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**THE USE OF KNOWLEDGE BASE VIRTUAL ASSISTIVE SYSTEM AS AN EFFECTIVE STATISTICS SIGNS AND SYMBOLS TEACHING STRATEGY FOR THE EARLY-CHILDHOOD EDUCATION OF STUDENTS WITH LEARNING CHALLENGES.**

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**ABSTRACT**

*The use of Information and Communication Technology (ICT) based virtual assistive technology in education is nothing new, but the question is where the limit is when the use of ICT does not have the desired effect, classroom delivery with the use of modern technology is still very low in Nigeria. From the report of World Health Organization (WHO) and World Bank (2011), physically challenged persons carry a significant proportion of the world's population, about 15%, as a result of differences in educational standard to the normal individuals; they are rarely seen as contributor to productive human capital development of the Society. Most of the Learning Challenged students have little access to education, this is as a result of several challenges they face in learning and comprehension. And Statistics is one of the most difficult subjects for this category of students to learn and understand at the early childhood level of Education. Most schools curricula were developed without considering the fact that, different categories of students including people living with learning challenges will also make use of them. This paper focuses on the use of knowledge base virtual assistive system as an effective Statistics signs and symbols teaching strategy for the early-childhood education of students with learning challenges. This research work was carried out in one of the government school for handicap children in Nigeria. From the cognitive ability*

*testing of the research, it was discovered that the students learn faster and easier with the use of ICT base virtual reality than normal classroom learning. As a result of this, this paper also compared the level of efficiency of the ICT base virtual reality over normal classroom learning for these categories of Students. The paper also explains different learning strategies that could promote learning ability of students in this modern age.*

**Keywords:** *Learning Challenge, Statistics signs and symbols, Virtual Reality, Assistive Technology, ICT, Teaching, Learning, Knowledge base.*

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## INTRODUCTION

Learning challenges affected persons find it difficult to learn and comprehend fast (Radka and Petr, 2016); as a result of this challenge, the need for assistive technology to enhance their learning ability is imperative. The use of information technology (ICT) in education is nothing new, but the question is where the limit is when the use of ICT does not have the desired effect. Statistics, Science and Technologies' classroom delivery with the use of modern technology is still very low in Nigeria. This brought a draw back in quality teaching and learning production. The use of ICT based Virtual Reality is a powerful technique for effective teaching of the Learning Challenged persons in different fields including Statistics. In the paper we discuss the restoring quality teaching and learning in education with the use of ICT based virtual assistive technology in delivering Statistics classroom teaching for the learning challenged students. The learner to learner relationships in a classroom is an essential element of education. Learning and participation with the use of ICT Based Virtual Assistive Technology help to promote learning ability of the Learning Affected persons. The success of ICT Based Virtual System use in Statistics depends on how they incorporated into curriculum and how teacher use it. The most appropriate use of ICT Based Virtual Reality seems essential for those that use them for supplementary tools for classroom instruction and laboratory. Multimedia supported, highly interactive, collaborative ICT Based Virtual Reality appealing growing interest because of their potentials to supplement constructivist learning. They offer inquiry environments and cognitive tools to scaffold learning and apply problem-solving skills. ICT Based

Virtual Assistive Technologies are good tools to improve students' hypothesis construction, graphic interpretation and prediction skills. The literature review also implied that ICT Based Virtual System have potential for distance education laboratories. In Nigeria, education has been challenged with the promise of educating all children. Fulfilling this promise may require more innovative use of computers. In fact, computers have been used in teaching and learning for several years.

### **Clinical description of Learning Affected Persons**

From the report of Learning Disability Rights Service Inc. (2009), Intellectual challenge is a disability which occurs in the developmental period of life that is before the age of 18, and is characterised by below average intellectual functioning. Most people with learning challenges were born with the disability. Significantly sub-average general intellectual functioning is defined as approximately 70 IQ or below as measured by a qualified psychological examiner on individually administered, nationally formed standardized measures of intelligence.

Clinically, and for the purposes of proving that a person has Learning disability, Learning disability is best assessed by a psychologist as:

- a. an IQ of 70 or under.
- b. deficits in at least 2 areas of adaptive behaviour, that is:
  - i. Communication
  - ii. Self-care
  - iii. Home living
  - iv. Social skills
  - v. Self direction
  - vi. Leisure and work
  - vii. Learning.

In clinical terms, Cognitive Impairment is often defined in terms of the severity of the disability.

**Table 1 Clinical description of Cognitive Affected Persons**

<b>Level of disability</b>	<b>% of people with Cognitive Challenge</b>	<b>IQ</b>
<b>BORDERLINE</b>		<b>70-75</b>
<b>MILD (Educable)</b>	75%	<b>55-70</b>
<b>MODERATE (Trainable)</b>	20%	<b>30-55</b>

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<b>SEVERE dependent)</b>	<b>(Totally 5%</b>	<b>under 30</b>
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Source: (IDRS Inc. 2009)

People with Cognitive affected Person have little or no access to education due to reasons as:

- a. poor societal perception of persons living with disability
- b. poor funding
- c. policy instability
- d. lack of commitment
- e. curriculum development and

## LITERATURE REVIEW

Anna *et al.* (2021) examined barriers and facilitators to implementation of a guideline for school-aged children with feeding difficulties. It was discovered from the work that swallowing difficulties are common and complex in children living with physical, behavioural and cognitive challenges. This study describes mealtime management and also observes barriers and facilitators to the implementation of a guideline for school-aged children facing feeding difficulties in a selected special school.

Allyson *et al.* (2021) worked on the impact of physical activity and sport programs on community participation for people with intellectual disability: A system review. The work examined the impact of involving in an intentional physical activities or sports on community involvement and inclusion for individuals with intellectual challenges. Among the papers searched for intellectual disability, intentional physical activities and community participation, nine were eligible reporting on seven unique studies conducted in North America, Europe and Australia. It ranged from Special Olympics to exercise and health education program. The selected programs involve substantial commitment of people and infrastructural support people living with intellectual disability in international physical activities.

Marieen *et al.* (2021) worked on examined the validity of an instrument that assesses functional abilities in people with profound intellectual and multiple disabilities: Look what I can do. The work observed data from the Behavioral Appraisal Scale (BAS) using two studies ( $n=25$ ;  $n=52$ ) were analyzed with the use of oblique multiple group method. Both the scale structure and ordering

were compared in two groups. Then, convergent validity was assessed by correlating scores on the BAS with scores on two other instruments. The results generated support the construct validity of BAS.

Ojuope *et al.* (2021) worked on developing ICT base virtual assistive system in Sub-Sahara African indigenous language Yoruba language option to promote virtual collaboration ability of Intellectually Challenged Yoruba ethnics living in rural communities for sustainable development during the COVID 19 lock down. They affirm that the inception of COVID 19 Corona virus pandemic disease has brought about the challenge of using Information and Communication Technology (ICT) in teaching and learning systems. The use of ICT in education is no longer a new idea, but the question is where the limit is when the use of ICT does not have the desired effect, most especially on the Intellectually Challenged individuals that cannot read and write in English Language. Most systems were developed without considering the fact that, there are different categories of users including people living with disabilities. Base on this, developing ICT base virtual applications in Yoruba Language option that will encourage the virtual learning ability of these individuals during the COVID 19 pandemic outbreak is highly imperative.

Ojuope *et al.* (2021) worked on the effective strategies of virtual teaching methodologies and the challenges of quality science and technology teachers of Intellectually Challenged in Africa continent in the fast-moving world during the COVID 19 lock down challenges. They established the fact that the pandemic crisis of COVID-19 brought big challenge which makes E-learning to become the mandatory component of all educational institutions like schools, colleges, and universities in and around the world. This challenging situation has flipped out the traditional teaching process and adopts virtual system of teaching and learning. The use of virtual teaching methodology during this COVID-19 pandemic provides an effective teaching method that brings out the best in students living with physical challenges. The paper focused on the effective strategies of virtual teaching methodologies and the challenges of quality science and technology teachers of the intellectually challenged in Africa continent in the fast-moving world during the COVID 19 Lock down challenges. This will enhance the learning ability of this category of Students during this COVID-19 lock down and also motivate their desire to learn.

Muktikanta and Angeline (2008), Worked on making web application operable by physically and mentally challenged users. The research work addresses some key recommendations of WCAG 2.0 and how to wricode which is compliant with the guidelines. For example, when a site is coded with semantically meaningful HTML, with textual equivalent, provided for images and with links named meaningfully. Many users who have disabilities need more time to complete tasks than the majority of users. These kind of users should be provided with enough time to read and use content. It was concluded that the basic concept behind web site operability is that everybody should be able to use the tools and mechanisms required to operate the web site.

Oksama (2013), Worked on the peculiar features of training program interface design developing for children with mental retardation. Recent changes in the system of preschool education affected the content of remedial developmental education of children with Cognitive Impairment. The ability of computer to produce the information simultaneously in the form of text, graphic images, sound, and voice, video to remember and to process data with great speed allows data to be processed with great speed, which will allow the development of multimedia training programs for children with Cognitive Impairment.

### **Research Gap**

Several related articles were reviewed on this paper, and we discovered that:

- Most of them did not address the area of Learning Challenge in terms of the use of ICT base assistive virtual reality.
- Most of the reviewed works did not solve the problem of Study inclusion of these people for economic growth and sustainable development.

### **METHODOLOGY**

This section analysed the difficulties faced by the Learning Affected persons in participate in learning Statistics. From the research carried out by the author of this paper in Home School for Handicapped Children, Ibadan, Oyo State 2018, four students of the school were tested with the use of ICT base Virtual Assistive System to teach Cognitive impaired students. It was discovered that the students performed better with the use of ICT than normal class room learning. From the interview conducted with the staff of the school, it was discovered that, these people have little or no access to education due to poor curriculum development.

The curriculum does not favour this category of students due to their level of IQ. Developing a curriculum that can promote their learning ability is highly imperative; this will enhance study inclusion of these people and further promote job creation. Learning challenge is significantly sub-average general intellectual functioning which exists concurrently with deficits in adaptive behaviour that adversely affects educational performance and originates before age 18. Learning Impairment does not include conditions primarily due to a sensory or physical impairment, Amyotrophic lateral Sclerosis (ALS), traumatic brain injury, autism spectrum disorders, severe multiple impairments, cultural influences or a history of inconsistent and/or inadequate educational programming (Braithwaite and Mont 2008).

### **Economic and social impact of enhancing the Learning Ability of the Learning Challenged through ICT base Virtual Assistive Technology.**

Individuals living with Learning Challenges have little or no access to education resources that drives economy based on:

- poor societal perception of persons living with disability
- poor funding
- policy instability
- lack of commitment
- curriculum development and
- focusing on resources base economy rather than knowledge base economy.

National Council on Disability (NCD) (2011) submitted that the power of learning inclusion pave way for high job opportunities in the society and digital barrier has brought about low employment among people with disabilities. Manipulation of information has pave way for job creation for people with disability; it gives opportunity for this category of users to work alongside non-disabled people. Consequently, the job opportunity rate of persons with disability still remains extremely low (fig.1). Development and improvements in assistive technology can go a long way to bridge this gap. Information society is being built on technology, knowledge and intelligence; appropriate use of the knowledge by people with Cognitive Impairment contributes to economic and

social development. Information technology facilitates fast, cheap, equitable, and resource efficient; access to information, adequate research for learning opportunities become a support tools for job creation and sustainable development.

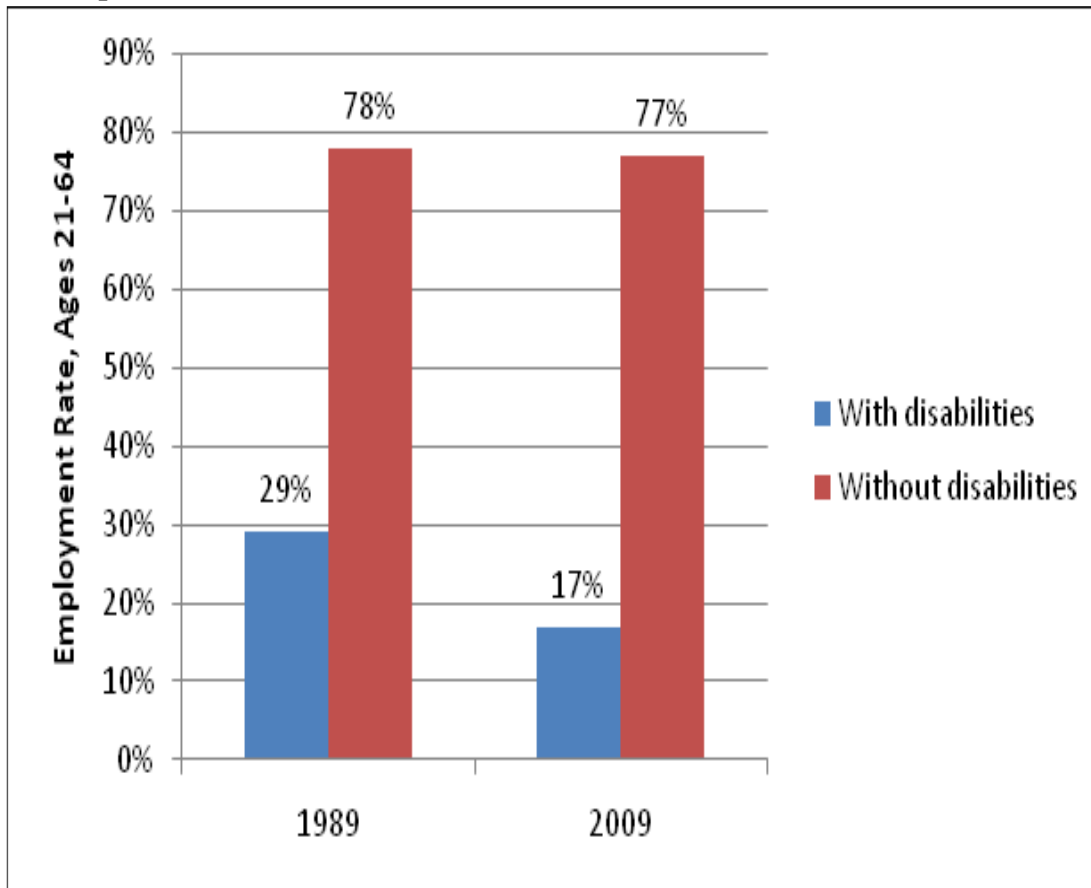


Figure 1: Comparing Employment Rates, 1989 and 2009. Source NCD 2011

### Elementary Statistics signs and symbols and the use of ICT based virtual assistive system.

Statistics is one of the most difficult subjects for the elementary students as a result of its signs and symbols. The learning challenged students find it difficult to learn this signs and symbols and comprehend. When we carried out this research work in one of the government school for handicap children in Nigeria, it was discovered that the early childhood education children with learning challenges can learn elementary statistics signs and symbols easier with the use of virtual assistive technology.



Table 2 Elementary school class population statistics  
Elementary school class population statistics

	Nurse ry 1	Nurse ry 2	Prima ry 1	Prima ry 2	Prima ry 3	Prima ry 4	Prima ry 5
<b>Populati on</b>	7	10	12	11	10	9	11
<b>Tally</b>							

From table 2, it can be seen that the learning challenged students would find it easy to learn and comprehend the school population with the use of pictures as tally. Building it on virtual assistive system will encourage their learning ability.

**Mean (Average) Population**

$$\bar{x} = \frac{\bar{x}_1 + \bar{x}_2 + \bar{x}_3 \dots + \bar{x}_n}{n}$$

Formula values  $\bar{x}$  is mean  
 $\bar{x}_{1,2,3,n}$  is the population  
 $n$  is number of occurrence  
 (classes) which is 7

$$\frac{\text{Total population}}{\text{Number of occurrence (classes)}} = \frac{7 + 10 + 12 + 11 + 10 + 9 + 11}{7} = 10$$

From table2, using virtual system to calculate the mean value for learning challenged students will make it more efficient for them to learn and comprehend.

### Median (Middle population)

The median can be selected by arranging the class population in ascending or descending order.

7, 9, 10, 10, 11, 11, 12

From the set of population, the median (middle population) is 10.

### Mode (class with highest population)

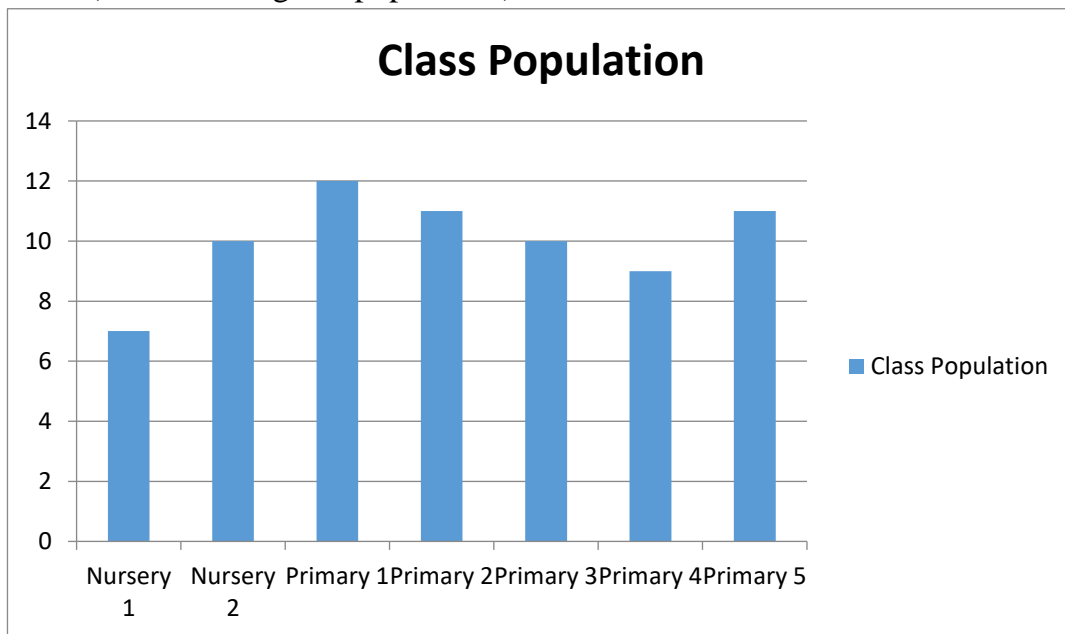


Fig. 2 Elementary class population

From fig.2, learning challenged student will not find it difficult to select class with the highest population. As we can see from the chart, the mode is 12, which is primary 1, class with the highest population.

From table 2 and figure 2, it is very clear that the use of knowledge base virtual assistive system as an effective teaching strategy of statistics signs and symbols for early-childhood education of students with learning challenges can be of a great advantage. And it is highly imperative to embrace this as teaching strategy for these categories of students.

### The challenge of disabilities in the sustainable society

The 2011 World Report on disability presents that approximately one in seven of the world's population, over one billion people are persons with disabilities which include Learning Challenge. Some estimates suggest that 80% of persons

with disabilities live in developing countries; it also expressed the compelling evidence of the barriers that women, men, girls and boys with disabilities face, such as inaccessible infrastructure, negative and discriminatory attitudes and out-dated laws and policies which infringe on their individual rights. These barriers result in persons with disabilities having poorer health, fewer educational achievements, less economic participation and higher rates of poverty and inequality than persons without disabilities. In 2015, a new set of Sustainable Development Goals (SDGs) is to be agreed by world leaders over the coming years as the new development framework begins to be implemented. Inclusive of every individual including people living with disabilities become imperative in achieving the sustainable development goals (Groce, et al. 2011).

### **The challenge ICT virtual assistive system in Restoring Quality Teaching and Learning in Education**

According to the results of the findings, it is evident that almost all (92 %) of students were fairly positive or very positive (see Figure 3). Thus, it could be said that these students will have a relatively positive attitude towards using ICT base virtual assistive system as an effective teaching tools.

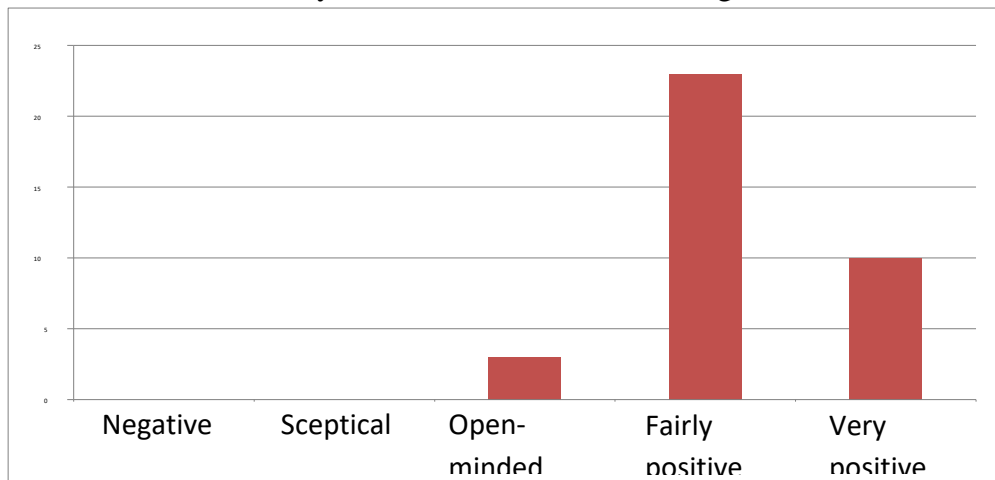


Figure 3 Attitudes to use of ICT in mathematics. Source: Bozkurt, G. (2016)

Of the 92% detailed above, five participants agreed to be interviewed. They all expressed efficiency in the usefulness of ICT in Statistics classrooms. Particular emphasis was made towards the dynamic use of visual elements of ICT. For example:

I think it has made a big difference because you can see how it gives kids more visual elements and it also increases the pace of their learning abilities and the fact they can see what is going on, and also interact with things as well.

The study suggests that the key factor encouraging student teachers' use of ICT in Statistics teaching was the fact that such use would change the way in which pupils learn (see Figure 4) and develop the pupils interest (see Figure 5). This also can be seen from the interview comments. That is:

Some students might not learn and comprehend or be interested in learning unless it delivered in a way which to them is not just book work. There are some students most especially the Learning impaired whom watching a graph being drawn or something that is moving, something that is more animated will motivate them to learn.

Furthermore, majority (92%) of the student teachers expressed their belief in the value of ICT in helping pupils to learn. Also, 80% of the student teachers responded that ICT is a priority to them.

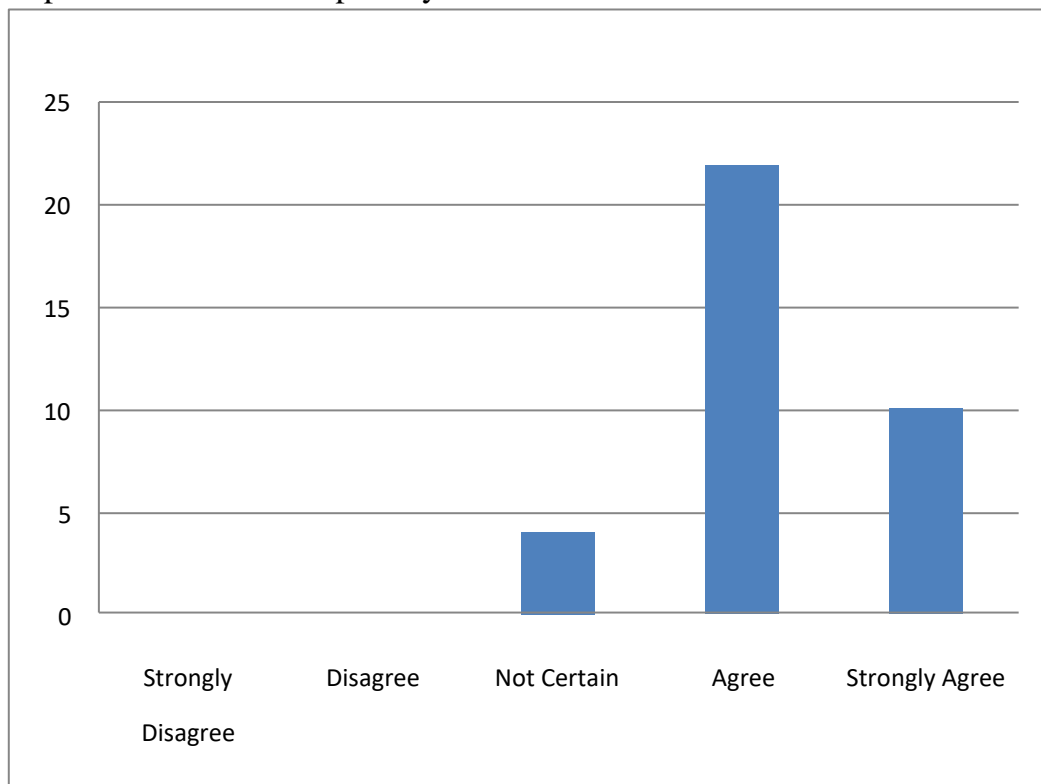


Figure 4 ICT changes the way pupils learn. Source: Bozkurt, G. (2016)

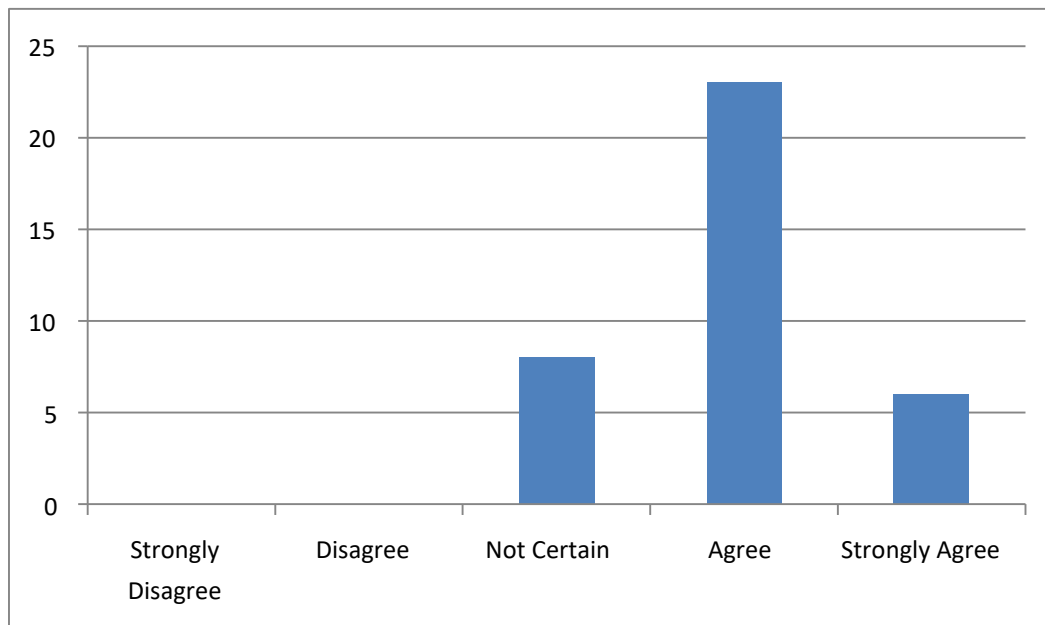


Figure 5 Pupils feel motivated when they use ICT. Source: Bozkurt, G. (2016)

In this study, the majority of the students (74%) reported that they were confident in using computers in teaching, and only 5% said they were not confident. As a result of this, it is important to note that student teachers interviewed expressed that they felt very confident in using technology in teaching and learning as well as in their personal use of ICT.

### Discussion of finding

The purpose of this research was to ascertain use of ICT based virtual assistive system in delivering Statistics classroom teaching for the learning challenged students purposely to restore quality teaching and learning in education. From figure 3, it was found that pre-service Statistics teachers appeared to think that ICT was important for teaching and learning. It was clearly demonstrated that the student teachers were trying to use ICT where it improves their pupils' learning.

The student and teachers were also convinced of the value of ICT in helping pupils to learn, and they believed that ICT use changed the way pupils learn. From the research, it was concluded that teacher commitment to integrating technology was connected with appreciating the value of Education and have confidence in the transformative power of the technology.

## CONCLUSION

Students living with learning challenges face much difficulty in learning; learners' relationships represent a very important factor of educational process. Some possibilities how to establish the relationships is the focus of this paper. The above studies establish that the ICT base Virtual Assistive System showed an effective means for integration of the learning challenged students to the class. The use of ICT based Virtual Assistive Technology to teach Statistics signs and symbols for this category of Students achieves more positive, and therefore we consider it appropriate to implement into education curriculum. However, it is a misapprehension that the use of ICT based Virtual Assistive system to deliver Statistics signs and symbols teaching for the learning challenge students is the only way of bringing isolates into the class, but the results of the research have confirmed that it is very useful help for the rapid comprehension of the learning challenged students to be incorporated into the learning environment.

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