doing tasks, and participating in activities. By having this wearable mobile device, the children with Autism Spectrum Disorder can freely engage in anything of their choice. The caregivers, parents or nurses cannot fear of them getting hurt or being subjected to any danger (Shane, et al. 2012). The devices are made in such away, that these children are aware of the surrounding environment. With independence, the autistic children will be able to enjoy and have fun, hence making them see life differently. The condition should not limit anyone not to be happy. The adoption of a wearable and mobile device such as the smart visual scheduler bracelet gives hope to these children making them forget their condition as they get involved in every activity with less assistance.

4.5 Implementation of smart visual scheduler bracelet

Getting intervention doesn't have to involve a trip to the hospital, with the help of smart visual bracelet and smart assistive tools, people with autism spectrum can get the help they needed to improve their social and cognitive impairment (Britto, and Kalbande, 2017). Smart Visual bracelet scheduler are a display of planned activities that gives

constant images about the scheduled activities for the day to those on the autism spectrum, so they know well in advance what they need to do. The visuals might be in the form of words, pictures, photographs or icons, and they come in the manner in which they will occur (Haroon, 2019). Schedules act as reminders of the day's events, preparing for activities and transitions and providing the learner with a basic structure, which will decrease anxiety and help better one's self-esteem. As per Knight, McKissick, and Saunders, (2013), the smart visual bracelet scheduler can represent an "in task" sequence, in which each step of a procedure is displayed, or, a "between tasks" sequence, in which the cards represent the day's activities.

Early detection of autism in children prepares parents on what is best and of value in controlling or providing guidance, (Lahiri, et al. 2012). It is good to know and understand children well. If they are autistic, then an appropriate action is taken to help them in curing with the challenge.

5. DISCUSSION

The findings from the sampled articles point towards how technology is of great help to children with ASD. The development of a wearable device, named the smart visual scheduler bracelet comes along with the full package of making life easy for children with Autism Spectrum Disorder (Melmed and Cubells 2016, p.1497). The use of manual systems are not equally up to the task based on the many demerits associated with them. For instance, caregivers making use of manual systems will not be at position of monitoring many autistic children at ago (Reed, Hyman and Hirst 2011). Also, a close monitoring and regular checking on these children is necessary since they cannot independently get involved in any sort of activity. According to Lofland (2016), the manual methods prove to be tedious and not helpful with the vast and diverse advance of technology.

According to autism speak .org, describe assistive technology as any equipment or thing that can be used to boost, strengthen or assist to effective capabilities of a person with disabilities. In accordance with the vision of the WHO Resolution on autism spectrum, such individuals need to exercise the full range of human rights and access high quality healthcare in promoting recovery. This is in order to attain the highest possible level of health and participate fully in society and at work, free from stigmatization and discrimination (Sharmin, et al. 2018). A smart visual bracelet scheduler can be very empowering for autism spectrum disorder increase the ability of a person to perform daily activities and partake in society and also has positively influenced a person's educational and social achievements by improving possible independent strength skills.

Waseem, Afzal, & Ashraf, (2019), uses a case study to elaborate about the application of technology to children living with ASD. This is a practical example through which the importance and usefulness of technology has been revealed. The authors account for a young boy by the name Muhammad Mujtaba Javaid, who was diagnosed with ASD when he was two and half years. His parents allowed him to make use of IoT (Internet of Things) devices in overcoming the Autism challenge. This is a true aspect on how smart visual scheduler bracelet positively impacts children with autism spectrum disorder.

An article by Artoni et al, (2018) gives an account on ICT usage on Applied Behavioural Analysis (ABA). Technology based rehabilitation for children with autism gives an outstanding result unlike the use of traditional manual centred attributes. The article highlights that the development of a system to involve ABA experts and parents, teachers or caregivers to autistic children was developed, bringing an elusive and conducive environment which spearheaded learning.

Sait, et al. (2019, pp.56) gives an in-depth account on the use of virtual reality techniques (VR) in handling children with autism spectrum disorder, especially in schools. The authors describe the use of virtual reality as a technique saving time and cost in providing or creating real environment for children with autism condition. As per these authors, their article gives an insight on how the country of Saudi Arabia

struggles to incorporate a friendly environment for Autistic children to enjoy too. But with the introduction of VR, learning is made easy as the environment created befits ASD children who find it appealing to get education. The VR applies simulation of a combined computer graphics that make learning interesting for these children. The support of making use of these technology is suitable to social care homes and even hospitals.

7 CONCLUSIONS

7.1 Summary of Key Findings

In summary, the study focused in finding out how smart visual scheduler bracelets benefited children with Autism Spectrum Disorder. The application of this technologically developed device could be of help to caregivers, parents and nurses who take time to manually monitor autistic children and also in guiding them on various aspects (Waseem, Afzal, & Ashraf, 2019). The incoming of the device meant the shifting from manually methods to automatic and less tedious ways of ensuring autistic children are controlled and monitored. In getting the information, about the idea of developing the smart visual scheduler bracelets, a sample of twenty articles published within the years 2010 and 2020 was used. Information collected pointed to how vital and useful the smart bracelets are to both children with ASD and those monitoring them. Some of the benefits echoed include; the children will independently carry out various tasks or participate in activities, caregivers will have plenty of time to do other chores without any problem, and it is possible to monitor many children with Autism Spectrum Disorder at ago since the device is automatic (Frauenberger, Good and Pares 2016). The tedious part of the manually applied methods will be eliminated and thus technology is fruitful in ensuring children with Autism Spectrum Disorder enjoy like any normal children.

The purpose of this literature review was to; explore the usefulness potency, promote the use and benefits of Smart Visual Bracelet Scheduler and further reviews of the wearables technologies to adequately analyse how they can effectively contribute to improving the lives of children with autism spectrum disorder in a more self-regulating strategy towards independent transition of daily routines.

7.2 Limitations and Suggestions for Further Study

The use of primary data through interviews or using questionnaires could have added weight to the study, but the Covid 19, measures could not allow. The use of theoretical work together with first-hand information could have been the best option. The restrictions put in place by the government of stopping the spread of Covid-19 prevented the collection of original facts. Among the measures put in place was the social distancing which translated to prohibit any meetings, social gatherings or conferences. This led to closure of many business leaving out essential service providers only like hospitals. Also no one was allowed to get into the autism foundation centres to collect data. The use of articles in getting information about smart visual bracelet scheduler sounded meaningful and it made it easy to continue with the study. The Corona Virus Pandemic has not only affected our country but the whole world setting confusion due to the high number of people getting infected and others dying. It could have been risky to neglect the measures put in place to curb and stop the pandemic from spreading with a notion of carrying out the primary data collection exercise.

For effective and efficient data gathering, the application of primary data collection is fundamental as original facts get collected. This prevents the dependence on secondary opinionS. Original facts bring forth the real issue at hand and presents the desired answers to research questions. In future when the pandemic is over, the application of primary data collection is vital and should be considered.

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