# Evaluating Visual Literacy as a Pedagogical Tool for Non-Formal Educational Setting

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# APPROVAL

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# DEDICATION

To Allah the Almighty

&

To Faculty, friends and family

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I also declare that the intellectual content of this thesis is the product of my own work, except to the extent that assistance from others in the project's design and conception or in style, presentation and linguistic is acknowledged. I also verified the originality of contents through plagiarism software.

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# ACKNOWLEDGEMENTS

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# LIST OF ABBREVIATIONS

**NFE**: Non Formal Education

**SEGD:** Society for Experiential Graphic Design

**OSCS:** Out of School Children School

**ARCS:** Attention, Relevance, Confidence, Satisfaction

**M:** Mean

**SD:** Standard Deviation

**MDG:** Millennium Development Goals

**EFA:** Education for All

**FDG:** Focused Group Discussions

**N**: Total Number of participants

**n:** Number of participants

**TMS:** Total Motivation Score

**P:** probability

**MDG:** Millennium development Goals

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# ABSTRACT

Education is fundamental human right which ensures freedom, empowerment and more importantly individual developing benefits but still millions of children and adults remain uneducated as a result of poverty, war, disaster and other social problems. In primary level of education 6.2 million children are out of school in Pakistan (Pakistan Education Statistics, 2014). In order to educate out of school children, Non-Formal education is alternate solution to this problem. There are many organizations in Pakistan which provide non-formal education. Unfortunately in Pakistan, non-formal education curriculum has pedagogical limitations, lack of visualization tools and techniques, no central control, outdated syllabus and lack of integration of technology.

The objective of this research was to evaluate the impact of visual literacy as a pedagogical tool for non-formal educational setting with integration of technology. This intervention had provided out of school children with a learning opportunity through the use of technology integrated with 360 panoramic views which was intended to assist them to learn life skill based on visual signs. Visual Signs of hospital were used in interactive web application to examine their leaning and interest. 360 view technologies assisted students to provide interactive environment in application along with proper visual aid.

 Study used mixed-method exploratory research approach. A pilot study was conducted before intervention to examine out-of-school children curriculum, use of 360 view technology (virtual tour), use of visual signs and selection of data collection tools.

Surveys and interviews conducted have revealed that academic achievement, engagement and motivation in these learning activities can help the out of school children learn life skills in a more meaningful and practical manner. These results were further validated by performing qualitative and quantitative data analysis. Wilcoxon test was used to analyze pre and post test data. SPSS was used for statistical data analysis. Results from data analysis have revealed very positive effects on the overall learning curve, motivation and engagement level of the students.

Implementing this approach in other settings such as museums, airports and formal education system, to further enhance the learning of out-of-school as well as enrolled children.

# CHAPTER 1: INTRODUCTION

## 1.1 Study Background

Education is a fundamental human right. It ensures freedom, empowerment and more importantly individual developing benefits but still millions of children and adults remain uneducated as a result of poverty, war, disaster and other social problems. Unfortunately Pakistan is ranked second highest in out of school children category. In primary level of education 6.2 million children are out of school in Pakistan (Pakistan Education Satistics, 2014).National and international communities, for a long time, have been charting out elaborate plans and road maps to address and overcome issues which have hampered the aim of achieving global goals like universal access to education and improvement in health and nutrition. Global movements like millennium development goals and EFA have set a host of aims and targets which call for addressing and overcoming issues concerning health and education. For instance, MDGs aims at achieving universal education, combating fatal diseases and ensuring environmental sustainability by 2015. Similarly EFA (Education for All, 2015) aimed to meet the learning needs of children, youth, and adults by 2015. As time would have it, world was unable to meet these goals at stipulated time (Millennium Development Goals, 2015).

As many children in Pakistan remain out-of-school, it's time to come up with innovative solutions which tend to alleviate the problems related to education. It's practically impossible to devise an all-out solution which would address all the issues related to education. So a better approach would be to address the part of the problem and aim at bringing about a solution which would hopefully address the part of the problem that is identified.

One problem that out-of-school children face is that they do not develop life skills which inculcate decision-making, negotiation and critical thinking. For instance, out-of-school children who live in slums, have no idea about things like how to use first-aid, how to navigate through hospital in case of medical emergency, and how to differentiate between healthy and unhealthy food. Research has proved that children with no prior knowledge or education can learn new things quickly when taught through visual aids.

Widget Software reports (Pampoulou & Detheridge, 2007) states student can learn and recall information in a better way by using visual symbols. This is mainly true for those students who

learn visually and whose visual memory may help to recall facts. It is also true that symbols can help to remind students of a concept. The symbol itself cannot teach the concept, but it can assist student to understand concepts and make the comprehension more clear.

It is evident from this research that an application can be designed and developed to non-formally educate out-of-school children on the importance of basic life skills including health and hygiene(Communication skills, literacy and numeracy skills, citizenship) using visual aids and illustrating the information.

Children with limited education and literacy find it difficult to engage themselves in educational activities. Most of the children in slums have never been to school or have attended early year schooling only. For such children alternative learning methods shall be employed. Informal learning is the best approach to deliver the academic content using nontraditional techniques and turning the learning process engaging and motivating. Learner who otherwise cannot maintain their engagement level and motivation will find themselves more motivated by alternative teaching styles.

However, in under development countries like Pakistan, there are various limitation of non-formal learning. Although formal training provides teachers with the opportunities of professional growth, on one hand, they have been found to display remoteness from contextual realities (Borko, 2004) and on the other hand, they are occasional while a teacher needs ongoing development to keep abreast with the changing need of non-formal teaching approaches. Therefore there is a huge requirement of training teacher in order to teach using this approach.

Non-formal learning activities are mostly unplanned, unassisted, organized and uncontrolled by a teacher. So such learning can either be deliberately encouraged by an organization, happen despite an environment that is not highly favorable to learning or not happen at all, even though environment is conducive to learning (Gola, 2009). However the school structures and curriculum does not incorporate non formal learning. There is a huge need of modifications and improvements in the education system in order to incorporate this approach

So the objective of this research is to facilitate such student's learning through visual literacy and also investigate student's learning while using their mental faculties in the instances mentioned

above through visuals literacy. Will they be able to improve on their abilities in the matters of life skills? Will they be able to practically perform better than those children who are not trained in life skills? To what extent is visual literacy effective as a pedagogical tool?

## 1.2  Study overview

The aim of this study is to conduct research on visual literacy (visual signs) as a pedagogical tool for learning and its impact on non-formal education. For this purpose, interactive application is designed and developed to assess students in non-formal educational setting. The designed application was facilitated by the 360 panoramic technology of virtual tour.

Intervention was conducted in two schools of Islamabad, OSC (Out of school children) schools. Research type is exploratory and mix method research. This research was conducted with data collection done by using Pre and Post test, Motivation Survey, Engagement Survey and Focused Group Discussions from the participants (n=55). Motivation and engagement of the participants of this study are measured through survey questionnaire to further check the effectiveness of this study. From above objective of research, following research question is derived.

> What is the impact of visual literacy supported by technology as a pedagogical tool on students' academic achievement, motivation and engagement in a non-formal educational setting?

A significant difference was observed when quantitative and qualitative data analysis was performed. Increase in learning outcomes along with positive changes in attitudes towards learning and life skill was recorded. Therefore, it was concluded that non-formal education, blended with technology has a significant impact on the learning of life skills.

# CHAPTER 2: LITERATURE REVIEW

This chapter will discuss Visual Literacy, its importance for primary school students and non-formal education, non-formal education in Pakistan, dependent variable engagement and motivation

## 2.1 Visual literacy

Visual literacy, by definition, is the ability to interpret and understand the information presented with the help of visuals signs and images. The term "visual literacy" was first used by Debes, co-founder of the International Visual Literacy Association. Fransecky and Debes (Fransecky & Debes, 1972) offered a tentative definition of the concept: "Visual literacy refers to a group of vision-competencies a human being can develop by seeing and at the same time having and integrating other sensory experiences". Avgerinou and Ericson (Avgerinou & Ericson, 1997) defined visual literacy as "understanding how people perceive objects, interpret what they see and what they learn from them"

Bristor and Drake (Bristor & Drake, 1994) defined visual literacy as the "ability to understand, interpret and evaluate visual messages". Although more than 200 years ago, Napoleon Bonaparte said "A good sketch is better than long speech". Additionally another phrase with same meaning "A picture is worth a thousand words" explains visual literacy and its importance in learning.

First visual literacy was limited to arts, painting and Images. So students view image, analyze and extract meaning from it (Baker, 2012). Now the use of visual literacy has been increased and becomes need for many disciplines. Many new fields are emerged like Human Computer Interaction, information graphics, and data visualization. Many of them are used in educational and professional institutes to resolve data complexity, enhance visualization and critical thinking, and show data in simple and organized form.

In short nowadays, many professions and fields are introduced like graphic designer, Design Interface developer, Creative / Art Director, Logo Designer, Web Designer which are working on visual literacy to create quality learning content according to 21th century skills.

Gray (2008) founder of visual thinking company 'XPLANE' explained visual literacy that we teach three R's reading, writing and arithmetic in our schools, but it is not enough. We should also

teach visual literacy in schools in order to prepare them for current challenges. Students should be trained to think visually and resolve problems in visual domain, so that they become successful in business and life.

Visual literacy, by definition, is the ability to interpret and understand the information presented with the help of visuals signs and images. This idea has been developed on the notion that visuals and pictures can be read and understood just like texts. In multicultural society, different people have different sets of ethnicities, languages and customs. So teaching model should be such that it caters to the learning needs of all the members of the society keeping socio-cultural diversity in mind.

According to Messaris (1994), visual education had four major goals:

1. Visual media's comprehension can be enhanced by using different visual forms like, image, graphs, diagrams and other related tools.

2. Visual media can enhance cognitive abilities like spatial relationships.

3. To aware people about visual aid/media manipulation, distortion, misinformation and impact on advertising and political campaigns.

4. Visual communication can be improved by using proper visual skills and arts.

Visuals help people to understand ideas and concepts which sometimes appear complicated when they are taught with help of written and printed text only. Our young people are growing up in an age where visual literacy is a vital filter in interpreting the images that bombard us all in both the real world and the virtual, where the digital revolution has revolutionized the capacity for others to influence our judgment.

How visual literacy can empower education? It is incumbent upon us to assess the impact of visual literacy on children. Are they able to learn more from visuals than they learn from conventional method of teaching? This research will actively seek answer to this question.

Visual literacy embedded within the curriculum of the art department can improve Critical faculties, aesthetic judgments and self-awareness when interacting with our visual culture.

In order to improve school eco-system, we have to adopt our creative and innovative approach. A

well designed class or lab with presence of visual media is considered as better environment for learning. Students   (Cambridge News, 2013)

A study conducted by Pillai and Vengadasamy (2016) shows that how visual aids can help to develop student's interest and increase motivation to read literary texts. Research findings show most of the respondents also stated that visual aids can assist students to understand literary concepts and used as an effective learning. This occurred because of visual aids used in the learning content. It also indicated that literacy text can be illustrated better by using visual aid. They claimed that the using visual aids like visual signs and video is a useful tool to help students' understand and learn literary concepts.

## 2.2   Visual Signs/Symbols (international Visual signs)

Visual symbols are used to guide people in different areas. There is the "international language of ISO graphical symbols" provide international sign and symbol which help people to reduce risk and guide them. The international language of ISO graphical symbols state that ISO graphical symbols can help you in many aspects of daily life like  to know direction, understand product features, find hotel, find shop,  it doesn't matter where you are (ISO, 2013).

 Visual Sings used in current study research are originally sourced from research SEGD, Society for Experiential Graphic Design (SEGD, 2015). SEGD's Education program organizes conferences, workshops, and webinars for many fields like   user experience, healthcare, practice and wayfinding, accessibility, and the business of design. Moreover SEGD has published the academic journals, magazines, and white papers on accessibility and sustainability topics.

## 2.3   Visual literacy importance in primary school students

In preschool, children use visual literacy skill before they learn to read and speak. They used picture books, where they connect word and picture to create meaning. Use of symbols can help them tell the teacher or parent what their needs are when children face any difficulty in communication. Children can point to the symbol that displays their needs Being able to use visual symbols successfully and relevantly to express an idea can clarify language confusion- both for the meaning of words in isolation (vocabulary instruction) and words in context (Topiel, 2015).

Widget Software reports (Pampoulou & Detheridge, 2007) states student can learn and recall information in a better way by using visual symbols. This is mainly true for those students who learn visually and whose visual memory may help to recall facts. It is also true that symbols can help to remind students of a concept. The symbol itself cannot teach the concept, but it can assist student to understand concepts and make the comprehension more clear.

Literacy professor Cornett (2014) in her book states that, "When we teach for visual literacy, we involve children in thinking about and expressing in images what is often beyond linguistic capabilities."

Another study conducted by Turkcan and Yasar (2011) on Visual Arts course where primary school Students were taught Visual Arts course through animation and cartoon. As a result the students found the Visual Arts course more entertaining and consider course content different form previous course. Moreover study finding also state that cartoon help students to more focus on subject and make association with related content.

In Educational setting, visual symbol helps children to remove the effects of barriers within the learning environment. While implementing visual support by Julie Baxter can help children to help children focus on activities, encourage positive behavior, support understanding of verbal instructions, support understanding of daily routines, facilitates sequencing and organizational skills. It helps children to participate in all daily life activities in their environment (Baxter, 2017).

Scorsese (Scorsese, 2012), director and filmmaker shared his view about visual literacy and how it happened to him when he was child. He stated that in order to shape the mind of children in critical way, visual literacy must be taught to them. It will help them to learn that how ideas and emotions are expressed through visual forms. Visual content might be video, film or painting. Storytelling should be made easy and compatible for children through visual literacy.

## 2.4   Visual literacy importance in Non-Formal Education

Visual literacy play important role in Non-Formal Education. There are many content areas of NFE like health, nutrition, vocational training, literacy, leadership training, agriculture, awareness and moral training where visual literacy acts a pedagogical tool. In NFE context, it is important to use available materials in creative and innovative ways to produce relevant and meaningful visual aids for remote areas of third world countries. The use of visual aids not only holds the attention

of an adult audience, but also helps them to recall and to internalize the lesson. Visual aid designers must know local context in order provide them accurate and precise visual aids (Vella, 1979).

According to Dale's research (Dale, 1946), the least effective method at the top, involves learning from what we read (10%), what we hear (20%), what see (30%) means presenting information through verbal symbols. Most effective methods at the bottom of Dale Cone of Experience is involving learners directly in learning which is purposeful learning experiences, such as hands-on or field experience. It also suggests that when choosing methods or instructional media, it is important to remember that students should be involved in the process to strengthen knowledge retention. Before selecting any methods or instructional media the instructor should refer to the cone of experience. Graphic materials like visual symbols, Chats, Graphs, Cartoon, 3D models and other multimedia mix have to be used according to the learner demographics like ability, age and experience of learners. These instructional media and methods are most suitable for the non-formal setting and are preferred over the rigid and formal methods (Vidya-mitra, 2009).
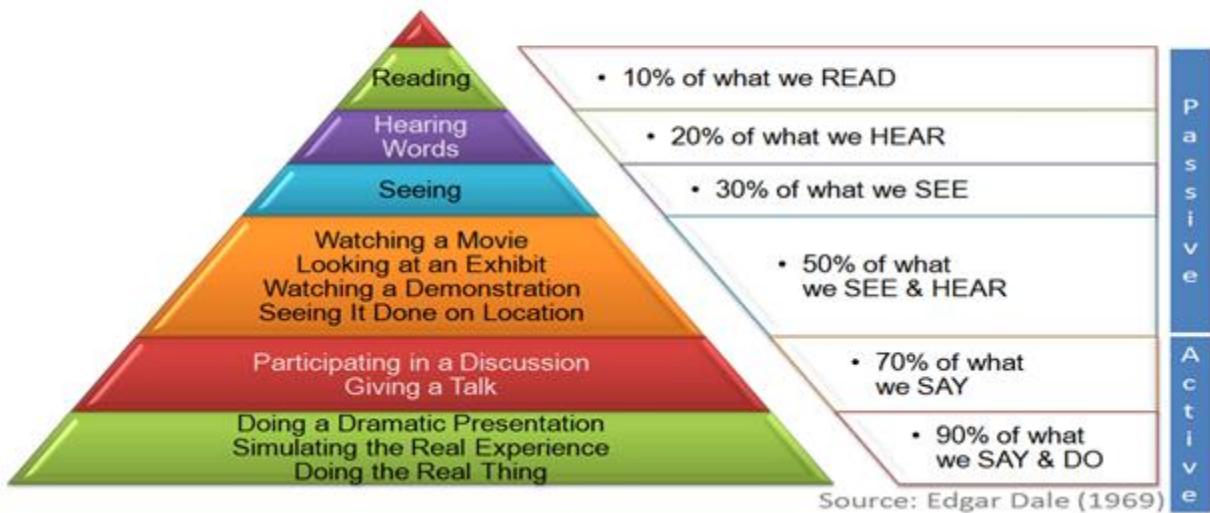


**Figure 2-1 Dale Con of Learning**

In this research, visual signs and 360 view panoramas pictures (30% of Dale Cone of Experience) were embedded in interactive web application. Students directly interacted with web application. They explored all related content in application.

## 2.5   Non formal education

The term "Non-Formal Education" emerged in 1950s from less developed countries (Rogers, 2007) where it was nearly established that the formal education system was insufficient to meet the needs of society. NFE programs have been used in low income countries to provide basic education where formal education system was unable to educate all its citizens (Kedrayate, 2012).

NFE is also used as alternative for basic education where FE has unable to provide basic education to citizens. In Asia-Pacific region, NFE is mainly used to provide the primary education and literacy programs. It helps children to complete primary education (UNESCO, 1987). Moreover NFE is also used for functional literacy to enhance skills and competence in job-related activities. Evans (1983) states NFE may help to meet the need of people and can also provide them the better opportunity to learn productive skills. As a result people can participate effectively in the development of their societies. Social and economic growth and development can assisted through proper NFE implementation. It can help community members to discuss and plan their problems and needs.

### 2.5.1   Difference between Formal and Non-Formal Education

According to Tim Simkins (Simkins, 1977 ) Formal and Non-Formal education can be differentiated on the basis of the five themes: Purpose, Timing, Contents, Delivery and control.

| Theme | Formal | Non Formal |
|---|---|---|
| Purpose | Long-term and general Credential-based | Short-term and specific Non-credential-based |
| Timing | Long cycle Preparatory Full-time | Short cycle Recurrent Part-time |
| Content | Input-centered and standardized Academic | Output-centered and individualized Practical |

| | | |
|---|---|---|
| Delivery System | Institution-based Isolated (from the socio-economic Environment and from social action) Rigidly structured Teacher-centered Resource-intensive | Environment based Community-related Flexibly structured Learner-centered Resource-saving |
| Control | External Hierarchical | Self-governing Democratic |

**Table 2-1 Difference Formal and Non-Formal Education**

## 2.6 Non Formal education in Pakistan

Pakistan is one of the countries who spend less in education. As a result, Pakistan has low literacy rate and is second in global ranking of out-of-school children. Although the number of out-of-school children has reduced from last year's figure of 24 million to 22.6 million, statistics of 2015-16 due to good efforts and steps. Among these, 44 percent children between the ages of 5 and 16 years are still out of school.

In Pakistan, non-formal education is generally provided through (Mujahid-Mukhtar & Iqbal, 2004):

- Non-formal basic education community schools
- Religious schools or "Deeni Madrassah"
- Vocational/skill training centers
- Adult literacy centers

There are some systemic factors responsible for low primary enrolments (Mujahid-Mukhtar & Iqbal, 2004):

- The shortage of school within area
- Teachers Absenteeism
- Teachers' lack of motivation;
- Outdated curriculum and sub-standard textbooks;
- Weak monitoring systems;

- Lack of community participation.

In Pakistan, there are many Non-Profit Organizations who work in NFE field. Following are some organizations which are working on Adult literacy and Non Formal Basics Education (Said, 2010).

- Bunyad
- AIM (Identity, Merge and Action)
- Literate Pakistan Foundation
- Bunyad Foundation
- TCF- The citizens Foundation
- SOS Children's Villages of Pakistan
- Idara-e-Taleem-o-Aagahi
- Pakistan Coalition for Education
- Punjab  Literacy and Non Formal Basics Education  Department
- ABES- Adult Basic Education Society
- Child Care Foundation of Pakistan
- Developments in Literacy (DIL)
- Zindagi Trust
- HOPE (Health Oriented Preventive Education)
- READ Foundation (Rural Education and Development Foundation)

Pakistan has more than 2.5 million students enrolled in institutions operated under the network of Non-formal Basic Education (NFBE). This is a very innovative initiative taken by the government of Pakistan where non-formal basic education schools are established to facilitate the out-of-school children. Currently, the total number of basic education community schools (BESC) operating in Pakistan are approximately 13,000 with a total of 0.6 million children enrolled in these schools. As for the employment rate, local female teachers are employed in 80% of these schools. At the end of grade V, an exam is conducted by the formal sector to promote these students to grade VI. BECS are financed by the Federal Government and operate directly under MET&SHE.

| No. | Balochistan | FATA | GB | ICT | KP | Punjab | Sindh | AJ&K | Pakistan |
|---|---|---|---|---|---|---|---|---|---|
| NCHD Schools | N/A | | | | | | | | |
| BECS | 683 | 1,069 | 1,466 | 277 | 1,616 | 6,040 | 1,738 | 205 | 13,094 |
| Other Non Formal School | N/A | | | | | | | | |
| Deeni Madaris | 719 | 524 | 93 | 46 | 2,802 | 5,811 | 1,991 | 1,254 | 13,240 |

**Figure 2-2 Non Formal Educational Institutions in Pakistan**

Moreover, as an initiative, Punjab government has also allocated budget for the development of Non-formal Basic Education Schools in a few selected areas of this province. To improve the access to education and increase the enrollment rate, National Commission for Human Development (NCHD) has also developed approximately 1000 primary schools in rural areas of Punjab.

| No. | Balochistan | FATA | GB | ICT | KP | Punjab | Sindh | AJ&K | Pakistan |
|---|---|---|---|---|---|---|---|---|---|
| NCHD Schools | N/A | | | | | | | | |
| BECS | 27,379 | 46,586 | 135,084 | 12,672 | 48,714 | 224,590 | 69,773 | 10,586 | 575,384 |
| Other Non Formal School | N/A | | | | | | | | |
| Deeni Madaris | 76,846 | 52,521 | 15,522 | 12,308 | 397,847 | 783,149 | 354,774 | 103,989 | 1,796,956 |

**Figure 2-3 Enrolment in Non Formal Educational Institutions in Pakistan**

Ministry of Education has supported Allama Iqbal Open University (AIOU) to establish non-formal middle schools in all of the provinces of Pakistan, and it has been a very successful initiative. Non-formal Education is a cost effective approach of providing education to out-of-school children especially in remote and rural areas (Malik, Amin, Ahmad, Mukhtar, Saleem, & Kakli, 2014).

Pakistan, for instance, is a home to people belonging to different ethnicities, customs, and languages. Though Urdu is nation's mother tongue, people of the land normally speak and are accustomed to speaking their native languages. While some people boast of having command over Urdu and English languages, many still struggle to have a good grip over these languages. As a consequence, any kind of knowledge or information taught in these languages without visual assistance, in all probability, will not be clearly comprehended by the people who speak and

understand their native languages. Therefore, it is all more important to introduce visual methods of teaching and learning in formal and Non formal educational settings.

## 2.7 History of Educational Software & Interactive Learning Environments

Educational technology evolved through many stages. The British Broadcasting Corporation (BBC) started educational radio programs for schools in the 1920s. Radio was used educational broadcasting tool for many years. In 1960 television was first used for education in schools. In 1970 use of television for education was increased. In 1990, people started to capture video lectures for later use. In 1995, the web based first learning management systems (LMS) was introduced. LMSs provided many features to educators like online teaching environment, content organizing, learning objectives, student activities, assignment questions, and discussion forums. In 2002 Massachusetts Institute of Technology (MIT) started its OpenCourseWare project that recorded lectures and make available for students. Later in 2005, YouTube was started. YouTube provided small educational video clips to students. Massive Open Online Course (MOOC) was introduced in 2008 by George Siemens, Stephen Downes and Dave Cormier in Canada. After that social media like Facebook, Twitter and Skype become one of the biggest platforms for education (Bates, 2014).

## 2.8 Virtual Tours

Virtual tours are nowadays mostly used for property, hospital and hotel businesses. These businesses promote and advertise their product and services through virtual tours. Educational organizations are gradually adapting virtual tour for their curriculum. Some universities are using virtual tour by showing all departments in 360 view pictures to attract students. Current study has used virtual tour to make application more interactive by using 360 view panorama pictures of hospital. Moreover, Facebook is also using 360 view panorama pictures and videos for many aspects.

Following are some advantages of Virtual Tours in education (Archer & Smith, 2011).

- No limit of location
  Virtual tour can take students anywhere like from the Metropolitan Museum of Art to Antarctica.
- Inclusiveness

Regular trips have many problems like finance, security and permission for parents while students can use virtual tour, regardless of financial or parental situations.

- Safety and Legal

    Real field trips have many issues like permission slips, arrange buses and other management concerns. Virtual tours have not any previous mentioned limitation.

- Learning

    Nowadays Virtual tour is becoming popular learning tool for students. Virtual tour is providing interactive environment for students where students can view pictures, videos, and sounds embedded in related environment.

## 2.9 Dependent Variables of the Study – Engagement

Student engagement can be defined as degree of attention, student's willingness, need and desire that students show when they are learning something or being taught. Engagement help students to participate in activity, as a result student can successfully complete work in the learning process

In some contexts, student engagement is used, when educators want to discuss and improve teaching techniques. For that purpose, surveys are conducted to know students views. Later survey findings are used to modify policies or programs in ways that would improve existing teaching technique and facilitate students (Abbott, 2016).

It is should be noted that educators have different views on student engagement and they interpreted on their own way. For example in one school they observe engagement through optimism, curiosity, motivation, or interest while other schools other observe through attending class, class participation , work on time, listening attentively and following rules.

It is fact that engagement is very important and has a positive effect on learning. It can be considered to show the willingness of a student for participation in normal school activities such as following the teacher's instructions or submitting his/her work as required. The most recent addition includes cognitive engagement which depends on the student's own investment in learning and strategies applied (Fredricks, Blumenfeld, & Paris, 2004). Student engagement is very critical for learning and educators these days have to face the challenges of keeping the student's interest to the highest level possible. Disengagement leads not only to lower achievement, but also to their mis-behavior and attitude. As a student gets older, his level of engagement falls to an extent

that lack of interest in school work can be seen more clearly to lead to drop outs and low rates of motivation.

Mainly learning and personal development of students can be demonstrated by their engagement in their respective lesson and activities. The more students study, practice and work on their course material, the more they tend to learn about it. Amy L. Reschly and Sandra Christenson said in their book "Handbook of Research on Student Engagement" that engagement not only drives learning but also predicts school success (Chando, 2013).

It has been shown (Fredricks, Blumenfeld, & Paris, 2004) that student engagement shows positive correlation with achievement and shows negative correlation with rates of drop outs. Researchers have reported that engaged students have more chances of getting better grades and also of performing better on standardized tests (Fredricks, Blumenfeld, & Paris, 2004).

Student engagement typically includes three dimensions by (Jonathan Martin, 2016):

- Behavioral engagement

  It mainly focuses on student participation in academic, co-curricular activities and social.

- Emotional engagement

  It focus on the extent and nature of positive and negative reactions to teachers, classmates, academics, and school

- Cognitive engagement

  It focuses on students' level of investment in learning.

There are several methods used to measure student engagement in their respective learning content. They include surveys, checklists, questionnaires and rating scales. Moreover educators and researchers also use direct observations, work sample analyses, and focused case studies to measure student engagement.

## 2.10 Dependent Variables of the Study – Motivation

It is fact that motivation play important in learning. It directs learner behavior to achieve desire goals. When students find interesting thing or value in a lesson or activity, they expect to successfully achieve a desired learning outcome and more likely to be strongly motivated to learn (Innovation, 2015) . Intrinsic motivation is that type which involves pleasure or interest whereas

extrinsic motivation is that type of motivation that is usually driven by external desires for some reward.

Motivation is very hard thing to define. It's a very complex phenomenon, and it's not possible to give a simple definition to motivation. Due to this reason different schools of thought take motivation differently. The students with high level of motivation perform much more well in class as compare to students having low motivation level (Gardner, 2006).

Learners show more output and engage more in classroom activities when they are *intrinsically* motivated. They tackle assigned tasks easily and are eager to learn classroom material and achieve at high outputs while extrinsically motivated learners perform only easy tasks and meeting minimal classroom requirements (Ormrod, 2014).

A study conducted by (Yunus, Salehi & John, 2013) shows that how visual aids can help to develop student's interest and increase motivation to read literary texts. Some of the research findings are that the majority (96.2 %) of the teachers believed that the using visual aids in in the literature classroom creates interesting and enjoyable learning environment for learners.  This was mainly due to the visual aids characteristics and design like background, color, light and sound that could trigger and stimulate students' interest in learning content. As a result they were motivated by use of visual aids and perform well in their respective learning content.

Motivation is most commonly assessed by rating scales completed by parents or teachers or by self-report measures. These instruments are based on different subscales such as attributions, self-efficacy, interest, self-perception, curiosity, persistence and enjoyment of learning.

# CHAPTER 3: METHODOLOGY

This chapter includes project settings and methodology of thesis. Sampling, data collection tools, development of application, various related research methodologies and proposed; planning analysis of are described here.

## 3.1 Research Paradigm

This is an exploratory research, where we employed mixed method approach (Creswell, 2012) by using quantitative and qualitative instruments. The quantitative tool was the survey questionnaire and pre-post test while the qualitative tool was focused group discussions. The mixed method approach was the most suitable approach for this study, because surveys can be easily used to measure the impact of visual signs on engagement and motivation of students while the focused group discussion can be helpful in finding the reasons for validating the results of surveys and Pre-Post tests.

## 3.2 Research Question and Hypothesis

The research was targeted "to evaluate visual literacy as pedagogical tool in non-formal education and how it can affect student's engagement and motivation."

From objective of research, following research question is derived.

> What is the impact of visual literacy supported by technology as a pedagogical tool on students' academic achievement, motivation and engagement in a non-formal educational setting?

This study had three Hypothesizes

- Hypothesis 1

    H0: Using visual literacy as pedagogical tool has no significant impact on student's academic learning in non-formal educational setting.

    H1: Using visual literacy as pedagogical tool has significant impact on student's academic learning in non-formal educational setting.

- Hypothesis 2

H0: Using visual literacy as pedagogical tool has no significant impact on student's engagement level in non-formal educational setting.

H1: Using visual literacy as pedagogical tool has significant impact on student's engagement level in non-formal educational setting.

- Hypothesis 3

H0: Using visual literacy as pedagogical tool has no significant impact on student's motivation level in non-formal educational setting.

H1: Using visual literacy as pedagogical tool has significant impact on student's motivation level in non-formal educational setting.

## 3.3  Existing Games and Application

Following are details of some related games and application.

1. ICOON for refugees

   It used to assist refugees in their communication with people. Visual symbols with multiple categories are used to help refugees in many aspects of their life to overcome language barriers.

   Platform: Playstore

   Source: https://play.google.com/store/apps/details?id=eu.amberpress.icoon.refugees&hl=en



2. Widgit Software

   It mainly used by early year, mainstream school and special need children to assist children in primary education. Basic visual signs are used in widget software to overcome reading and language difficulties.

Platform:  PC Software

Source: https://www.widgit.com/



3. ConnectABILIT(Visual Engine)

ConnectABILITY-Visual Engine create different visual aids (image, map chart) for early age children to enhance their learning.

Platform: web based (online)



Source: https://connectability.ca/category/kids/

4. ChatAble - symbol based app

It designed to assist people who has communication difficulties. Symbol, image, voice and charts are used to improve their communication skills.

Platform: App store

Source: https://itunes.apple.com/us/app/chatable-symbol-based-app/id803004748?mt=8



## 3.4  Pilot Study

Pilot study was conducted before intervention to evaluate following points.

- To check prior knowledge of students
- Selection of suitable Data Collection tools for Non-Formal Educational Setting.

- Evaluation of Application Design
- Use of visual Signs in Hospitals.
- Hospitals Survey

   A survey of different hospitals of Rawalpindi and Islamabad was conducted to find presence of visual signs and how they use it.

## 3.5   Topic Selection for Intervention

Hospital topic was selected for intervention. Following are main reasons of selection for intervention.

- Presence of Visual Elements (Visual sings)
   Wide ranges of visual signs are used in hospitals for different reasons.
- Wayfinding (Navigation skills)
   Navigation and directions are mostly used in hospitals in order to find desired location.
- Multi-faceted Learning
   Plethora of avenues that allows students to explore experience and learn.
- Social Importance.
   It lends participants and students a much-needed space that allows them to interact with afflicted segment of society. This advertent or inadvertent interaction has its own significance since it has a capacity to generate emphatic behavior in the participants.

## 3.6   Project Setting

The study was conducted at Out-Of-School Children System F-11 and I-8 Islamabad.

OSC (Out of School Children) School is an initiative to educate the part of society for whom few people care for. The main aim behind OSC Schools is to provide free quality education to poor children who never had the opportunity to go to school because of financial constraints and being over age.

In Federal Government (FG) school of F-11 and I-8 Islamabad, OCS are provided with educational facilities in order to prepare them for main stream education. These educational activities were

provided for a comparatively shorter time. They are also facilitated by providing free of cost lunch, copies, stationary, uniform, shoes and other basics.

The school is operating on funding received by general public who care for the less fortunate in our society. People visit these schools with an intention to sponsor the education of the children enrolled in these schools. A minimum of 800Rps per month is required to finance the education of a single child, as this amount is enough to cover all the expenses including books, stationary, uniforms, shoes etc.

## 3.7 Project Participants

### 3.7.1 Teacher Participants

A total of 4 class teachers and technology coordinator were involved in the entire phase of the project. The teachers helped in organizing class, making groups and instructions during intervention. Before Intervention teachers were given brief details of project intervention.

### 3.7.2 Students Participants

Students from second and third class were selected for intervention. The average class size was from 25-32. Each period was one hour time from 9am-10am.

## 3.8 Sampling

A purposive sampling technique was used to select specific participants for intervention. In this research study, only two schools were selected among different OSC schools depending time and availability for research. Furthermore, only one class was selected from each school. Total 55 students had participated in intervention. There were 30 students from OSC School F-11 and 25 from OSC I-8. Age limit was 7-14 years.

## 3.9 Curriculum Resources

In this research study, hospital basics visual signs were embedded in interactive web application. Visual sign represent specific department of hospital, while environment of related department is simulated by 360 view panorama in interactive application.

Curriculum resources are consist of two parts

- Visual Sign/Symbols

Visual Sings used in current study research are originally sourced from research SEGD, Society for Experiential Graphic Design (SEGD, 2015). SEGD's Education program organizes conferences, workshops, and webinars for many fields like   user experience, healthcare, practice and wayfinding, accessibility, and the business of design. Moreover SEGD has published the academic journals, magazines, and white papers on accessibility and sustainability topics.



**Figure 3-1 SEGD's Universal Symbols of Healthcare**

- 360 View Panorama Pictures
  360 View Panorama Pictures of Hospital Department used in application originally sourced from different Hospital websites (Virtual tours).

## 3.10 Web Application

### 3.10.1  Content of the Application

The contents of this application are related to basics information of hospital. Following are main content of the application.

- Main page /Homepage (Map) which contains all visual signs related to hospital.

- 360 view (panorama) of Clinic/Departments

- Way finding and location

- Audio Description of Every Department

- Textual Information

### 3.10.2 Brief Description of the Web-based Application Developed for the Research

This section describes design of the web application and its different components.

The application starts off with a home screen where map of hospital is labeled with different visual signs of hospital.



**Figure 3-2 Main page (index page image)**

### Hospital Departments

Following departments were selected due to most often used by public and availability of pictures.

- Reception

- Dental

- Cardiology

- Pharmacy

- Emergency

- General ward

- ENT(Ear Nose Throat)

- Laboratory

- Operation theatre

- Administration

- Cafeteria

Every Department section consists of 6 panoramic pictures.

Picture Type                    Picture


Back
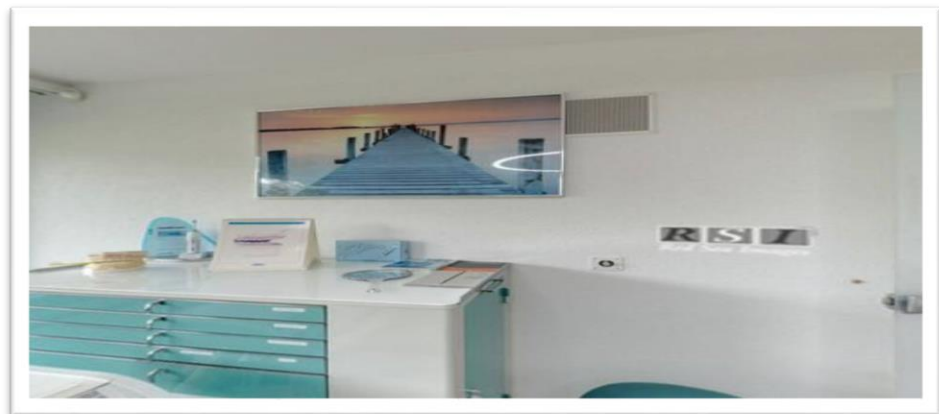


**Figure 3-3 Back Side Picture of Panorama**

Left



**Figure 3-4 Left Side Picture of Panorama**

Up



**Figure 3-5 Up Side Picture of Panorama**

Right



**Figure 3-6 Right Side Picture of Panorama**

Front
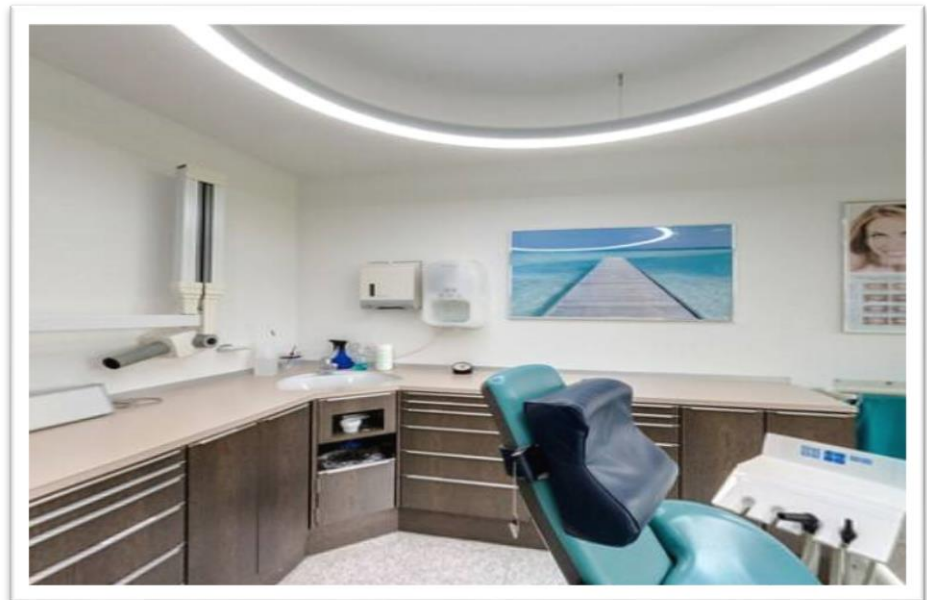


**Figure 3-7 Front Side Picture of Panorama**

Down
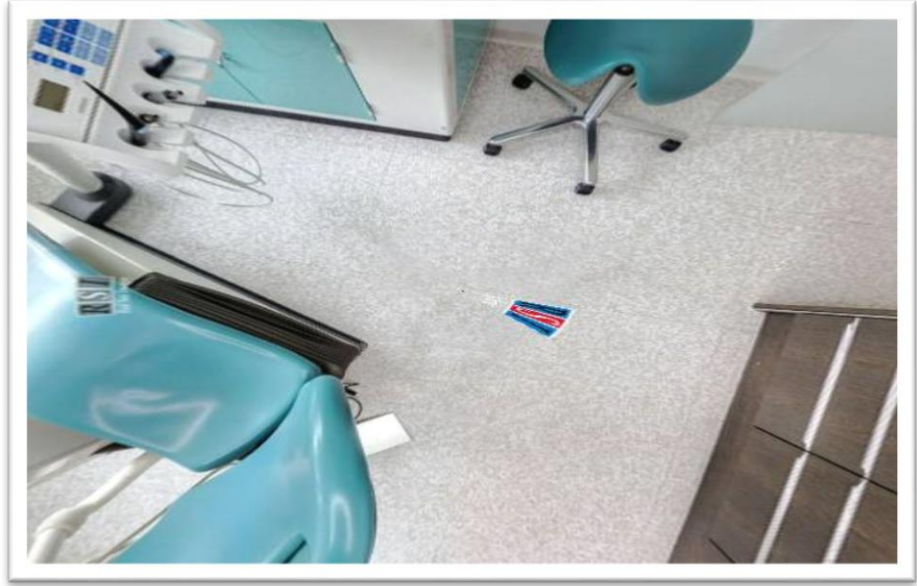


**Figure 3-8 Down Side Picture of Panorama**

Full Picture
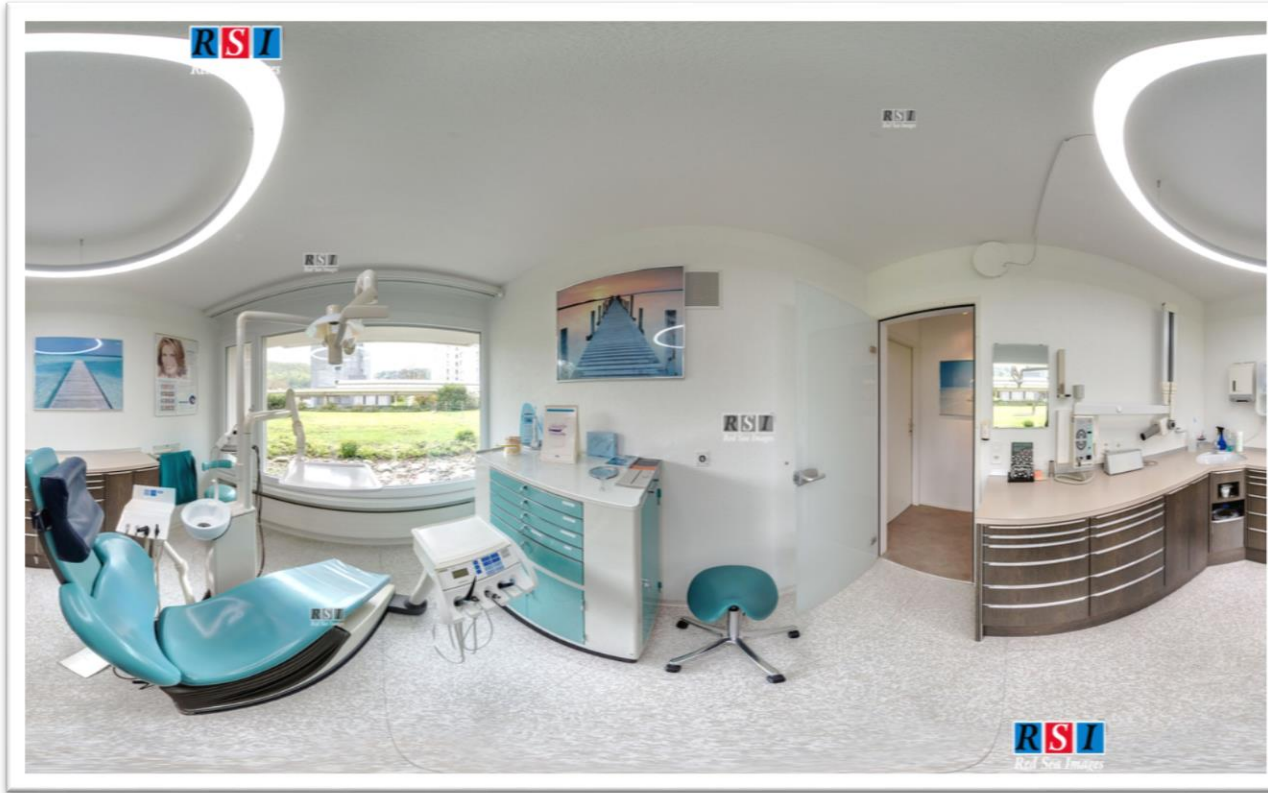
**Figure 3-9 Full Panorama Picture of Dental Clinic**

## Menu of Application

Following are menu of application for every department.

- **Homepage sign**

    When user click on home Button, application redirect to Homepage of application
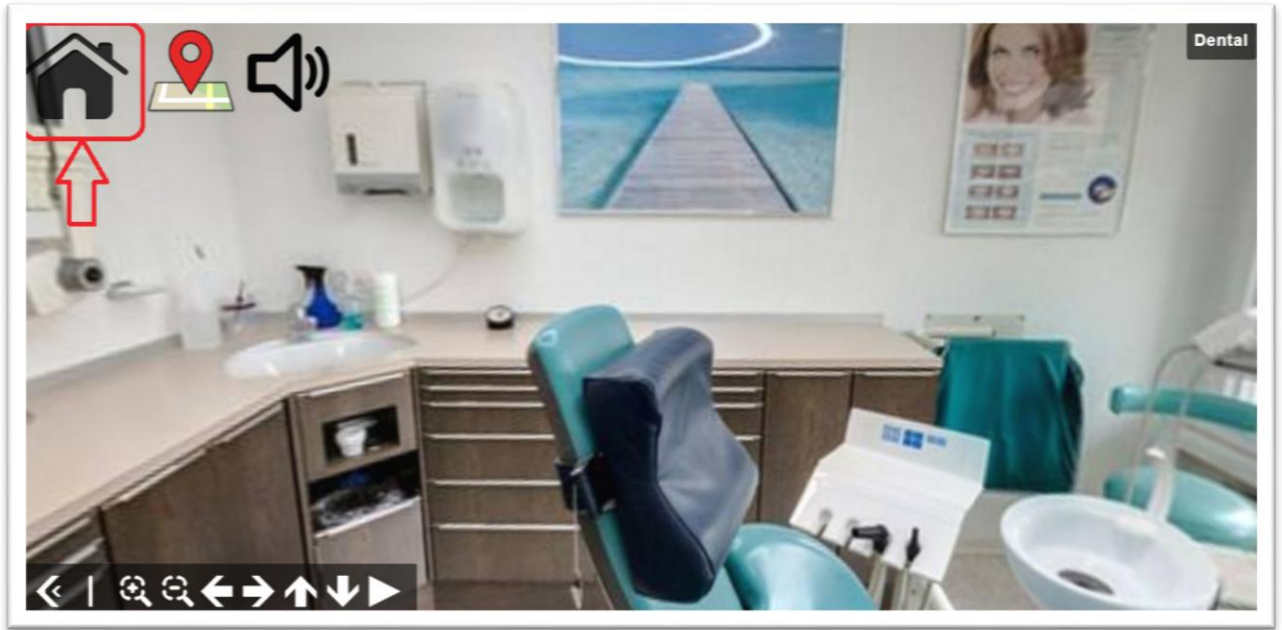
**Figure 3-10 Home Sign**

- **Map department /location identification**

When user click on Location Button as shown as below figure, application show the Location of Dental department.
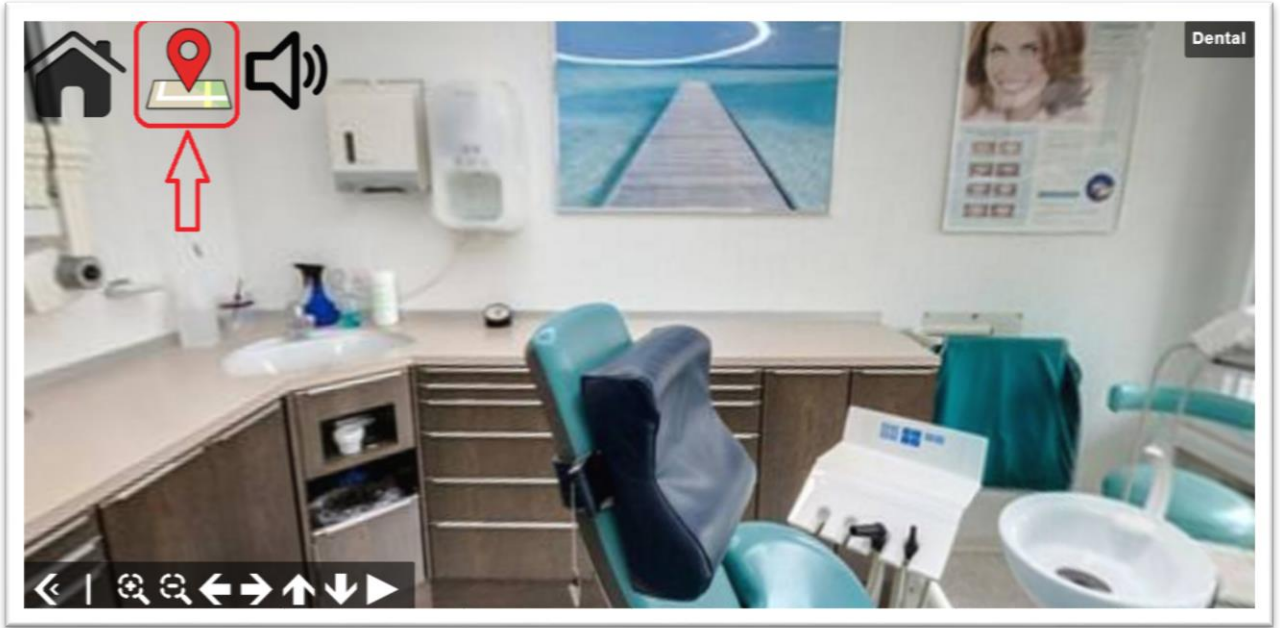
**Figure 3-11 Location/Navigation Sign**

**Figure 3-12 Dental Clinic Location in Map**

- **Audio description**

  When user click this audio sign shown in figure, application start audio description of related department
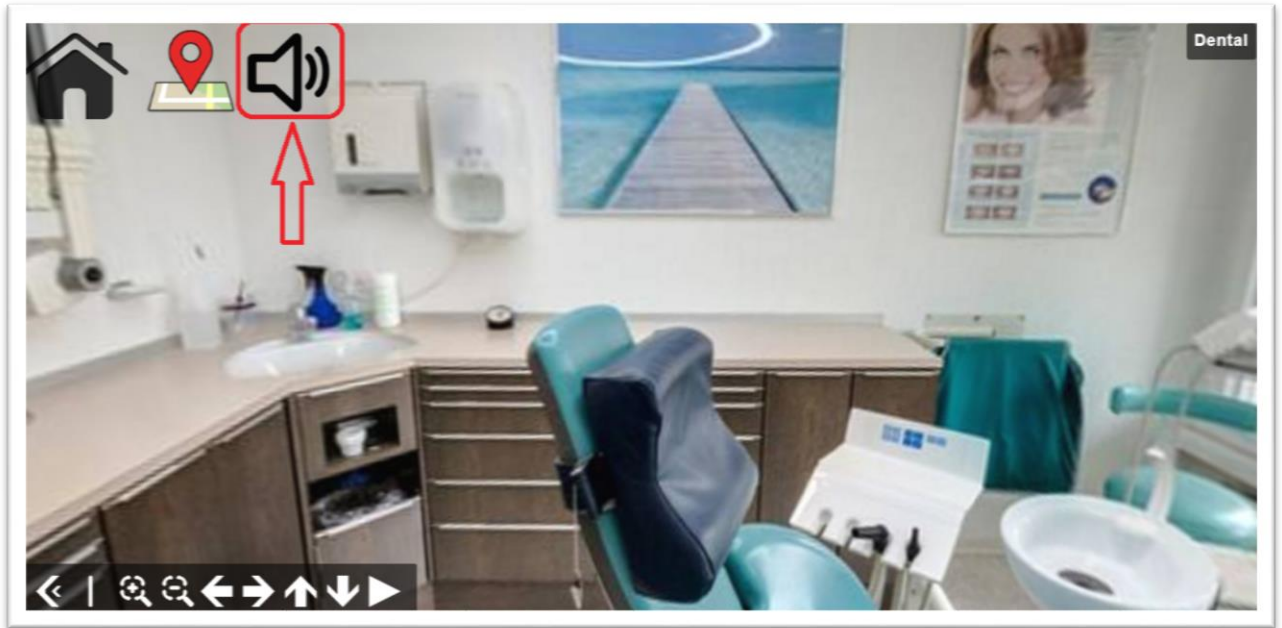
**Figure 3-13 Audio Sign**

- **Department Name**
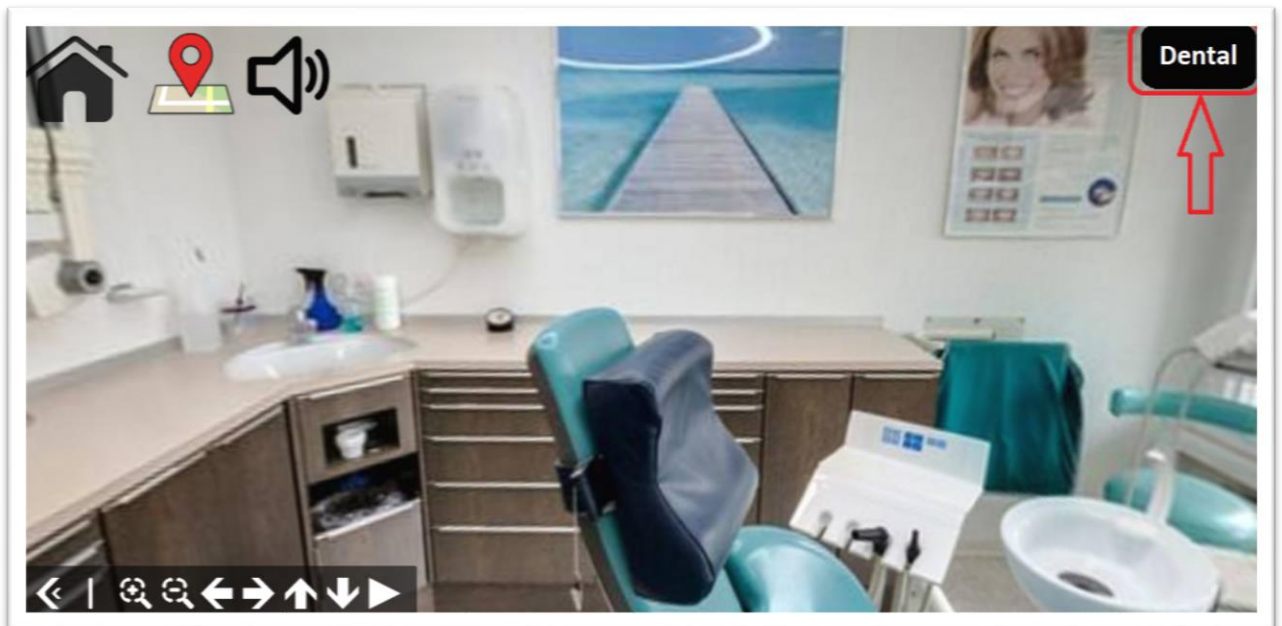


**Figure 3-14 Textual Information**

**Control Signs**

On the left bottom, there is control menu where user perform following function

- Move panorama left ,right, up and  down
- zoom-in and zoom-out
- Play, Pause
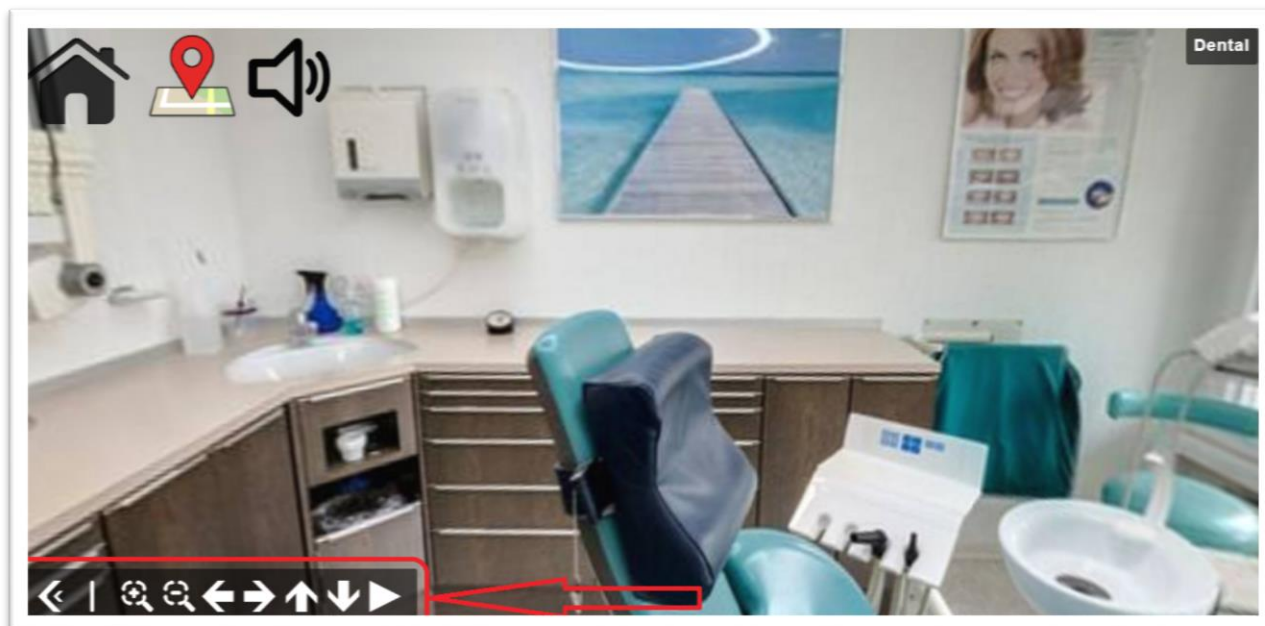


Figure 3-15 Control Signs

**Development Tool**

Following were some tools used to for developing application.

- Adobe Dreamweaver

  Used for web page design
- Adobe Photoshop

Used to edit and design picture/visual sign.

- Open source library Leanorama

  A jQuery plugin for displaying and navigating Virtual Tours based on panoramic images.

  Web URL: https://github.com/leandigo/leanorama

- PTGui  (photo editing tool )

  PTGui is panoramic image stitching software for Windows and MacOS. Originally started as a Graphical User Interface for Panorama Tools (hence the name), PTGui has evolved into a full featured, industry leading photo stitching application. It is tool used to combine six different pictures as one picture and vice versa.

  Web URL: https://www.ptgui.com/

## 3.11 Instruments and Data Collection Procedures

Data for the research was collected using the following methods:

- Knowledge Pre-Tests and Post-tests
- Survey
- Focus Group Discussions

### 3.11.1   Knowledge Pre-Tests and Post-tests

Pre and Post tests were planned to provide a measure of the student learning and understanding about the concepts given in application. A pre-test was given before teaching the topic and a post-test was administered after the topic was covered completely. Each test contained 5 questions, based upon different sections of the application with the same level of difficulty. The total number of marks for each test was 5.

A pilot study was conducted to find effectiveness of research study. During pilot study, pre and post test design was checked and discussed with supervisor. Details of Pre and Post test are available in appendix section A.

### 3.11.2 Focus group discussions

Focus group discussions were held with students in the study to gather further feedback about student's thoughts and feelings about the web (application) based learning approach.

Following were some questions asked in Focus group discussions

- How much of the information were you familiar with prior to using the application?
- Do you think the information provided in this application will be helpful to you? If yes, explain with some examples.
- List three things that you liked best about the application.
- List three things that need improvement in the application.
- What challenges did you face while using this application?
- Do you think you can learn better using such applications or do you like learning in your traditional classroom settings? Please explain why?
- How can this application help you in future?

### 3.11.3 Survey

Survey was conducted to measure the engagement and motivation of students while using web application. This survey was taken from two different surveys.

- Keller's ARCS Model of motivation  (Keller, 2010)
  To measure motivation
- Computer attitude questionnaire by Christensen and Knezek (Christensen & Knezek, 2015 )
  To measure engagement level

## 3.12  Statistical Analysis

All statistical analysis was performed using IBM SPSS for Windows, with 0.05 as the level of statistical significance for accepting or rejecting a hypothesis. **Wilcoxon Signed-Rank Test** was used for finding differences between the pre-test and post-test scores of the experimental group.

# CHAPTER 4: RESULTS

This chapter presents the analysis of quantitative and qualitative data. The qualitative data was collected with the help of focused group discussion with students, see appendix F. The quantitative data was collected with the help of survey questionnaire of the ARCS Model of Motivation (Motivational survey), Engagement survey and Pre-Post test, see appendix A. After that the qualitative analysis was done to further validate the quantitative data and the reason behinds the quantitative data. The chapter consists of the following sections.

## 4.1 Analysis of Motivation Survey Scores

Descriptive statistics of the motivation survey scores are shown below with the separate subscales of Attention, Relevance, Confidence, Satisfaction as well as the combined Total Motivation Score (TMS):

There were 11 attention related, 8 relevance related, 8 confidence related and 4 satisfaction related questions and the scale was Likert-type scale with minimum score 1 (Not True) and maximum score 5 (Very True).

Below table shows demographics of participants.

| Characteristics | Participants | In percentage |
|---|---|---|
| Age Group | | |
| 7-9 | 16 | 29 |
| 10-12 | 30 | 54 |
| 13-14 | 9 | 17 |
| Gender | | |
| Male | 14 | 25 |
| Female | 41 | 75 |
| Class | | |
| 2nd Class | 24 | 44 |
| 3rd Class | 31 | 56 |

**Table 4-1 Demographics of Participants**

| Item | Minimum | Maximum | Mean |
|---|---|---|---|
| Attention (11 items) | 2.72 | 4.45 | 3.63 |
| Confidence (8 items) | 2.75 | 4.50 | 3.80 |
| Relevance (8 items) | 3.12 | 4.75 | 3.94 |
| Satisfaction (4 items) | 3.50 | 4.75 | 4.09 |
| Total score | 3.02 | 4.61 | 3.86 |

**Table 4-2 Motivation Survey Mean**

From above table, Total means score is 3.86. Overall minimum mean score is 3.02 and maximum score is 4.61.In attention section, minimum mean score is 3.02, maximum score is 4.61 and overall attention score is 3.63. In confidence section, minimum mean score is 2.75, maximum score is 4.50 and overall attention score is 3.80. In Relevance section, minimum mean score 3.12, maximum score is 4.75 and overall relevance score is 3.94. In Satisfaction section, minimum mean score 3.50, maximum score is 4.75 and overall relevance score is 4.09.

Below Figure shows overall mean score of participants in graph.
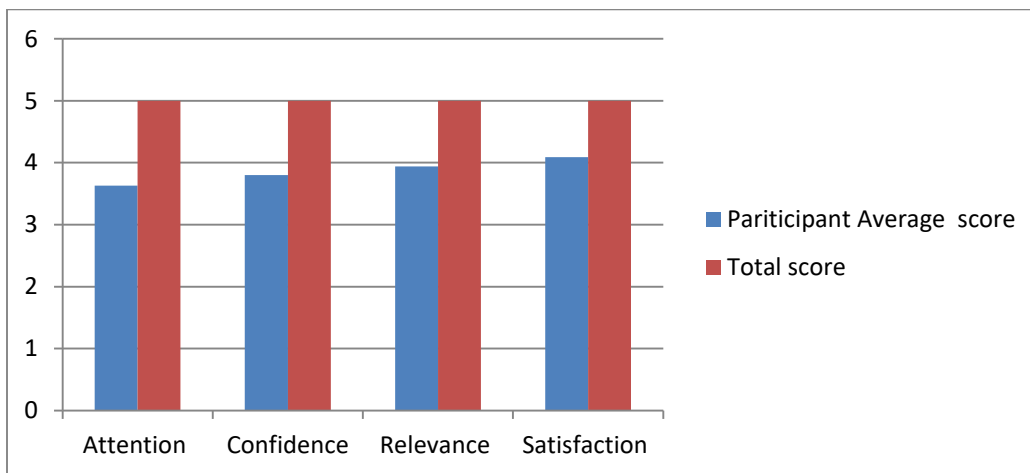


**Figure 4-1 Bar Graph of Average and Total mean Score of Students**

To discuss motivation survey results furthermore, participants score can be classify in to three categories.

- Class
- Gender

### 4.1.1 Class wise Motivation Level

There were two classes 2nd and 3rd class in intervention. Class wise results of motivation survey are given below.

| Item | 2nd Class | 3rd Class |
|---|---|---|
| Attention (11 items) | 3.54 | 3.71 |
| Confidence (8 items) | 3.77 | 3.81 |
| Relevance (8 items) | 3.90 | 3.98 |
| Satisfaction (4 items) | 4.14 | 4.05 |
| Total score | 3.83 | 3.88 |

**Table 4-3 Motivation of Second and third class**

From above motivation level scores, it is clear that third class students were more motivated than second class students while using interactive application.

### 4.1.2 Gender wise Motivation Level

Gender wise results of motivation survey are given below.

| Item | Male | Female |
|---|---|---|
| Attention (11 items) | 3.44 | 3.69 |
| Confidence (8 items) | 3.73 | 3.82 |
| Relevance (8 items) | 3.84 | 3.97 |
| Satisfaction (4 items) | 4.25 | 4.05 |
| Total score | 3.81 | 3.88 |

From above motivation level scores, it is clear that girls were more motivated than boys while using interactive application.

## 4.2 Analysis of Engagement Survey Scores

A modified version of Computer attitude questionnaire developed by Christensen and Knezek (Christensen & Knezek, 2015 )  was used to measure student engagement.

Following table show mean and standard deviation of engagement survey.

| Engagement | SD | Mean |
|---|---|---|
| I enjoy exploring the application | 0.66 | 3.67 |
| I believe that it is important for me to learn how to use this application | 0.60 | 3.56 |
| I feel comfortable using this application | 0.74 | 3.50 |
| I enjoy using the application. | 0.53 | 3.58 |
| Using application does not scare me at all. | 0.60 | 3.52 |
| Using this application (does not make) makes me nervous.* | 0.76 | 3.45 |
| Using this application is very frustrating.* | 0.53 | 3.40 |
| This application is difficult to use.* | 0.57 | 3.50 |
| I can learn more from books than the application. | 0.88 | 3.12 |
| I get bore using this application.* | 0.62 | 3.58 |
| Total | 0.65 | 3.49 |

**Table 4-4 Mean and Standard Deviation of Survey**

Above results indicates that Total Mean Score is 3.49 (M=3.49, SD=0.65) which might be considered as statistically high score. Additionally student's engagement time were also noticed during intervention, which was relatively high.

## 4.3 Analysis of Pre and Post Tests Scores

Pre and Post was conducted to check the performance of participants during intervention. Both Pre and Posttests contain 5 multiple choice question. Detail of Pre and Post are given in Appendix A.

To check whether data is parametric or Non-Parametric, normality test is applied. If p value is less than 0.05 (p<0.05), then data is non-parametric otherwise it is parametric data. Following table 4.2 shows normality test data.

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | Df | Sig. | Statistic | df | Sig. |
| post_test | .285 | 55 | .000 | .709 | 55 | .000 |
| pre_test | .314 | 55 | .000 | .829 | 55 | .000 |

**Table 4-5 Test of Normality**

Above table 4.5 shows 'p' value less than 0.05, thus it shows that data is non-parametric. Different test are applied on non-parametric data depending on nature of data. Wilcoxon signed rank test is non-parametric test. It is used to measure difference in mean rank of single sample or two related samples.

Wilcoxon test is applied on pre and post test. Following are table shows Wilcoxon test results.

**Descriptive Statistics**

| | N | Mean | Std. Deviation | Minimum | Maximum | Percentiles | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 25th | 50th (Median) | 75th |
| pre_test | 55 | 3.4727 | .83565 | 2.00 | 5.00 | 3.0000 | 3.0000 | 4.0000 |
| post_test | 55 | 4.4000 | .62657 | 2.00 | 5.00 | 4.0000 | 4.0000 | 5.0000 |

**Table 4-6 Descriptive Statistics**

Above table shows there is significant difference between pre-test mean (3.47) and post-test (4.4)mean, where N (55) shows number of participants. It shows there is improvement in their learning during intervention.

**Ranks**

|  |  | N | Mean Rank | Sum of Ranks |
|---|---|---|---|---|
|  | Negative Ranks | 3[a] | 15.50 | 46.50 |
| post_test | - Positive Ranks | 40[b] | 22.49 | 899.50 |
| pre_test | Ties | 12[c] |  |  |
|  | Total | 55 |  |  |

**Table 4-7 Test Ranks**

a. post_test < pre_test

b. post_test > pre_test

c. post_test = pre_test

Above table indicates ranks in three sections

- b. post_test > pre_test

  40 Participants improve their mean score (performance) in intervention.

- c. post_test = pre_test

  12 participants have same mean score (pre test score=post test score) throughout intervention.

- a. post_test < pre_test

  Only 3 participants mean score has been declined during intervention.

**Test Statistics[a]**

|  | post_test - pre_test |
|---|---|
| Z | -5.390[b] |
| Asymp. Sig. (2-tailed) | .001 |

**Table 4-8 Test Statistics**

Above table shows test statistics of Z value and probability value. We can make decision about hypothesis on basis of probability value. If probability value is less than 0.05, then null hypotheses is rejected. If probability value is greater than 0.05, then null hypotheses cannot be rejected.

As shown in above table p value is less than 0.05. Hence null hypothesis is rejected. Z value is -5.39. The Wilcoxon signed rank test results shows that the observed difference between both measurements (pre and post test) is statistically significant. Thus we might assume that using visual literacy in non-formal setting cause a significant increase in students learning.

## 4.4  Cohen Effect size

Cohen Effect size can calculated through below formula

$$r = \frac{z}{\sqrt{N}}$$

'r' represent the strength of association, Z represents standard normal deviate and N represent number of participants.

By putting values in above equation,

$$r = -5.39/\sqrt{110}$$

$$r = -0.51$$

Where 0.52 is considered high value.

## 4.5  Focused Group Discussion

Focus group discussions were held with students in the study to gather further feedback about student's thoughts and feelings about the web (application) based learning approach. Students were divided in groups. Each group contains 5 students.

Following were some questions and answers given by student are discussed in focus group discussions.

Question 1: How much of the information were you familiar with prior to using the application?

Most of students already knew about visual signs. Some of them responded with traffic visual sings, while some described health visual signs. They shared their prior knowledge and experience about visual signs. 360 view panoramas (virtual tour) were new experience for them, because it was new technology. They were motivated and excited while using virtual tour.

Question 2: Do you think the information provided in this application will be helpful to you? If yes, explain with some examples.

Different groups responded differently to this question. Some students responded that it will help in finding some public sites like hospital, parking, mosque and directions. Some students thought that it would help in school, finding toilets and parks, while some students couldn't share anything.

Question 3: List three things that you liked best about the application?

Most of students liked 360 view panorama pictures. They stated that 360 view panorama (virtual tour) was new experience for them. Moreover they also point out visual signs help them to recognize related department of hospital. One student shared her experience that she has already seen Visual sign of Dental Clinic, when she visit clinic with her mother. Some of students couldn't participants actively.

Question 4: List three things that need improvement in the application?

Most of student suggested that there should be video in every section. One of student also suggested that there should assistant (avatar) that would describe every section of application. Some students couldn't share any suggestion.

Question 5: What challenges did you face while using this application?

Some students stated that virtual tour (360 view panorama pictures) were new for them. So they do not know how to operate application. Functionality of Control buttons was not clear to them. Some students haven't used computer before. It was new experience for them.

Question 6: Do you think you can learn better using such applications or do you like learning in your traditional classroom settings? Please explain why?

Most of the students were agree to use interactive web application in class. According to them, Interactive application was not boring as traditional class. They stated that using application; it was like real tour of hospital, while traditional classroom cannot provide such interactive view. Few students prefer to use traditional classroom over interactive application. They also shared their views on interactive application that it was new and complicated for them.

Question 5:   How can this application help you in future?

Most of students shared their personal experiences and suggested that application will help them in related areas.  Some students stated that it will help them in traffic, markets, Park and museum, while some students stated that it will help them in schools, hospitals, public washrooms and post office. Few students also suggested that it will help to visit another country because they cannot visit there.

# CHAPTER 5: DISCUSSION

The purpose of this study is to evaluate visual literacy as pedagogical tool for non-formal education setting and how it can improve student motivation. This chapter will discuss study findings and its impact on academic achievement, engagement and motivational level.

## 5.1   Impact on Academic Achievement

Null Hypothesis 1: Use of a visual literacy (blended with technology) as a pedagogical tool will not academic learning in non-formal education?

In research study, main aim was to check student performance before and after using interactive web application embedded with visual signs. Student previous knowledge about research topic was checked through pre test.  After pre test, visual signs were taught through interactive application. Each and every part was explained through proper procedure by instructor. Then Students were allowed explored application. Students used application in their own way. Student's queries were facilitated and answered by instructor. During intervention, student behavior and interaction were noticed. After exploring application, post test was conducted to check their learning.

As a result of this study, significant improvement in student learning was observed. Results of study revealed that student perform significantly higher in post test (M=4.4, SD=0.62) than student perform in pre test (M=3.47, SD=0.83). This means that student learn more and perform better in post test.

Moreover students were active and motivated while using application. They discussed content of application with their class fellow and relate many aspects of application with prior knowledge. Focused group discussion of students also supported

Thus above facts and figures reveal that using visual literacy supported by technology can used as effective pedagogical tool for non-formal educational setting.

## 5.2   Impact on Motivation

 Null Hypothesis 2: Use of visual literacy in non-formal curriculum will not affect student motivation level.

Research study findings revealed that using visual signs in non-formal education curriculum has brought significant difference in motivation level of students. The overall engagement level of students was M=3.86, which is statistically high mean score of engagement level. Range of overall motivation scores was defined as

- High: Above 3.5 out 5
- Medium: 2.5-3.5 out of 5
- Low: Below 2.5 out of 5

As overall engagement level of students (M=3.86) lies between 3.5 and 5, which is statistically high.  As a result of study findings, above null hypothesis has rejected.

A recent study was conducted on Massive Open Online Courses to measure learners' motivation level by Huang and Hew (Huang & Hew, 2016) Study findings show that overall motivation score was 3.69. We can easily conclude that survey results reveal positive impact on student motivation.

## 5.3   Impact on Engagement

Null Hypothesis 3: Use of visual literacy in non-formal curriculum will not affect student engagement level.

Research findings reveal that using visual signs, blended with technology in non-formal education curriculum has brought significant improvement in student's engagement. Students were found active, engaged and motivated during intervention. Survey questionnaire (Christensen & Knezek, 2015 ) was used to measure engagement. Survey results revealed that engagement level of students (M=3.49, SD=0.65) was significantly high. As a result of study findings, above null hypothesis has rejected.

A related research study (Beeland, 2002) was conducted to investigate that whether use of interactive whiteboard as pedagogical tool affect student engagement or not. Research study reveal that engagement level of students (M=3.48, SD=0.15) was also significantly high. Study findings showed that student engagement was improved by use of interactive whiteboard.

## 5.4   Impact on Teaching Practices

Following points were noticed from teacher feedback, results and observations.

- It can used as an effective instructional tool to enhance student learning

- From teacher feedback shows that it has improved teaching practices in better way

- To inculcate 21 century skills in upcoming curriculum, we have to embed interactive visual tools in curriculum to assert as policy.

## 5.5   Feedback from Focus Group Discussions

Students explain their views on using interactive applications in their class. Following are some feedbacks from Focus Group Discussions are explained in different sections.

### 5.5.1   Relevant Content

Some students were excited to use application, because materials used in application were relevant to them. They shared prior experiences about visual signs and how it makes them confident to use application.

### 5.5.2   Easy to Use

Some students explained that first it looked difficult to use application, but when they started exploring application through visual sign help, they were confident to use it.

### 5.5.3   Graphics and Animations

360 view panorama pictures of hospital and their simulations were very attractive for students. It helped them to explore whole application.

### 5.5.4   Wayfinding

Some students explain that due to complex map of some areas like in hospital, they were lost from their parents in many cases. They told that directions, signs and maps (like in application) help to find their desired place.

### 5.5.5   Audio Description

Students shared their view about audio description that some part of application was easy understandable. Audio description helped them to explain specific department in area.

## 5.6  Limitation of Study

The study had number of limitations. Following are some of the limitations of the study are discussed.

- Complex Demographics of students

  Unlike formal class, non-formal education setting classroom has different age groups students. Their learning style is different from one another.

- Technology Adaption barriers

  Some of the teachers and students were not comfortable with new technology and application.

  According to them, it takes a lot of time to switch from traditional to modern technology use in education.

- Limited time for intervention

  Limited time slot was given by school for intervention. As intervention was carried out within limited period of time, thus it may affect intervention results. Mostly longer time period are more helpful in conducting quality research and its evaluation.

- Lack of resources for Development of project

  360 view picture of local hospital are not available. Foreign hospitals pictures were used in application. It was difficult for students to relate visual sings with other foreign hospitals pictures. Expert photographer was required to capture hospitals pictures (360 view panorama) for application.

- Awareness of Latest Technology

  Most of the students were in out-of-school children belong to poor family. They have not used 360 view technologies. For first time, it was difficult for them to interact with technology.

- Accessibility to areas

  Hospitals administration did not allow us to take pictures of related department because of security and administrative concerns.

# CHAPTER 6: CONCLUSION

The aim of the study was to evaluate visual literacy supported by technology as pedagogical tool for non-formal educational setting and test the impact on: engagement, motivation and academic achievement.

The first phase of the study was pilot study. In pilot study was conducted in two steps. In first step, survey of some local hospitals of Rawalpindi/Islamabad was conducted. Main aim of hospitals survey was to find out the use of visual sign. In Second step, different OSC schools were visited to examine out-of-school children curriculum, use and effectiveness of 360 view technology (virtual tour) and selection proper data collection tools. Pilot study was helpful to find out effectiveness of visual literacy and its impact on non-formal educational setting.

The second phase of the study involved the design and development of the interactive web application that would present visual signs in affective way. Visual signs (SEGD, 2015) and 360 view pictures of hospitals were embedded in interactive web application, where visual signs identify hospital specific department and 360 view pictures show full view or environment of that department. Other features like Location finding, Voice description and textual description were added in application to assist and facilitate students in learning. Related application designs were studied and reviewed to improve application quality and design.

The third phase of the study involved data collection and data analysis. Quantitative data was collected through pre-test, post-test, while qualitative data was collected through focused group discussions.

The results of the study show that all the null hypotheses were rejected; and thus student's engagement levels, motivation levels and knowledge was seen to be more positively influenced by visual literacy.

It is clear that the using visual literacy in interactive application as a pedagogical tool can improve student's engagement, motivation and academic achievement in non-formal educational setting. Finding of the research reveal that visual  literacy (visual signs, 360 view pictures) appears to be more beneficial to the primary school students for achieving significantly higher score as compared

to a learner who has received non-formal traditional classroom instruction. Current research findings and previous studies supported that visual methods and materials should be included school's curriculum for student's better understanding and learning. It is strongly recommended that visual literacy along with latest technology should be embedded in non-formal school's curriculum to achieve desired academic goals.

# CHAPTER 7: RECOMMENDATIONS

## 7.1 General Recommendations

The current study was to evaluate visual literacy as pedagogical tool supported by virtual tour technology for non-formal educational setting. Main purpose was to provide quality educational content for non-formal education setting. Study results supported that technology should be embedded in related curriculum to enhance student learning. Same initiatives related to educational technology and research should be started. It will help schools and other educational institutes to improve their educational content for learners. Those initiatives results and its impact should be published publicly, so that it can make trend for other institutes. Educational related industry should consider investing on latest educational development and research. Moreover Educational technology awareness seminars and workshops should be arranged to reduce technology barriers.

Expert's resources are required in many aspects of quality research. Human resources for educational research and development like graphic designers, Software developers, Instructional designers and content developers should be trained to create quality content for education. During intervention of current study, 360 view panorama photographers were required along with compatible camera. It was hard to find related resource. Moreover access to public sector departments is not allowed mostly for educational research. Researchers and educators should be allowed to access any part of area and study every aspects of research.

## 7.2 Recommendations for Future Research

The Virtual tour (360 view panorama) is new field of research for education and contains a lot of scope for further research in the field. Some recommendations for future research are as follows:

- A research study can be conducted to figure out the use of virtual tour (360 view panorama) on formal education curriculum and its impact on student's learning.
- Embed augmented reality in web application.
- A detailed research can be conducted on use of visual signs in different areas including museums, parks, sports and other public places.

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# APPENDICES

## Appendix A: Pre and Post Test

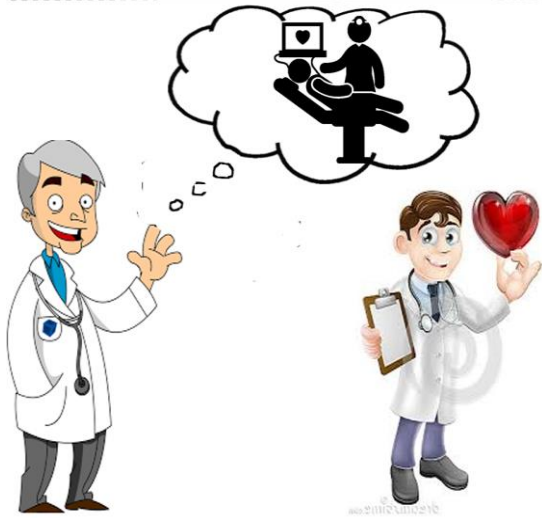| No | Pre Test Scenario | Options |
|---|---|---|
| 1 |  | |
| 2 |  | |

3



4

5



| No | Post Test Scenario | Options |
|----|--------------------|---------|
| 1  |  |  |

4

5

# Appendix B: Engagement Survey

**SD = Strongly Disagree D = Disagree A = Agree SA = Strongly Agree**

**SD=1    D=2    A=3   SA=4**

|  | Engagement | SD | D | A | SA |
|---|---|---|---|---|---|
| 1. | I enjoy exploring the application | | | | |
| 2. | I believe that it is important for me to learn how to use this application | | | | |
| 3. | I feel comfortable using this application | | | | |
| 4. | I enjoy using the application. | | | | |
| 5. | Using application does not scare me at all. | | | | |
| 6. | Using this application (does not make) makes me nervous.* | | | | |
| 7. | Using this application is very frustrating.* | | | | |
| 8. | This application is difficult to use.* | | | | |
| 9. | I can learn more from books than the application. | | | | |
| 10. | I get bore using this application.* | | | | |

## Appendix C: Motivational Survey

Instructional Material Motivational Survey

Name: _____     Age: _____     Gender: Male/Female

Class: _____     School: _____

**Rate as  5: Very True; 4: Mostly True; 3: Moderately True; 2: Slightly True; 1: Not True**

| S# | Questions | 5 | 4 | 3 | 2 | 1 |
|----|-----------|---|---|---|---|---|
| 1 | When I first looked at this game, I had the impression that it would be easy for me. | | | | | |
| 2 | There was something interesting at the beginning of each level that got my attention. | | | | | |
| 3 | The game content was more difficult to understand than I would like for it to be. | | | | | |
| 4 | After listening to the introductory information for each level, I felt confident that I knew what I was supposed to learn from the game. | | | | | |
| 5 | Completing the activities for this game gave me a satisfying feeling of accomplishment. | | | | | |
| 6 | It is clear to me how the content of this game is related to things I already know. | | | | | |
| 7 | Many of the scenes had so much information that it was hard to pick out and remember the important points. | | | | | |
| 8 | These graphics are eye-catching | | | | | |

| S# | Questions | 5 | 4 | 3 | 2 | 1 |
|----|-----------|---|---|---|---|---|
| 9 | There were stories, pictures, or examples that showed me how the activities in the game could be important to some people. | | | | | |
| 10 | Completing this game successfully was important to me. | | | | | |
| 11 | The quality of the instructions helped to hold my attention. | | | | | |
| 12 | The activities are so abstract that it was hard to keep my attention focused on the game. | | | | | |
| 13 | As I played the game, I was confident that I could learn the content. | | | | | |
| 14 | I enjoyed the activities in the game so much that I would like to know more about this topic. | | | | | |
| 15 | The graphics of this module look dry and unappealing. | | | | | |
| 16 | The content of this game is relevant to my interests. | | | | | |
| 17 | The way the information is arranged in the game helped keep my attention. | | | | | |
| 18 | There are explanations or examples of how people use the knowledge in this game. | | | | | |
| 19 | The activities in this game were too difficult. | | | | | |
| 20 | This game had things that stimulated my curiosity. | | | | | |

| 21 | I really enjoyed learning through this game. | | | | | |
|----|---------------------------------------------|--|--|--|--|--|
| 22 | The amount of repetition in this game caused me to get bored sometimes. | | | | | |
| 23 | The content and style of writing in this game convey the impression that its content is worth knowing. | | | | | |
| 24 | I learned some things that were surprising or unexpected. | | | | | |
| 25 | After playing this game for few times, I was confident that I would be able to pass the exam related to the topic of Measurements. | | | | | |
| 26 | This content in the game was not relevant to my needs because I already knew most of it. | | | | | |
| 27 | The assistance I received during this game helped me feel rewarded for my effort. | | | | | |
| 28 | The variety of written and verbal instructions, and illustrations helped keep my attention on the game activities. | | | | | |
| 29 | The instructions are boring. | | | | | |
| 30 | I could relate the content of this game to things I have seen, done, or thought about in my own life. | | | | | |
| 31 | There are so many written and verbal instructions on each scene that it is irritating. | | | | | |
| 32 | It felt good to successfully complete this game. | | | | | |

| 33 | The content of this game will be useful to me. | | | | | |
|----|-----------------------------------------------|--|--|--|--|--|
| 34 | I could not really understand quite a bit of the material in this module. | | | | | |
| 35 | The good organization of the content helped me be confident that I would learn this topic. | | | | | |
| 36 | It was a pleasure to work on such a well-designed game. | | | | | |

**IMMS SCORING GUIDE**

Instructions: The response scale ranges from 1 to 5. This means that the minimum score on the 36 item survey is 36, and the maximum is 180 with a midpoint of 108. The minimums, maximums, and midpoints for each subscale vary because they do not all have the same number of items.

- An alternate scoring method is to find the average score for each subscale and the total scale instead of using sums. For each respondent, divide the total score on a given scale by the number of items in that scale. This converts the totals into a score ranging from 1 to 5 and makes it easier to compare performance on each of the subscales.
- There are no norms for the survey. As it is a situation specific measure, there is no expectation of a normal distribution of responses. As data become available from a variety of applications of the scales, descriptive statistical information will be published.
- Scores are determined by summing the responses for each subscale and the total scale. Please note that the items marked *reverse* are stated in a negative manner. The responses have to be reversed before they can be added into the response total. That is, for these items, 5=1, 4=2, 3=3, 2=4, and 1=5.

| Attention Items | | | Confidence Items | | |
|---|---|---|---|---|---|
| 2 | 15 (reverse) | 24 | 1 | 13 | 35 |
| 8 | 17 | 28 | 3 (reverse) | 19 (reverse) | |
| 11 | 20 | 29 (reverse) | 4 | 25 | |
| 12 (reverse) | 22 (reverse) | 31 (reverse) | 7 (reverse) | 34 (reverse) | |

| Relevance Items | | | Satisfaction Items | | |
|---|---|---|---|---|---|
| 6 | 18 | 33 | 5 | 32 | |
| 9 | 23 | | 14 | 36 | |
| 10 | 26 (reverse) | | 21 | | |
| 16 | 30 | | 27 | | |

## Appendix D: Modified Motivational Survey

**Rate as 5: Very True; 4: Mostly True; 3: Moderately True; 2: Slightly True; 1: Not True**

| S# | Attention | 5 Very True | 4 Mostly True | 3 Moderately True | 2 Slightly True | 1 Not True |
|---|---|---|---|---|---|---|
| 1 | The graphics of this application are eye-catching | | | | | |
| 2 | There was something interesting at the beginning of each section/department that got my attention. | | | | | |
| 3 | The quality of the instructions in the | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | application helped to hold my attention. | | | | | |
| 4 | The graphics of this application look dry and unappealing. | | | | | |
| 5 | The way the information is arranged in the application helped keep my attention. | | | | | |
| 6 | This application had things that stimulated my curiosity. | | | | | |
| 7 | The amount of repetition in this application caused me to get bored sometimes. | | | | | |
| 8 | I learned some things that were surprising or unexpected. | | | | | |
| 9 | The variety of written and verbal instructions, and illustrations helped keeping my attention | | | | | |
| 10 | The instructions are boring. | | | | | |
| 11 | There are so many written and verbal instructions on each scene that it is irritating. | | | | | |

| | **Confidence** | | | | | |
|----|------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| 12 | When I first looked at this application, I had the impression that it would be easy for me. | | | | | |
| 13 | The content was more difficult to understand than I would like for it to be. | | | | | |
| 14 | After the introductory information, I felt confident that I knew what I was supposed to learn from this module | | | | | |
| 15 | Many of the scenes had so much information that it was hard to pick out and remember the important points. | | | | | |
| 16 | As I explored the application, I was confident that I could learn the content. | | | | | |
| 17 | After using this application for few times, I was confident that I would be able to apply the knowledge gained in real life situations as well. | | | | | |
| 18 | I could not really understand quite a bit of the material in this module. | | | | | |
| 19 | The good organization of the content helped me be confident that I would learn this topic. | | | | | |

| | **Relevance** | | | | | |
|---|---|---|---|---|---|---|
| 20 | It is clear to me how the content of this application is related to things I already know. | | | | | |
| 21 | Exploring this application completely was important to me. ⌊SEP⌋ | | | | | |
| 22 | The content of this application is relevant to my interests. | | | | | |
| 23 | There are explanations or examples of how people use the knowledge in this application. | | | | | |
| 24 | The content and style of writing in this application convey the impression that its content is worth knowing. | | | | | |
| 25 | This content in the application was not relevant to my needs because I already knew most of it. | | | | | |
| 26 | I could relate the content of this application to things I have seen, done, or thought about in my own life. | | | | | |
| 27 | The content of this application will be useful to me. | | | | | |

| | **Satisfaction** | | | | | |
|---|---|---|---|---|---|---|
| 28 | I enjoyed the application so much that I would like to know more about this topic. | | | | | |
| 29 | I really enjoyed learning through this application. | | | | | |
| 30 | It felt good to successfully explore the application. | | | | | |
| 31 | It was a pleasure to work on such a well-designed application. | | | | | |
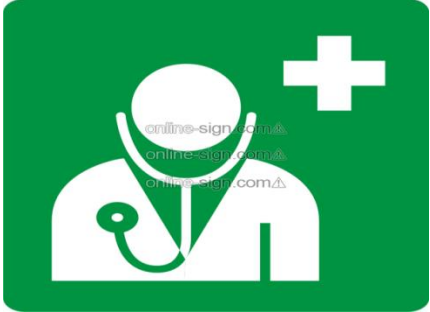
**Appendix E: Focused Group Discussion**

1. How much of the information were you familiar with prior to using the application?

2. Do you think the information provided in this application will be helpful to you? If yes, explain with some examples.

3. List three things that you liked best about the application

4. List three things that need improvement in the application.

5. What challenges did you face while using this application

6. Do you think you can learn better using such applications or do you like learning in your traditional classroom settings? Please explain why?

7. How can this application help you in future?

## Appendix F: Prior Knowledge Test (Pilot Study)

**Connected Related Items**

| | |
|---|---|
|  | **NURSE** |
|  | **Dentist** |
|  | **AMBULANCE** |
|  | **DOCTOR** |

| | |
|---|---|
|  | **Syringe** |
|  | **X-RAY** |
|  | **Laboratory** |
|  | **Ward** |

# Appendix G: Hospital Survey and Pilot Study pictures