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Assessing the Effectiveness of Elaborating the Visualization Aspect of Selected Physics Lessons in Teaching and Learning Physics at Secondary Education Level

Madawala Liyanage Shanaka Piyatissa[1], Md Gapar Md Johar[2] and Arun Kumar Tarofder[3]

[1]Department of Science, National Institute of Education

[2,3]Management and Science University, Malaysia

Abstract

There involves an overt component of visualization in physics and helping students to visualize the needed areas in physics is a way to strengthen students' familiarity with the visualization aspect embedded therein. This study was carried out as a field experiment to test whether paying a deliberate attention on elaborating the visualization aspect in teaching physics in the classroom can have a positive impact on students' physics performance at secondary school level. A group of 308 students of grade 11 (aged 15-16 years) studying at three government schools in Sri Lanka participated in this study. The physics lessons selected for this study are kinematics, Newton's laws of motion, turning the effect of force, resultant of forces, frictional force and mechanical energy. To assess the students' familiarity with the visualization aspect in these lessons, a lesson specific assessment tool called Visual-Perceptual Assessment Tool (VPAT) consisting of 26 multiple choice physics questions was developed and validated. It showed a Cronbach's alpha coefficient of 0.721 - a satisfactory reliability level. Carefully selected Computer Aided Learning (CAL) materials were the principal visualization objects employed in this study. This teaching intervention showed a considerable gain in the experimental group at the post-test administration of the VPAT when compared to the pre-test results (a gain of 18%). Besides, an analysis was done on the physics performance by the same sample of students at their school term test papers given immediately before and immediately after the teaching intervention, and there too the experimental group showed a nearly 15% improvement over the control group.

Keywords: Visualization, Representations, Model, Physics performance, Assessment

Introduction

Although visualization is a complex process which includes cognitive and brain activities, in science education, visualization can be taken as any type of representation used to make an abstract scientific concept visible. In this context, representation means using one structure that stands for something else. Representations are two-fold: external representations and internal representations (Gilbert, 2005). In classroom teaching, the students experience the external representations basically by way of five modes of external representations (Gilbert, 2005). They are (a) the material/the concrete mode (physical models or practical set ups), (b) the verbal mode (written and spoken language), (c) the symbolic mode (standard notations and formulae), (d) the visual mode (diagrams, graphics, graphs, videos, animations, simulations, etc.), and (e) the gestural mode (gestural expressions). With relevance to these external representations, the students build internal representations which can be called visualizations, mental images or visual-perceptions (Gilbert, 2005; Gilbert, 2010) in science education. The visualizations may include the temporal/spatial relationships of external representational items which can be static and/or dynamic. Models in science can be considered as another construct in visualization which is closely related with the representations (Shu-Nu & Yao, 2014). The model can be considered as a simplified representation of a phenomenon, which is used to simulate its functionality (Piyatissa, Gapar, & Tarofder, 2018). Beside the complex nature of the field of visualization, effective use of external representations to elaborate the visualization aspect of science can be recognized as a practical way to help students to better visualize the necessary areas in science subjects, which will enhance the students' science performance.

This study focuses on how the above mentioned visual mode (limited video clips, animations and simulations) can be used to elaborate the visualization aspect of six secondary school physics lessons, kinematics, Newton's laws of motion, turning the effect of force, resultant of forces, frictional force and mechanical energy presently taught under the physics component of GCE-OL (General Certificate of Education-Ordinary Level) science syllabus (National Institute of Education, 2015) implemented from the year 2015 in the secondary school level in Sri Lanka (students of age 15-16 years). Low physics performance of the students at GCE-O/L examination as revealed by the evaluation reports of the subject science (subject code 34) issued by the Department of Examinations, Sri Lanka (for the years 2009 – 2015) is one reason for selecting physics for the study (over 50% of the students have scored marks in the range of 0-25% in the essay type questions). Further, the reason for selecting these physics lessons is that they are the introductory lessons in many other similar physics courses and at the same time they are rich in visualization content too. Though this study is limited to the above

mentioned physics lessons at GCE-OL, the same approach can be extended to other physics lessons such as waves, optics, current electricity, electromagnetism, electronics, hydrostatics, etc., making it a new method worthy of trying out for the purpose of improving the students' low physics performance at GCE-OL.

Literature Review

Some of the areas related to visualization in science education can be mentioned as (a) theories on visual-learning, (b) studies done in the field of spatial ability, and (c) studies done in the fields of representations, representational competence, models and modeling. Almost all of these areas are interrelated and there can be overlapping.

Piaget's work on his classic theory of developmental psychology laid a strong foundation for the studies in the field of visual learning, in relation with the child's cognitive development. Piaget and Inhelder (1967) pointed out that the child's early spatial conceptions are topological in nature and at about 12 or 13 years of age the child is able to visualize the concepts such as area, volume, and distance in combination with those of translation, rotation, and reflection, which are essential in learning physics. Further, Piaget emphasized the role of building schemas and activating them in problem solving. According to Piaget, the student activates an appropriate schema such as a scientific model/equation in solving physics problems. Wiley (1990) proposed a hierarchy of visual learning consisting of three stages of visual learning as visual cognition (or perceiving a visual image), visual production (or creating a visual object) and visual resolve (or comprehending the purpose of a visual object). The Dual Coding Theory (DCT) (Paivio, 1986; Sadoski & Paivio, 2001) and the Visual Imagery Hypothesis (VIH) (Johnson-Laird, 1998; Pylyshyn, 2003) can be considered as the most frequently used theoretical foundations for many recent studies on using computer based visualization tools. The DCT says that the linguistic information (words and sentences) and the visual information (images) are encoded by two independent mental systems, a verbal one and a nonverbal one. This theory can be considered as an attempt of explaining how the visualization relates with memory and how visualization may be used to improve learning and understanding. The VIH argues that use of graphical representations reduces the demand on working memory allowing one to process information more efficiently, compared to use of text based representations.

Researchers have found a positive correlation between the students' performance in spatial ability tests and their performance in Science, Technology, Engineering and

Mathematics (STEM) subjects (e.g. Shea, Lubinski, & Benbow, 2001; Uttal & Cohen, 2012; Wai, Lubinski, & Benbow, 2009). Generally, spatial ability refers to one's ability to visualize, transform, and manipulate non-verbal information, such as symbols, figures, and 2-D and 3-D objects based on visual stimuli (Carroll, 1993; Linn & Petersen, 1985; McGee, 1979).The spatial ability consists of various sub levels (spatial ability factors). With the general identification of the spatial ability as a successful predictor in STEM education, physics educationists also conducted spatial ability research, basically with the aim of identifying the spatial ability factors (e.g. mental rotation, metal transformation, spatial orientation) correlated with various physics domains (e.g. Pallrand & Seeber, 1984; Kozhevnikov, Motes & Hegarty, 2007; Lyna & Fulmer, 2014). The researchers' attention on this kind of spatial ability research influenced to broaden the studies on formation of mental images and manipulating such images in science subjects (Piyatissa, Gapar & Tarofder, 2018). As an implication of spatial ability research, it can be mentioned that if a student is good at the skills such as mental rotation, mental cutting, viewing cross sections, etc., it is reasonable to generally guess that the student can easily visualize the necessary areas in physics.

Representational Competence (Kohl & Finkelstein, 2005; Kohl & Finkelstein, 2006) is needed to work exclusively with representations, in science subjects. The skill of dealing with the representations is called representational competence (Kozma & Russell, 2005). Multi-representational instruction and simulations can be considered as an effective way of improving the students' representational competence in learning science subjects (Steiff, 2011; Opfermann, Schmeck, & Fischer, 2017). Though science teachers use multiple representations in classroom teaching they may not sufficiently pay their attention on step by step development of concepts through the use of these representations (Wong & Chu, 2017).

The teacher can represent the external models by way of a diagram, a physical practical set up, a computer simulation/animation, etc. and they all come under public models where the scientific community has a common agreement on them. Then the student builds their own internal (mental) private models (Gilbert, 2005) where his/her background can also infer to make individual differences. Therefore, to bring uniformity into the internal representations among students at least to a certain extent, it is advisable to use more than one mode of external representation (Piyatissa, Gapar & Tarofder, 2018). The student should have the capability of visualizing the models in three representation levels: the macroscopic, the microscopic, and the symbolic (Johnstone, 1993).

Methodology

Experimental Design

This study is a field experiment conducted in the existing school system. The experimental design used is a 'pre-test and post-test experimental and control group design' (Sekaran & Bougie, 2013).

The experiment group is taught physics lessons by highlighting the visualization aspect using CAL materials, reinforcing the usual classroom teaching while the control group is also taught the same physics lessons of the same duration as for the experimental group intentionally not highlighting the visualization aspect with/without using CAL materials. For both the groups, the Visual-Perceptual Assessment Tool (VPAT) was administered as a pre-test and a post-test (here the same test was used as the pre-test and the post-test). The experimental teaching was done during the second school term, that is, during the period May to July of the year 2017 (the school term in Sri Lankan school calendar are; Term 1: January-March, Term 2: May-July, Term 3: September-November; at the end of each school term, the term end examination is conducted by the schools). Students' marks for the physics questions of the term end school science papers (term 1 end: end of March 2017 and term 2 end: end of July 2017, that is prior to the experimental teaching and after the experimental teaching respectively) were extracted as a measure of their general physics performance. Table 1 shows the experimental design of the experiment.

Table 1: Experimental design of the study

Group	Pre-test	Treatment	Post-test
Experimental	a. The Visual-Perceptual Assessment Tool b. Physics questions at the end of Term1 school science term test paper	Use of CAL materials to highlight the visualization aspect, embedded with usual classroom teaching	a. The Visual-Perceptual Assessment Tool b. Physics questions in end of Term 2 school science term test paper
Control	a. The Visual-Perceptual Assessment Tool b. Physics questions at the end of Term1 school science term test paper	Usual classroom teaching without giving any deliberate attention on highlighting the visualization aspect with/without using CAL materials	a. The Visual-Perceptual Assessment Tool b. Physics questions in end of Term 2 school science term test paper

Random assignment of the students to the groups increased the internal validity of the experimental design. Selecting a sample of students from averagely performed schools increased the external validity of the experimental design.

During the time of the experiment, the participating students have completed the experimental lessons at their usual school time table. The experiment was conducted during the period, May-July 2017. The experimental lessons were conducted as after-school sessions. For both the groups 14 hours of experimental teaching was done. These 14 hours were distributed across the lessons on the basis of the time allocated for the each lesson as per the syllabus. One teacher conducted the experimental lesson for the experimental group while another teacher conducted the experimental lesson for the control group in each school. The medium of instruction was Sinhala. The CAL materials were used in the lessons with the experimental group as a whole class student participatory interactive demonstration sessions.

The Population and the Study Sample

The population of the study is grade 11 students in the government school system in Sri Lanka following GCE-OL science syllabus developed by the National Institute of Education (NIE), Sri Lanka. For this study, a sample of 308 students from grade 11 during the year 2017 studying at three averagely performed government schools in Colombo district were selected. Table 2 shows the composition of the sample.

Table 2: Sample of the study

Name of the school	Number of students participated	
	Expt. group	Contr. group
Buddhist Girls' College, Mount Lavinia	53	53
Science College, Mount Lavinia (Boys)	55	56
Dehiwala Central College, Dehiwala (Mixed)	45	46
Total	153	155

The students were randomly assigned to the experimental group and the control group. In each school, two classes were formed, one for the experimental group and the other for the control group. The three experimental groups are collectively taken as one whole experimental group, and the same treatment applies to the control group as well. No school-wise analysis was of interest in this study.

Selection of a girls' school, a boys' school and a mixed (girls and boys) school made a sample consisting of quite equal number of girls and boys in the sample. However, no gender-wise performance analysis was done in this study.

Notable Visualization Related Areas and Assessing the Students' Attainment in Visualization

When it comes to identifying the visualization related areas to be elaborated in classroom teaching and learning of physics, in general, various visualization aspects such as (a) building a mental image of an object physically seen, drawn, or heard about, (b) comparing physical quantities related with moving objects, (c) spatial imaginations of objects, (d) visualizing spatial relationships and orientations of objects, (e) visualizing algebraic equations, (f) mentally inverting, cross-sectioning or rotating an object, (g) imaginations resulted from some hypothetical scientific models, etc. can be enumerated. Therefore, selecting the most appropriate visualization aspect for elaborating specific subject content at the classroom teaching and assessing its impact on the students' physics performance is, to a large extent, content specific in nature. Because of this broad variety in visualization even in a particular lesson topic, finding a common framework for assessing students' attainment in visualization in physics is difficult and therefore, a mixed of external representation is preferred. Notable visualization related areas identified in this study are given in Table 3.

Table 3: Outline of the visualization related areas

Lesson	Notable visualization related areas
Kinematics	a. Differentiating the distance and displacement, and its impact on average speed and average velocity by visualizing the rectilinear motion of an object (treating plus and minus signs of the displacement and velocity)
	b. Interpreting the acceleration concerning the distance or displacement
	c. Interpretation of displacement-time and velocity-time graphs
Newton's laws of motion	a. Visualizing the effect of an object kept on zero gravity, zero air pressure, and zero surface friction (background of Newton's first laws)
	b. Visualizing Newton's first law of motion in terms of speed and the external force applied on the object

Lesson	Notable visualization related areas
	c. Visually predicting the effect of a constant force applied to an object continuously for a specific time (background of Newton's second law) in term of its speed
	d. Visualizing the effect of varying the variables in $F = ma$ in terms of the change in speed, of the object in question, keeping one variable constant at the time (Newton's second law of motion)
	e. The imagination of action and reaction pair of forces under Newton's third law of motion
Turning effect of forces	a. Visualizing the turning effect of forces regarding moments of the force (the magnitude of the force multiplied by the shortest distance to the line of action of the force from the point around where the moment is calculated)
	b. Visualizing the principle of moments (clockwise moments are equal to anti-clockwise moments if the system is in force equilibrium)
Force equilibrium	a. Visualizing the centre of gravity of the lamina regarding moments
	b. Visualizing stability of an object (under the force equilibrium)
Resultant of forces	a. Visualizing the resultant of parallel forces
	b. Visualizing the direction of the resultant force of two angled forces
Frictional force	a. Visualizing the factors affecting the frictional force
	b. Visualizing the direction of the frictional force
	c. Visualizing the static and dynamic friction by differentiating them
Mechanical energy	a. Visualizing the definition of mechanical work
	b. Visualizing kinetic and mechanical energy transformations

Table 3 contains visualization aspects generally identified in this study. In order to elaborate them at classroom teaching, the science teachers can use various external representation modes. In this study, the CAL materials (coming under the visual mode) were used to improve the students' familiarity in visualizing these areas only for the experimental group.

Development and Validation of the Visual-Perceptual Assessment Tool (VPAT)

The VPAT is a paper and pencil test consisting of a set of physics questions (test items) which can be considered as capable of measuring the students' attainment of visualizing the above mentioned notable visualization related areas of the physics lessons given in Table 3. The test consists of 26 multiple choice type questions which have to be answered within 25 minutes. The number of questions under each lesson topic in the VPAT was decided according to the time allocated for the topic as per the syllabus.

Nine test items of the test were developed by the researchers specifically for this study. The rest have been adopted / adapted from the existing sources. They are, science past papers of school term tests, science past papers in GCE-OL (Sri Lanka) examination, Physics past papers in Cambridge IGCSE Physics, O Level Physics MCQ Hot Spots 1000 Frequently Examined Questions - Red Spot Publications (Lim, 2015), IGCSE Physics Course Book-General Physics (Sang, 2011), and Mechanics Diagnostic Test (Korsunsky, 2003).

The reliability of the VPAT was tested in a pilot study conducted with 67 students of the three schools not participated in the main experiment and a Cronbach's alpha value of 0.716 was obtained. In the pre-test administration of the VPAT in the main experiment, a Cronbach's alpha value of 0.721 was obtained. For a classroom assessment, if this value is around 0.700, it can be concluded that the assessment is reliable or having the internal consistency (Santrock, 2009). Therefore, it can be considered that the VPAT is a reliable tool.

The content validity of the VPAT was tested. That is, whether the questions match with the depth of the GCE-OL science syllabus and they contain a considerable visualization component were assured by getting the comments from the participating science teachers and a group of subject experts.

To test the concurrent validity of the VPAT, the aggregate scores of three spatial ability tests administered for participating students were used. This was done in parallel to the pre-test administration of VPAT. The three spatial ability tests used were the Paper Folding Test (PFT) (Ekstrom, French, & Harman 1976), the Perspective Taking/Spatial Orientation Test (PTSOT) (Hegarty & Waller, 2004), and the Revised Perdue Spatial Visualization Tests: Visualization of Rotations (Revised PSVT: R) (Guay, 1976; Yoon, 2011). The major reason for selecting the students' scores in spatial ability as a measure suitable to test the concurrent validity of VPAT is the strong literature support that the ability to solve science (physics) problems involving an overt component of visualization and spatial ability are positively related (e.g. Gilbert, 2005;

Kozhevnikov et al., 2007; Lyna & Fulmer, 2014). The correlation coefficient (Pearson's) of 0.526 (p-value = 0.000) between the spatial ability score and the VPAT score showed that the VPAT can be considered as having the concurrent validity.

In order to test the predictive validity of the VPAT, the correlation between the pre-test scores of the VPAT and the school term test physics marks (end of term 2, that is, after the teaching intervention) were calculated. The correlation coefficient value (Pearson's) of 0.696 (p-value = 0.000) showed that the VPAT has the predictive validity.

The construct validity is the extent to which there is evidence that the VPAT measures an unobservable trait, the students' level of visual-perception in physics. The judgments about the construct validity might also rely on a description of the development of the tool (test) (Santrock, 2009). In developing the VPAT, the test items which are capable of measuring the students' familiarity with the visualization aspect in physics had been carefully selected. Therefore, it can be said that the VPAT has the construct validity to a certain extent. However, in this study, no factor analytic type of analysis was done for testing the construct validity of the VPAT as the test had not been developed based on a factor structure due to the broad variety in visualization even within a particular lesson.

Sample Test Items in the VPAT

As special emphasis was made for elaborating the visualization aspects motioned in Table 3 using selected CAL materials, only for the students in the experimental group, special care was taken not to connect these CAL materials directly to these questions. This makes sure the control group students not being familiar with the new learning materials used with the experimental group do not experience any difficulty in understanding the questions. Three sample questions of the VPAT are given below (developed by the researchers).

Question 1

An ant goes on a curved path from A to B, on a horizontal wall (marked in dark line). The time taken for this journey is 10 s. The ant's curved path from A to B is 30 cm and the shortest distance from A to B is 24 cm (marked in dotted line).
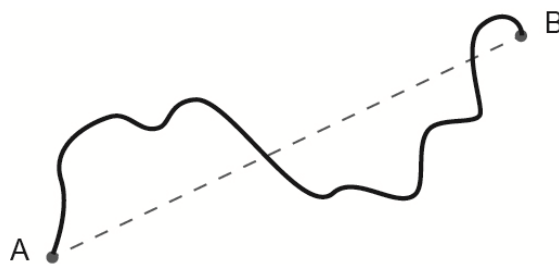
What are the average speed and the magnitude of the average velocity of the ant respectively?

(a) 2.4 cm s^{-1} and 3 cm s^{-1}

(b) 3 cm s^{-1} and 2.4 cm s^{-1}

(c) 3 cm s^{-1} and 0

(d) 2.4 cm s^{-1} and 0

In this question, the student needs to visualize how the distance changes in a unit time interval in relation with the nature of motion of the object, that is whether it is at rest, it moves with constant velocity, or it moves with acceleration.

Question 2

The ant what travelled from A to B in the above question number 2 returned back from B and travelled on BA straight path (marked on dotted lines) reached to A again within 8 seconds. For the whole motion of the ant including the previous motion of it, which of the following statement is true regarding its average speed v_1 and the magnitude of average velocity v_2?

(a) $v_1 = v_2$

(b) $v_1 > v_2$ and $v_2 = 0$

(c) $v_1 < v_2$

(d) $v_1 > v_2$ and v_2 is not equal to 0

The students are familiar with diagrams like that in the question 2 because they have come across similar diagrams in their grade 9 and grade 10 textbooks in introducing the displacement as the shortest distance. The question 2 primarily tests their ability to visualize the concepts of average speed and average velocity in relation to the above diagram in the question.

Question 13

The diagram shows a car which is under breakdown condition and a group of people pushing the car forward. Their push is sufficient to move the car forward. The group of people continues applying the same push from the beginning until they pass the second street lamp tower.

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If the speed of the car when it passes the first street lamp tower is 5 km/h, what can be said about its speed when it passes the second street lamp tower?

(Assume that when the people push the car throughout this journey the driver does not use any breaking of the car and the car is on neutral position. Also assume that the stretch of road is horizontal, it has a uniform surface, all the other conditions of the car held unchanged during this motion, and the air resistance is the same during this motion).

    (a) Less than 5 km/h

    (b) Greater than 5 km /h

    (c) The same as 5 km /h

    (d) No sufficient information to answer

In this question, the student needs to perceive the effect of a constant force applied to an object. The student must link the situation with the idea of Newton's second law of motion. There are chances of the student incorrectly answering the question if the student perceives that when the force is constant, the velocity will also be constant. This question assesses whether the student has such a visual-perceptual misconception.

Highlighting the Visualization Aspect through CAL Materials

How the selected CAL materials were used to elaborate the visualization related areas are discussed below with three examples. The most of the materials used were downloaded from the World Wide Web. They are available to the end user free of charge. These materials were selected after closely evaluating them on whether they are relevant to the GCE-OL science syllabus (National Institute of Education, 2015) (considering the learning outcomes in the syllabus and limitations guided by the teacher's guide). These CAL materials can generally be considered as supporting materials developed by their producers/presenters for secondary school introductory physics courses. In this study, they are used as visualization tools to help the students to build necessary visualizations.

Example 1: Kinematic graphs

According the syllabus, kinematics graphs include displacement-time graphs and velocity-time graphs. Kinematics graphs involve visualization of moving objects and relating them with the graphs where the ability of visualization can be considered as very important. To introduce the displacement-time graphs, a program downloaded from https://www. youtube. com/watch?v=UefWw5k4G0U was used. In this program, the displacement-time graph is drawn when the ball moves on the ruler at real time (Figure 1).
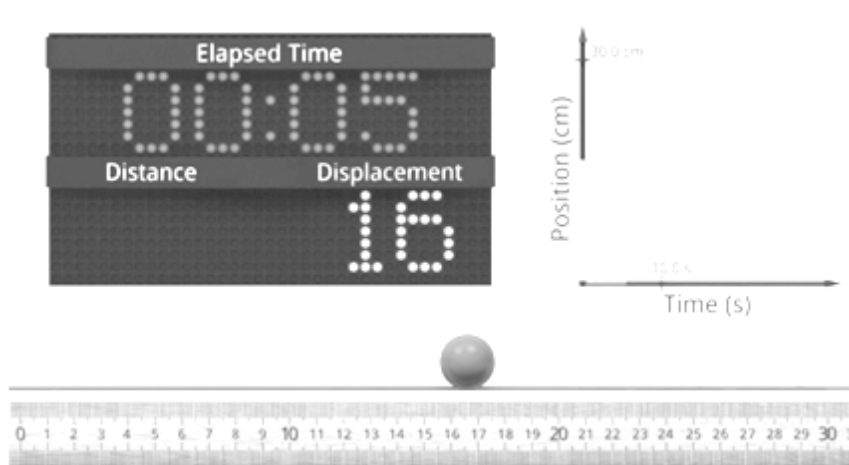
Figure 1: Real-time drawing of a displacement-time graph
(Source: https://www.youtube.com/watch?v=UefWw5k4G0U)

The primary advantage of using this program is that it shows the movement of the physical object, changes in numerical values of displacement and time, and the displacement (position)-time graph in one screen. Several screens of the program explaining how the changes in displacement of a ball moving on a metre ruler relate to a displacement-time graph were used with teacher explanations. Then converting a displacement-time graph into the corresponding velocity-time graph was explained using the program. This program can be considered as helping the students to visualize the relationship between a displacement-time graph and the corresponding velocity-time graph by showing them the real-time visual effects of the two cases.

Example 2: Newton's Laws of Motion

Newton's laws of motion can be considered as a section of physics in the science syllabus where the images of still and moving objects in relation with the direction of force inserted on the object and the direction of the motion of the object have to be built by the students where the ability to visualize can be considered as necessary in coping up with the subject matter with much ease.

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An interactive simulation (*PhET*) called 'Force and Motion Basics' (https://phet. colorado.edu/sims/html/forces-and-motion-basics/latest/forces-and-motion-basics_en. html) was used to elaborate the Newton's first and second laws of motion. Under 'Force and Motion', 'Motion' sub module was used here. In this interactive simulation, the student can decide the force applied by the man and keep the force at a constant value by holding the mouse, and then how the speed increases can be seen in the speedometer on top of the screen (Figure 2).

Figure 2: When the force is applied the speed is displayed in real time on the speedometer

(Source: https://phet.colorado.edu/sims/html/forces-and-motion-basics/latest/forces-and-motion-basics_en.html)

Then the student can change the force applied to the cart (object) and can change the mass of the object. The speedometer on top of the screen shows the change of speed. The student can visualize the effect of force applied to the object and mass of the object. This interactive lesson was done as a whole class interactive demonstration. Further, the above mentioned 'Motion' simulation can be used to help the students to build imaginations in Newton's first law of motion also. There is an option in this programme for converting the moving track into a frictionless surface. Then, once the force applied to the object by the man is released by releasing the mouse, the object must move forward with the constant velocity. Now there is no net force, and the object must move forward on the track with the same velocity it attained at the moment the force is released.

Example 3: Turning Effect of Forces

Under the science syllabus, turning effects of forces involve the introduction of the concept of moment of forces and application of the principle of moments for simple systems.

Understanding the principle of moments needs the visualization of turning effect caused by the forces and determining how the forces cause to the deviations from the equilibrium state of the whole system.

As an effort of helping the students to visualize the application of the principle of moments, an interactive *PHET* simulation called 'Balancing Act' downloaded from https://phet.colorado.edu/sims/html/balancing-act/latest/balancing-act_en.html was used. The simulation consists of three modules 'Intro', Balance Lab', and 'Game' where it takes the student from simple tasks to little bit complicated tasks. Figure 3 shows a screen from 'Intro'.
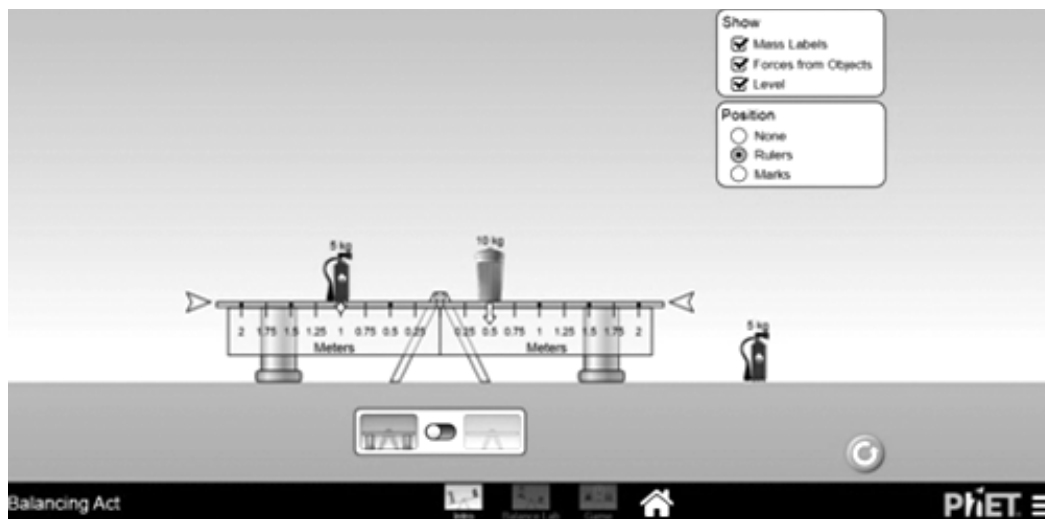
Figure 3: Balancing the weights on the seesaw

(Source: https://phet.colorado.edu/sim s/html/balancing-act/latest/balancing-act_en.html)

In Figure 3, the student can move the weight here and there on the seesaw and by removing the two side supporters whether the seesaw is balanced or not can be seen. By repeating the same thing using different weights the student can derive the principle of moments, that is, total clockwise moments is equal to the total anti-clockwise moment if the system is at the force equilibrium. In 'Balance Lab', the student can experience the same thing by using several masses. 'Game' module presents some interesting problem-solving tasks.

Methods of Statistical Analysis

It is expected that the students in the experimental group having exposed to the experimental teaching emphasizing the visualization aspect should indicate a notable gain in the post-test performance in the VPAT compared to their pre-test performance. It is also expected that similar gain to the gain as mentioned above in the control group, if any, should be lower

compared to that in the experimental group as the control group has only been exposed to the standard teaching without emphasizing the visualization aspect. To statistically test these effects, the group comparison tests were used.

Results and Discussion

Statistical measures relevant to testing the validity of the VPAT were discussed under the section, '3.3 Development and Validation of the Visual-Perceptual Assessment Tool (VPAT)'. In this section, the focus is on comparison of the students' performance by using the VPAT and by using the school term end science papers. Group comparison tests are used for this purpose.

Group Comparison Tests on Use of the VPAT

The VPAT contains 26 questions. For each student, the total number of correct answers in VPAT was calculated and converted it in to a percentage. Table 5 and Figure 4 show the mean of total scores obtained by the students of the two groups for the VPAT at the pre-test and the post-test.

Table 5: Students' performance in VPAT (mean total scores as percentages)

Group	Pre-test		Post-test	
	Mean	Std. dev.	Mean	Std. dev.
Experimental	32.11%	13.32%	50.13%	13.80%
Control	32.17%	14.95%	33.78%	14.78 %
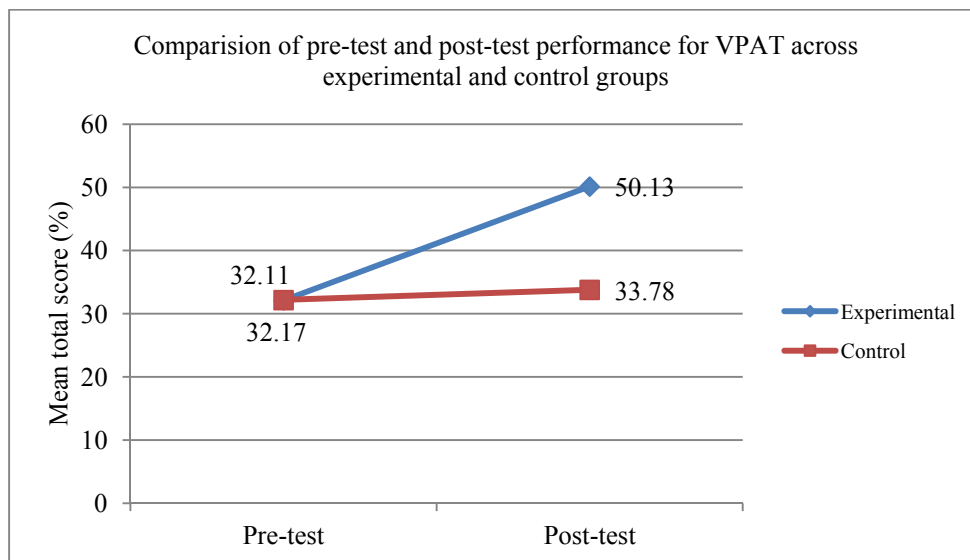
Figure 4: Students' performance in VPAT in the pre-test and the post-test

According to Table 5, the sample shows a quite high standard deviation. Table 5 shows that the performance after the treatment has gone up in the experimental group by 18.02 % and the improvement in the control group is only 1.61%. Further, there is a 16.41% increase in the post-test performance in the experimental group compared to the control group.

The significance of these within the group improvements (that is, 18.02% and 1.61 %) was tested using the related sample tests (paired sample t-tests) and the significance of this across the group improvement (that is, 16.41%) was tested using the independent sample tests.

Table 6 and Table 7 show the statistical measures needed to test the significance between the within the group comparisons and across the group comparison respectively.

Table 6: Testing the significance of the difference between the pre-test and the post test total mean scores within a group (Related group comparison results)

Group	Mean pre-test total score	Mean post-test total score	Mean difference	p-value from Kolmogorov-Smirnov Test of normality	p-value from Wilcoxon Signed-Rank Test
Experimental	32.11%	50.13%	18.02%	0.000	0.000
Control	32.17%	33.78%	1.61%	0.000	0.000

Table 7: Testing the significance of the difference between total mean scores of the experimental group and the control group for the pre-test and the post test (Independent group comparison results)

Test	Mean total score (%)		Mean difference	p-value from Levene's test for equality of variance	Skewness		p-value from Welsh test
	Expt. group	Cont. Group			Expt. group	Cont. Group	
Pre-test	31.11	32.17	1.06	0.011	0.437	0.287	0.964*
Post-test	50.13	33.78	16.41	0.031	0.466	0.247	0.000

According to Table 6, both the improvements, that is, the improvement in the experimental group (18.02%) and the improvement in the control group 1.61% at the post-test administration of VPAT compared to the pre-test administration, are statistically significant as the p-value of the Wilcoxon Signed Rank Test is less than 0.05.

According to Table 7, the initial performance (pre-test) is almost similar between the two groups as the p-value is greater than 0.05 for the Welsh test (. Further, there is a 16.41% increase in the post-test performance in the experimental group compared to the control group which is statistically significant as the p-value from the Welsh test is less than 0.05.

Analysis of the students' performance for the individual test items of the VPAT supports the above analysis. Figure 5 compares the students' performance for VPAT between the pre-test and the post-test of the experimental group and Figure 6 compare that for the control group.
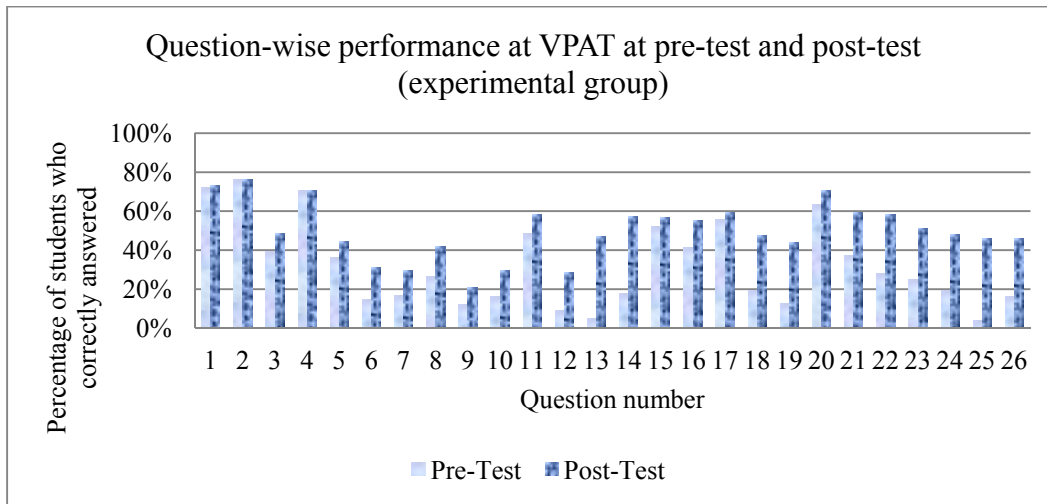
Figure 5: Question-wise comparison of VPAT performance in experimental group
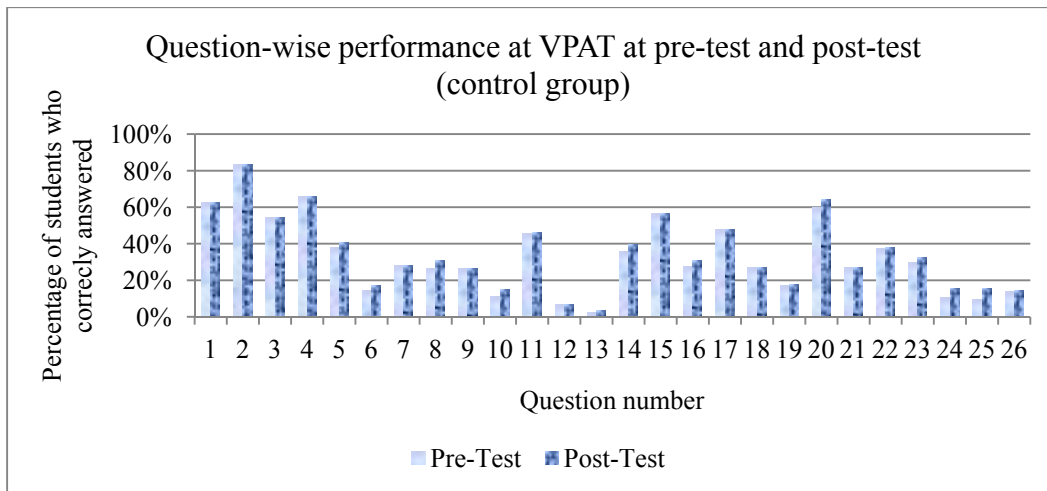
Figure 6: Question-wise comparison of VPAT performance in control group

As shown in Figure 5, in the experimental group, the percentage of students correctly answered the questions 01, 02 and 04 at the pre-test is 70% or above, and after the treatment, it

does not show a significant improvement. The percentage of students correctly answered the questions 06, 07, 08, 10, 12, 13 and 25 in the pre-test is below 20%, and after the treatment, it has gone up notably. Figure 6 shows that the improvements in the control group are not salient.

Group Comparison Tests on Use of School Science Term Test Papers

Students' general physics performance was measured by summing up the marks a student obtained for the physics questions related to the experimental topics at the Term 1 (as a pre-test) end and Term 2 (as a post-test) end school term test science papers. Table 8 and Figure 7 show the overall view on the general physics performance.

Table 8: General physics performance (% marks) before and after the experimental teaching

Group	Term 1 end mean physics performance	Std. dev. of Term 1 end physics performance	Term 2 end mean physics performance	Std. dev. of Term 2 end physics performance	Mean differe-nce
Expt.	38.17	13.42	53.04	13.35	14.87
Control	38.58	14.78	42.55	14.96	3.97
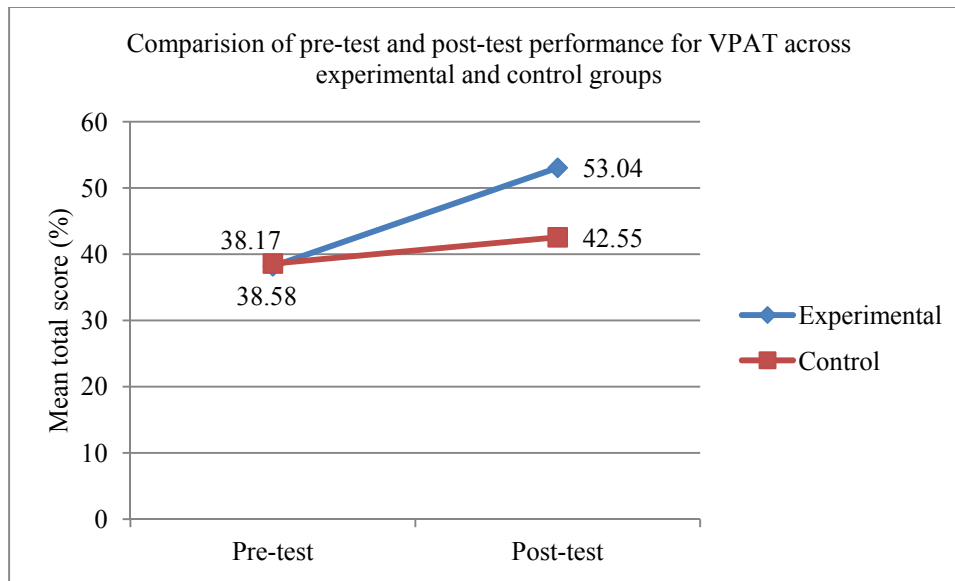
Figure 7: Term 1 and Term 2 end school science term test performance

As shown in Table 8, there is a 14.87% improvement in the general physics performance in the experimental group. Similarly, that improvement for the control group is 3.97%. Further, there is

a 10.9% improvement in the general physics performance in the experimental group compared to the control group. Statistical information regarding the significance are given in Table 9 and Table 10 (for testing the significance within the group improvements and across the group improvement respectively).

Table 9: Comparison of the Term1 end and Term 2 end physics performance before and after the treatment in the same group

Group	Mean Term 1 physics score (%)	Mean Term 2 physics score (%)	Mean difference	p-value from Kolmogorov-Smirnov Test of normality for the mean difference	p-value from Wilcoxon Signed-Rank Test
Experimental	38.17	53.04	14.87	0.000	0.000
Control	38.58	42.55	3.97	0.000	0.000

Table10: Comparison of the Term1 end and Term 2 end physics performance before and after the treatment across the two groups

Term End Test	Mean physics performance (%)		Mean difference	p-value form Levene's test for equality of variance	Skewness		p-value from Welsh test
	Expt. Group	Cont. Group			Expt. Group	Cont. Group	
Term 1	38.17	38.58	0.41	0.037	.207	.128	0.904*
Term 2	53.04	42.55	-10.49	0.002	.170	.114	0.000

As shown in Table 9, the p-values for the Welsh test is below 0.05 for both the groups. Therefore, there is a significant difference between the Term 1 end physics performance and Term 2 end physics performance for both the groups. As shown in Table 10, for the Term 1 end physics performance there is no significant difference between the experimental and the control groups as the p-values from the Welsh test is more than 0.05. For the Term 2 end physics performance, there is a significant difference between the experimental and control groups, as the p-value from the Welsh test is less than 0.05. Therefore, it can be concluded that the teaching approach tested with the experimental group resulted in improving the general physics performance.

Conclusions

This experimental study is an attempt of emphasizing the visualization aspect of the selected secondary school physics lessons, kinematics, Newton's laws of motion, turning effect of force, force equilibrium, resultant of forces, frictional force and mechanical energy, basically utilizing the visual-mode of external representations (Gilbert, 2010). Computer aided learning materials such video clips, animations and simulations were used with verbal explanations in this study to supplement the usual classroom teaching.

The significant gain in VPAT scores of experimental group students (16.41%) showed over the control group students shows that the new approach, highlighting the visualization aspect in physics, is capable of improving the students' attainment in visualizing the principles in physics which are not very tangible to senses. Further, the gain of 10.9% in general physics performance of the experimental group over the control group showed that the teaching approach tested with the experimental group resulted in improving the students' general physics performance as well.

It is recommended that for other units of secondary school physics such as hydrostatics, electricity, waves, optics, electromagnetism, electronics, etc. and also for the sections of the other component subjects in science such as biology and chemistry, it is worthwhile to apply the new approach.

However, it should be mentioned that using CAL materials is only one method of elaborating this aspect and in usual classroom teaching the teacher may use other suitable methods (Bybee, 2014; Osborne, 2014) as well which could strengthen students' visualizations, internal representations or imaginations. Some of them are use of practical setups, verbal explanations by way of similes / story-telling, annotated diagrams, 3D diagrams, etc.. Whatever the materials the teacher uses the most important thing is directing the students to visualize the necessary areas in science. In this respect, teacher has to identify the important visualization related areas in the lessons before conducting the lesson.

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Learners' Attitudes, Motivation and Motivational Strategies:
Do They Contribute to the Success of Language Learning?
Evidence from Sri Lanka

Madhubhashini Deldeniya

Classical and Foreign Languages Unit, National Institute of Education, Sri Lanka

Abstract

The aim of the study was to investigate the relationship between attitudes, motivation and achievement of students learning Japanese as a foreign language (JFL) in secondary schools in Sri Lanka. Further, it examines the JFL students' preference of motivational strategies employed in motivating them to learn Japanese language successfully. The sample consisted 273 JFL students in secondary schools. The current study used quantitative research paradigm and adapted two questionnaires to collect data. The international version (2004) of Gardener's Attitude/Motivation Test Battery (AMTB) was adapted to analyze the students' attitudes and motivation. Further, JFL students were asked to rate the list of 28 motivational strategies which was used by Bernaus and Gardner (2008) and Dörnyei and Cheng (2007) in their studies. The descriptive statistics was used to analyze the perception of students regarding the use of motivational strategies. Further, multiple linear regression was performed to examine the relationship between attitudes, motivation and achievement. The results indicated that there was positive relationship between JFL students' attitudes toward learning situation and their achievement. However, there was no significant relationship between intergrativeness, instrumentality and achievement. The findings revealed that the students strongly agreed with using 23 strategies in the classroom for motivate them and prefer innovative strategies than traditional strategies. Based on these findings, some recommendations were made to JFL teachers to improve the learning-teaching process in secondary schools in Sri Lanka.

Key words: JFL Students, Attitudes, Motivation, Motivational Strategies, Secondary Schools

Introduction

As globalisation and communication are bringing the world together, it is considered that the functionality and competency in other languages are essential and useful to a global citizen in addition to the native language. Indeed, knowing a foreign language is a requirement for communication throughout the world community and understands other cultures to interact

successfully with the other communities. Undoubtedly, every person has a high level of proficiency in their first language, but such proficiency is not expected from the learners who learn a second language (L2) or foreign language (FL) in informal educational settings (Alnatheer, 2013).

The variation in the level of proficiency of learners has been identified as an important characteristic of learning languages. In the process of learning foreign languages, it is influenced by some dominant factors such as students' motivation, attitude, anxiety, learning achievements, aptitudes, intelligence, age, and personalities (Asghar, Jamil, Iqbal & Yasmin, 2018). As well the teachers' role and their strategies used in the classroom also effects on students' learning process (Noreen et al., 2015; Gardner, 2005). Among the factors affecting language achievement, the learners' motivation is strongly related to achievement than other factors, and it is a driving force that enables learners to expend the continuous sustained effort to learn languages (Gardner, 2005).Students' attitudes and motivation are crucial factors in foreign language learning. The learners with high motivation and positive attitudes are tending to achieve higher language proficiency. Therefore, many studies have been conducted to investigate the relationship between learners' attitudes, motivation and the language achievement. Most of studies have been conducted based on the socio educational model which developed by Gardner and his associates in the period from 1959 to 1990. Motivation has been identified by researchers and the teachers in the field of language learning as one of the most fundamental factors influencing the success of foreign/second language learning (Dörnyei, 1998, 2001; Ryan and Deci, 2000). It was emphasized by Gardner (2005) and Dörnyei (2001) too as the pioneer researchers in this field in a series of studies on L2 motivation during the past decades. Dörnyei, (2005) states that without sufficient motivation, even with the substantial abilities, appropriate curricula and good teaching, the learner cannot achieve long-term goals in leaning process. Further, Dörnyei (2001) emphasized in his studies that motivated language learners can master a working knowledge, regardless of their language aptitude or cognitive characteristics.

The concept of language learning motivation has been evolving since more than five decades. Gardner and his associates initiated the L2 motivation research with Gardner's theory: integrative motivation and the socio-educational model. Gardner (1985) investigated the relationship between learners' individual differences, motivation and language learning and also he argues that the L2 language does not only contains words, sounds, grammatical components, but also integral parts of its culture and community. According to Gardner, deficiencies in one's

language aptitude and learning conditions can be addressed with high motivation which initiates L2 learning and sustains the long and difficult learning process afterward.Generally, achievement is believed to depend on individuals' effort to achieve their target with the desire to engage with the task, and this psychological concept is referred to as motivation in the area of second language learning (Kondal, 2015).

Motivation can be considered as one of the primary characteristics of the human being. Hence, it plays a vital role in determining the failure or success in any learning situation (Dörnyei, 2001) and it has been recognised as a significant factor in both education and social psychological fields. Motivation supports to boost up the language proficiency when acquiring a foreign/second language, regardless of the students' aptitude or any other learning conditions (Cheng & Dörnyei, 2007). Therefore, motivation and its' impact on achievement is the most frequently researched area in L2 researches. Since themotivation is a complex and multifaceted construct it has been defined by theorists in various fields in different ways which makes it difficult to give a simple definition to explain the exact meaning. Gardner mentioned that some characteristics of motivation are cognitive or affective while some are behavioural. Since the concept of motivation is not a simple construction, it cannot be measured by only one or few scales (Gardner, 2007). Gardner (1985), defines the motivation as "the effort plus desire to achieve the goal of learning the language plus favourable attitudes toward learning the language" (p.38). He clarifies that the motivation is a combination of three factors which needs to be completed at the same time. Masgoret and Gardner (2003) define it in the same way as 'a combination of motivational intensity, desire and attitudes towards learning the target language'. The students with high motivation will exhibits more effort, goal directed in learning language, really enjoy the learning activities and spend more time to learn (Lovalto, 2011). Also they will be more confident with their success and enjoy their learning than the students with low motivation.

Most of studies have concerned about two types of motivation namely integrative motivation and instrumental motivation. Gardner and Lambert (1972) explain that integrative motivation is learning a language for genuine interest to become a member of the target language community while instrumental motivation is learning a language for practical purposes such as academic success and job advancement. Further, Masgoret and Gardner (2003) explains that the motivated learner has openness to identify other language communities and also has favourable attitudes toward the language, the culture and language situations. Gardner (2005) argues that integratively motivated individuals with favourable attitudes toward learning situation are highly

motivated to learn the language. However, according to the literature there is no agreement that integrative motivation is better than instrumental motivation or instrumental motivation is better than integrative motivation since it depends on the learning context and the other related factors. Deci and Ryan (1995) introduced another two types of motivation in the self-determination theory; intrinsic motivation and extrinsic motivation. Intrinsic motivation refers "the personal interest and inner needs of learner" to learn a language (Salimb & Kabir, 2014, p.80) for communicating purpose or interacting with other language community and culture. A learner with intrinsic motivation enjoys learning activities with feelings of happiness and thinks about the target and achievement of language learning. Further they state that "extrinsic motivation derives from the external sources 'such as material rewards'. Hence it is therefore, external to the task. For an example, prizes for doing well, getting the job of one's choice, a higher position, gaining some certificates on a test score,' etc." (P, 81).

Though, the main question of the researchers was that how motivation can be developed and increased for students' better achievement. Dörnyei (2001) argued that the every teacher who cares about the long-term development or life-long learning process of their students should take the responsibility to increase and maintain their students' motivation (p.27). However, it would be a difficult task to achieve success, especially for those who learn languages in the formal educational context. Therefore, some teachers apply unique strategies based on their experiences to maintain students' motivation to learn foreign languages though most of the language teachers become discouraged by unmotivated students. The way teachers use to teach, methodology and behaviour influence on students' progress (Huyen, 2018). Gardner (2001) suggests that a teacher should improve their ability to support the students to acquire the fundamentals of language and use language correctly. The teachers should develop their personality as a teacher or otherwise students will realized that teachers are lacking proficiency and skills.

When reviewing the literature on L2 motivation, many researches have been conducted to review the motivational theories and identify the effect of different types of motivations (Cheng & Dörnyei, 2007). The attention on motivational strategies also has been prevalent since 1990 in L2 motivation literature after L2 motivation researchers started to highlight the importance of learning environment (Guilloteaux & Dörnyei, 2008). Hence, during the past decades there was a trend to conduct studies on motivational techniques and strategies to develop students' motivation. Even though Gardner and Tremblay (1994) state that the investigation on motivational strategies to suggest the practical implications would be important

in scientific view. Teachers, learning materials, and teaching strategies are mainly influence on how language is acquired by learners (Anderson, 2018). Yet the empirical studies are not enough to justify the validity of them (Cheng & Dörnyei, 2007). Also the empirical studies on the effectiveness of motivational strategies in foreign language classroom are considerably limited. Available literature proves that many of studies have conducted in western countries (Lu, 2018) though some studies in this area were carried out in the Asian context too. However, the researchers conducted in the field of foreign language education in Sri Lanka have not received much attention on identifying the relationship between learners' motivation and language achievement and the effectiveness of using motivational strategies. Therefore, the current study investigates the relationship between JFL students' attitudes, motivation and achievement in Sri Lankan context to fulfil the research gap in this area.

Literature Review

Attitude and motivation are considered as the most significant factors in the literature in the field of foreign languages. The learners who have positive attitudes with high motivation tend to achieve higher proficiency than those with negative attitudes and low motivation (Dörnyei, 2005; Gardner, 2007; Dörnyei & Ushioda, 2009). Therefore, many researches have been conducted studies on L2 motivation in foreign/second languages, though R. C. Gardner was the pioneer of this area since he started to investigate L2 motivation in 1959 (Lai, 2013). Gardner was interested in individual differences variables and he began to investigate the role of attitudes and motivation in second language learning. There are so many factors which are responsible for individual differences in learning L2/FL such as age, gender, attitude, motivation, aptitude, intelligence, personality, anxiety etc..Gardner and Lambert (1972) showed that these factors are interrelated and affect the students' achievement in foreign language (Gardner, 1960; Lambert, 1972). This concept has been widely accepted as an important factor on L2/FL achievement and therefore, many researches in social psychology has been focused on investigating the relationship between individual differences variables and achievement.

The most important part of Gardner's motivation theory is the socio-educational model which was developed by Gardner and Smythe (1975). The initial model was presented in 1979 (Lovalto, 2011) and it has been revised continuously based on empirical studies (e.g. Gardner, 1985; Gardner & MacIntyre, 1993; Gardner, 2000; Gardner, 2005) which were conducted by Gardner and his associates (Lai, 2013). The socio educational model was primarily developed

featuring integrativeness, integrative motive and instrumentality in 1960 and it was focused mainly on the role of individual differences of language learnerGardner's socio-educational model explains the importance of culture related factors too. According to Gardner (1985), "another language is also an aspect of behaviour and that is characteristic of another ethno linguistic community" (p.4). Because there is a set of grammatical rules, structures, pronunciations and various characteristics which is unique to another language community.

In 1985 Gardner modified his model by introducing the new concept of integrative motivation which included two components; the integrativeness and attitudes toward learning situation. . Integrativeness and attitude towards the learning situation are related to achievement though the affect is mediated by motivation (Masgoret& Gardner, 2003).Gardner has given his attention to the principal three components of his motivation theory; integrative motive, Attitude /Motivation Test Battery (AMTB) and Motivation (Dornyei, 1998, p.123). Lai (2013) points out the two orientations which was introduced and investigated by Gardner in his theory as integrative orientation and instrumental orientation. Integrative orientation can be explained as the positive attitudes toward the target language community and instrumental orientation refers to pragmatic reasons to learn language such as obtaining higher grade from the examination or getting a job.

Integrativeness is another important factor which can be directly influenced on motivation (Gardner, 2005) and it was one of the main points in Gardner's theory. One who is open to other ethnic, cultural community generally, and to target language group specifically, will have high integrativeness and it will improve their motivation to learn language (Gardner & Lalonde, 1985). The socio educational model has been revised several times with some modifications which identified by Gardner based on studies which he conducted for years. Lai (2013) states that "the model was first proposed by Gardner and Smythe (1975) and has undergone a number of changes since then (e.g. Gardner, 1985; Gardner & MacIntyre, 1993; Gardner, 2000; Gardner, 2005).Gardner and his associates have conducted many studies and collected data from elementary and secondary students who learn French as a second language in various research sites (e.g. Canadian provinces of Quebec by Gardner, 1960 & Gardner & Lambert, 1959; Ontario by Gardner & Smythe, 1998; Smythe, Stennett & Feenstra, 1972; in British Columbia, Alberta, Manitoja and New Brunswick by Gardner, Smythe & Lalonde, 1984; in the states of Maine, Louisiana and Connecticut by Gardner & Lambert, 1972 as sited in Gardner, 2009). Most of the studies have identified that the type of motivation is influenced on language achievement and revealed that integrative motivation is associated with the success of

language learning (e.g. Gardner & Lambert, 1959; Gardner & Lambert, 1972; Gardner & Smythe, 1975; Gardner, Smythe, Clément & Gliksman, 1976; Clement, Gardner & Smythe, 1977; Clément, Major, Gardner & Smyth, 1977; Gardner, 1980; Clément, Gardner & Smythe, 1980; Gardner & Smythe, 1981; Gardner, 1985; Lalonde & Gardner, 1985; Gardner, 2006, as cited in Gardner, 2009).

Some studies which were focused on attitudes toward learning situation and integrativeness have identified that students with high level of integrativeness and positive attitudes from the beginning of the course were more successful in the end of the course. Those who exhibited success during the course were tend to maintain a high level of motivation and attitudes. In addition to the study conducted in Canada with a sample of English and French Canadian students, few studies have been conducted in six countries with the sample of EFL students by using the international version of AMTB. The findings were similar to the results of Canadian context.

According to the findings in the Canadian context and other countries, integrative motivation had an impact on learning second language regardless of any cultural background (Gardner, 2009). Dörnyei (2005) emphasized that language achievement is influenced by integrative motivation, language aptitude, and some other factors. Integrative motivation is included three variables namely integrativeness which have three subcomponent; integrative orientation, interest in foreign language, and attitudes towards the L2 community, attitudes towards the learning situation which includes two sub scales; attitudes toward language teacher and the L2 course, and motivation which measured by an effort, desire, and attitude towards learning foreign language (Dörnyei, 2005).

According to Gardner (2007), learning a foreign language is different to learning other subjects since it involves with linguistics and culture specific characteristics which unique to another culture such as vocabulary, pronunciations, language structure and its' culture. Hence, it would be a difficult task to achieve success especially for those who learn it in the formal educational context. Therefore, to maintain students' motivation to learn foreign languages, some teachers apply unique strategies based on their experiences. In general, foreign language students attend their language classes without sufficient interest to engage in challenging activities relevant to acquire the target language. However, teachers should be aware that without enough motivation students may be unable to achieve the long term goals as expected by the teacher. The strategies which are used in language classroom are remarkably influenced to increase or decrease the level of students' motivation (Lu, 2018). Therefore, some researchers have investigated various motivational strategies which improve

students' attitudes towards learning and build self-confidence in language classroom (Cheung, 2018). Motivational strategies refer to 'the instructional intentions applied by the teacher to elicit and stimulate student motivation and self-regulating which are used purposefully by individual students to manage their own level of motivation' (Guilloteaux & Dörnyei, 2008, p.57).

Even though, Dörnyei (2001) discusses about the gap between motivation theory and practice in this research area. There has been many researches on student motivation in language learning, though only limited number of studies regarding practical recommendations has been conducted to facilitate motivation in language learning(Dörnyei, 2001).Yet during the past decades there was a trend to conduct studies on identifying motivational techniques and strategies to develop students' motivation. Even though Gardner and Tremblay (1994) state that the investigation on motivational strategies to suggest the practical implications would be important in scientific view. Teachers, learning materials, and teaching strategies are mainly influence on how language is acquired by learners (Anderson, 2018).

As a result, Dörnyei and Csizer (1998) investigated an empirical study of Hungarian English language teachers to evaluate 51 motivational strategies. The aim of this study was to identify how they considered these strategies as important in teaching and frequently use them. Based on the findings of this study they presented a list of "ten commandments" among 51 motivational strategies for motivating language learners. Later Dörnyei (2001) wrote a book related to motivational strategies in the language classroom including a list of more than 100 motivational strategies. Dörnyei proposed 35 motivational strategies under four main dimensions based on an approach of the process-oriented model explaining that "although those can be regarded as the most reliable, they are not absolute rules, but rather guidelines and suggestions for just one or a group of teachers. Not every strategy works in every context" (p. 30).

- Creating the basic motivational conditions.
- Generating initial motivation.
- Maintaining and protecting motivation.
- Encouraging positive retrospective self-evaluation

Nevertheless, the empirical studies are not enough to justify the validity of them (Cheng & Dörnyei, 2007). Based on Dörnyei's motivational strategies, few studies have been conducted in EFL contexts for example in Taiwan (Cheng & Dörnyei, 2007) with 378 Taiwanese teachers; Japan (Sugita & Takeuchi, 2010) with 124 English teachers; Korea (Guilloteaux, 2013) with 268 South Korean secondary EFL teachers; Hungary (Dörnyei & Csizér, 1998) with

200 Hungarian English teachers; Turkey (Deniz, 2010), and in China (Wong, 2014) with 10 teachers and more than 900 students and 30 classroom observations. To fulfil the literature gap in this area Bernaus and his colleagues conducted a study to investigate student motivation and achievement in English and their relation to teacher motivation and strategy use in the classroom. The study revealed that teacher motivation is related to teachers' use of motivational strategies, student motivation and English achievement. Further, they suggest that any change in the educational system which enables to develop teacher motivation should result in improved student levels of education and their achievement (Bernaus et al, 2008). Guillautaux and Dörnyei (2008) investigated the relationship between the teachers' motivational strategies and the language learning motivation. They investigated 27 teachers and more than 1,300 learners in 40 ESOL classrooms in South Korea. The findings show that there was a significant relationship between teachers' use of motivational teaching strategies and students' motivation. However, they did not find out the relationship between teacher's motivational strategies and the language achievement (Bernaus et al, 2008).

The main role in the classroom that encourages the students to achieve the goal must be the teacher. The teacher should be able to create appropriate learning environment and use strategies to increase students' motivation. Salim and Kabir (2014), suggest that "if the learners find the materials authentic, personalized, localized, and learner-centered, etc., it will motivate them" (p.83). Thus, when teaching a second or foreign language, a teacher needs to be qualified with skills and methodologies which are unique in teaching a language, besides the knowledge and proficiency. Therefore, experience and knowledge for choosing activities and content that appropriate for students' age, level, interest, and goal are important to encourage students to learn the language more interestingly (Huyen, 2018). In this endower teachers should use appropriate motivational strategies for their classroom teaching to maintain the successes of students' language learning process (Porakaew, 2004). However, the effectiveness of teaching approach is depend on learners' attitudes toward learning languages and their level of motivation (Lai & Aksornjarung, 2018).

This study investigates the relationship between JFL students' attitudes, motivation and achievement and their perception of using various motivational strategies. Therefore, the current study will contribute to the L2 research field through the findings to fill the existing gap in the current literature and it will encourage for further research for other languages too in this area to develop foreign language education in Sri Lanka.

Research Questions

1. Is there any relationship between integrativeness, instrumentality, attitudes towards learning situation, and JFL students' achievement?

2. What is the relationship between motivation and achievement in Japanese language students in secondary schools in Sri Lanka?

3. What motivational strategies used in the classroom do JFL students think most effective for motivate them?

Methodology

This study adopted quantitative research paradigm in data collection and data analysis procedures in order to generalize the findings in similar contexts in Sri Lanka. The quantitative method is exploring the relationships among variables rather than explaining the variables. This section discusses the research methodology used throughout the study and how it guided data collection and analysis.

Participants

The participants were 273 JFL students in grade 13, the last year of secondary schools in Sri Lanka. Students were selected from six provinces out of nine provinces since currently Japanese language is being taught in only six provinces. The sample frame of this study was the list of secondary schools which currently teach Japanese language in grade 13 in six provinces in Sri Lanka. The systematic sampling technique was used under the probability sampling method to select the sample.

Instruments

Survey method was used in this study as it is accepted as the best method to investigate the personal attitudes, beliefs, perception etc. Two questionnaires were adapted in this study. The questionnaire consists of three parts; first part includes demographical information about the student. The second part includes items adapted from Gardner's (2004) IAMTB since the reliability and validity of this test battery has been reported in many studies which conducted in various contexts to measure the attitudinal and motivation variables. The items of the sub scales were presented in random order using a 6 point rating scale that ranged from "strongly disagree" to "strongly agree" as same as presented in the original instrument. The original test battery consists of 12 scales with 104 items though in the current study only 74 items were adapted for measuring attitudes and motivational component. In the third part, the students were asked to

rate their level of agreement for 28 motivational strategies ranging from 1 (strongly disagree) to 5 (strongly agree) as same as the study conducted by Bernaus and Gardner (2008) and Cheng and Dörnyei (2007). Before conducting the pilot study with 30 JFL students, the drafted questionnaire was translated to Sinhala by two experts and reviewed by another two experts for ensuring the validity of the instrument. After implementing the pilot study some items were modified. The reliability coefficient (Cronbach Alpha) values for the items in the questionnaire were greater than 0.70 which was considered as acceptable.

Data analysis

Statistical Package of Social Sciences (SPSS 21) was used to analyze the data gathered from JFL students. The statistics in the study included descriptive statistics with mean scores and standard deviation in order to analyze the perception of students regarding the use of motivational strategies. Further, multiple linear regression was performed to examine the relationship between variables.The achievement of students were measured by the grades obtained for Japanese language in G.C.E. Advanced Level examination. The results of the AMTB were analysed with the results of Advanced Level examination to identify the relationship between the scales of AMTB and achievement.

Result and Discussion

In the current study the female participants were greater than male participants. The total number of the participants was 273 and out of this, 252 (92.3%) were girls while only 21 were (7.7%) were boys. In the following section the descriptive statistic of the variables is presented. As presented in Table 1, mean values for all variables were greater than 5 which shows that the students' level of agreement toward the each variable was 'agree' to 'strongly agree'. The mean score for intergrativeness was 5.1162 and the mean score of the attitudes towards learning situation and instrumentality were 5.4290 and 5.0554 respectively. The table 1 presents the descriptive statistics of the variables.

Table 1: The Descriptive Statistics of the Variables

Variables	Mean	Std. Deviation
Intergrativeness	5.12	0.62
Attitudes	5.43	0.54
Instrumentality	5.05	0.75

The JFL students have high integrative motivation and instrumental motivation to learn Japanese yet their integrative motivation is little higher than their instrumental motivation. These results shows that the JFL students are interesting to know about the Japanese community and culture and they have positive attitudes towards Japanese people since the intergrativeness was measured by two sub scales namely 'Integrative Orientation' and 'Attitudes toward Target Language Community'.Moreover, they also have positive attitudes toward the JFL teacher and the language course. In order to answer the first research question, multiple linear regression was performed to examine the relationship between intergrativeness, attitudes toward learning situation, instrumentality and achievement. The results from the regression analysis with achievement as the dependent variable and integrativeness, attitudes toward learning situation and instrumentality as the independent variables are presented in Table 2.

Table 2: The Results from Regression Analysis

Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	5.27	0.93		5.65	0.00
Intergrativeness	0.10	0.14	0.04	0.71	0.47
Attitudes	−0.63	0.15	−0.26	−4.17	0.00
Instrumentality	0.09	0.11	0.05	0.83	0.40

a. Dependent Variable: Achievement

In Table 2, the P-Values for integrativeness and instrumentality are greater than 0.05 and only attitudes toward learning situation is less than 0.05. Hence, integrativeness and instrumentality are not significant predictors of achievement. Achievement depends on only attitudes toward learning situation among the variables in this study. The results revealed that there is a positive significant relationship between attitudes toward learning situation and achievement.

Attitudes toward learning situation are measured by two scales namely 'teacher evaluation' and 'course evaluation'. Attitudes toward the learning situation refer to "affective reactions to any aspect of the class and could be assessed in terms of class "atmosphere", the quality of the materials, availability of materials, the curriculum, the teacher etc."(Gardner,

2011, p.10). The findings of this study show that JFL students have favourable attitudes toward the JFL teacher and the course.

The findings of previous studies show that the students' favourable attitudes facilitate the learning process. By understanding the students' attitudes toward the learning situation support to plan and design the proper curriculum. The whole educational situation influences the students' level of motivation to learn. As well an experienced and skilful teacher influence on students' motivation too. As same as the well planned curriculum, organized lesson plan, the materials and the strategies use in the classroom can be effects on students' motivation and their achievement. Therefore, measuring the students' attitudes and perception regarding learning situation is an appropriate method to evaluate the quality of them. The role of teacher can be considered as a one of the main factor which may effect on students success or failure in Sri Lanka as still the education system has been not changed much from teacher cantered education to learner cantered education. Therefore, students' attitudes toward the teacher is very important to be considered in such an environment. As a developing country in South Asia, majority of students in Sri Lanka are depended on their teachers' instructions to gain knowledge. Still many of students in Sri Lanka do not use internet facilities and other technologies to enhance knowledge beyond the classroom. Therefore, they do believe their teachers and what they teach.

However, there is no significant relationship between integrativeness, instrumentality, and achievement found in this study. Though, in some studies conducted in other contexts identified the relationship between the type of motivation and achievement. Al-Khasawneh and Al-Omari (2015) reported that the highly motivated students who have instrumental motivation to learn English were received high score in their achievement test. Further Choosri and Intharaska (2011) examined the relationship between English learning motivation and achievement among Thai vocational students. The results showed that higher level of instrumental motivation than integrative motivation among them.

The regression analysis of this study indicates that there is a positive and significant relationship between motivation and achievement. Motivation is considered as a one of the most important factor in the achievement. Also it is a key factor which positively influence on the success of learning process and it cannot be neglected in the learning second/foreign language too. The result from the regression analysis is presented in Table 3.

Table 3: The results from the regression analysis

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	4.579	0.810		5.653	0.000
Motivation	−0.328	0.152	−0.130	−2.152	0.032

The results presented in table 3, the P-value for motivation is less than 0.05, and hence motivation is a significant predictor of JFL student achievement. The findings indicates that there is a positive and significant relationship between motivation and achievement. Number of studies has been conducted to investigate this relationship and have proven that more motivated individuals achieve better in L2 (Bernaus & Gardner, 2008; Gardner, 1959; Gardner & MacIntyre, 1991; Dashtizadeh & Farvardin, 2016). Also it is a key factor which positively influence on the success of learning process and it cannot be neglected in the learning second/foreign language too. Therefore, teacher should pay attention on to motivate students by using more effective methods and strategies.

In order to answer the third research question, descriptive statistics was performed to investigate JFL students' preferences on motivational strategies. The questionnaire which included 28 motivational strategies was administered to rate students' preferences. The students were asked to rate their agreement level for each strategy. Based on the descriptive statistics 28 strategies were ranked considering the mean value. The mean score and standard deviation of motivational strategies were calculated and ranked according to the criteria for mean value given by Cho and Teo in 2013. The students' preferences on motivational strategies are presented in the *Table 4.*

Table 4: *The students' preferences on motivational strategies*

Item No	Type of Strategy	Mean	SD	Agreement Level
12	I	4.73	0.58	Strongly Agree
28	I	4.61	0.69	Strongly Agree
27	I	4.56	0.73	Strongly Agree
4	I	4.55	0.76	Strongly Agree
1	I	4.54	0.70	Strongly Agree
2	T	4.51	0.78	Strongly Agree
3	T	4.50	0.72	Strongly Agree
22	I	4.50	0.77	Strongly Agree
9	I	4.49	0.73	Strongly Agree
6	T	4.47	0.74	Strongly Agree
13	T	4.45	0.72	Strongly Agree
5	T	4.44	0.86	Strongly Agree
15	T	4.43	0.79	Strongly Agree
14	I	4.43	0.83	Strongly Agree
20	I	4.42	0.72	Strongly Agree
17	I	4.42	0.79	Strongly Agree
19	T	4.40	0.77	Strongly Agree
1	I	4.40	0.76	Strongly Agree
26	I	4.38	0.80	Strongly Agree
23	T	4.38	0.76	Strongly Agree
7	T	4.37	0.81	Strongly Agree
25	I	4.29	0.81	Strongly Agree
8	T	4.29	0.91	Strongly Agree
10	T	4.20	0.87	Agree
11	T	4.19	0.89	Agree
24	I	4.19	0.90	Agree
16	T	4.08	0.93	Agree
18	T	3.20	1.04	Neutral

*Innovative Strategies –I   **Traditional Strategies- T

The Table 4 presents the JFL students preference of motivational strategies used by their JFL teachers. The mean values for 23 strategies are above than 4.21 since it shows that students strongly agree with using 23 strategies in the class. The most agreed strategy is item no 12, "I like it when my Japanese teacher makes us aware about the Japanese culture". This finding shows that the students' interest in Japanese culture. The students have rated the item no 18 ("I like it when my Japanese teacher allows us to speak Sinhala in class") as the last strategy in the list and agreement level was 'neutral'. It means that students do not recommend using the mother tongue when teaching Japanese language. This finding will encourage JFL teachers to use Japanese language as much in the classroom. Also the findings show that students prefer innovative strategies than traditional strategies as the most preferred strategies. Also the top five ranking of students' preferences were innovative strategies. The top five strategies which were students agreed most are "my Japanese teacher makes us aware about the Japanese culture", "my Japanese teacher creates a pleasant and relaxed atmosphere in the class", "my Japanese teacher recognizes my effort and compliments my success", "my Japanese teacher makes us play games in class" and "my Japanese teacher supplements our textbook with other materials". This findings support to JFL teachers to select appropriate strategies to increase and maintain the students' motivation. This finding suggests that teachers should use innovative strategies as much as they can. However, in Sri Lanka it can be difficult to use modern technologies as still many schools are not provided modern facilities. Therefore, the teachers should be aware to be creative for using various strategies by utilizing the available facilities by knowing the students preference of strategies. Finally the findings show that all JFL students highly agreed with the use of 23 motivational strategies out of 28 motivational strategies for motivating them since these 23 strategies were rated as strongly agree.

Conclusion

This paper explores the relationship between attitudes, motivation and achievement. Further, the JFL students' preferences for motivational strategies also examined. The results of the study showed that there was a positive relationship between attitudes toward learning situation and achievement though there was no significant relationship between intergrativeness, instrumentality and achievement. However, there was a significant relationship between motivation and achievement. Further, the findings revealed that the students strongly agreed with using 23 strategies in the classroom for motivate them and prefer innovative strategies than traditional strategies.

This study might contribute to JFL teachers' understanding of learners' preferences of motivational strategies which can be used in language class to motivate their students. This finding will support to identify students' views on using strategies and further it will insight of how much JFL students agree on using some specific strategies to motivate them. A foreign language learner acquires the language only from the formal language classroom and therefore itis difficult to receive experience from authentic language environment. Thus, the teacher can make appropriate learning environment by applying suitable strategies, giving opportunities to engage in language activities and developing self-confidence to use language which support to increase students' motivation. Further, teacher can provide useful feedback and autonomous learning environment. Therefore, language teacher need to plan interesting lessons which should focus on the given curriculum. However, Dörnyei (2001) mentioned that teachers should select and use only a few most appropriate strategies which may comfortable for both teachers and their students. Teachers should not try to become "super motivator" by applying many strategies. It is enough to be a "good enough motivator". Some of successful teachers use only few strategies to motivate students and it shows good results.

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The Effect of Perceived Course Quality on the Satisfaction of Secondary Students in Sri Lanaka

K G W K Katukurunda

Department of Technology Education, Faculty of Science and Technology, National Institute of Education, Sri Lanka.

Abstract

Changing global trends in education evidently emphasizes that there is a need to revisit the quality of general education. Since satisfaction of students is a major concern of the quality of courses offered at different levels of education, many studies have been conducted to examine the factors affecting students' satisfaction. Past studies emphasized that students who are satisfied with the quality of courses, encourage future students' enrolment. The present study used five dimensions that contributed to the course quality based on empirical evidence to analyze students' satisfaction. The sample of the study was 410 senior secondary students following the subject of Biosystems Technology in the Central province of Sri Lanka. The main data gathering instrument was a self-administered questionnaire which tested the model comprised the five dimension mentioned above and data were analyzed using multiple regression analysis. The results of this study are consistent with past studies and show that level of students' satisfaction is mostly affected by the subject availability for electives, subject content in major, and classroom environment and class size, and also school facilities and learning resources. The findings indicate that the subjects' availability for electives play a major role in satisfying the students. It is suggested that this study should be repeated in other local contexts including a longitudinal component attached to the research design.

Keywords: Perceived course quality, dimensions, senior secondary students, students' satisfaction, biosystems technology programme

Introduction

In the present competitive global economic context, Sri Lanka aims to transit from the lower middle income status in to the upper middle income status by the year 2020. To achieve this target, the country needs a competent workforce. However, this challenge is being

significantly affected by the higher number of art graduates who remain unemployed or underemployed due to the competency-mismatch between the job market and the graduates. In the other words, higher unemployment among art graduates is a critical interference to the country's development strategies. Biosystems Technology is a competency-based curriculum which was introduced recently to senior secondary stage (Advanced Level) of education in order to reduce the oversupply of art graduates to the job market in terms of reducing the number of students enrolling to the Art stream up to 25% by year 2020 (Ministry of Education, 2013; Ministry of Education, 2014). Hence, a higher number of students' enrollment to Biosystems Technology programme is the most important factor as above development strategy is concerned.

However, the number of students who were enrolled to Biosystems Technology programme has unexpectedly dropped in the year 2015 in comparison to the preceding years 2013 and 2014 (National Education Research Centre, MOE, 2016; Ministry of Education, 2015; National Institute of Education, 2015; Department of Examination, 2014). In this context, Ministry of Education in Sri Lanka declared that conducting an in-depth study to investigate the factors affecting the low levels of student enrolment is an urgent matter (Ministry of Education, 2016). Furthermore, a number of reasons that could contribute to such a decrease were identified by the previous studies. Many studies depicted that students' satisfaction with course or programme is important if students want to continue the course or programme (Degigamma and Sennanayake, 2012; Tessema, *et al*., 2012; Peng and Samah, 2006). Studies also emphasized that both emotional responses (e.g. pleasure) and cognitive judgment (e.g. perception of website quality) are the prerequisites that need to generate satisfaction. (Im and Ha, 2011) highlighted that either emotion or cognition as an antecedent of students' satisfaction and various behavioral intentions such as word of mouth (Ha and Im, 2012; Park *et al*., 2008; Fiore and Kim, 2007). These analyses further elaborated that the higher levels of students' satisfaction lead to uplift the rate of student enrolment to the institutes such as universities or colleges (Serenko, 2010) or even to the course or programme. Thus, satisfied customers with product or service are effective promoters of any organizations and more likely to say positive things about the organizations and also recommend the institutions to a close friend or relative (Dolen, *et al*., 2007).

Hence, evidence of students' satisfaction is deemed important where student enrolment to course or programme or institutes is concerned (Serenko, 2010). In fact, many studies emphasized that quality of course offered by any institutions (e.g. colleges, universities) as

perceived by the students is the key antecedent of the students' satisfaction where the student enrolment to the programme of study is concerned (Palmer, *et al*., 2011; Serenko, 2010).

Numerous studies investigated students' satisfaction in different disciplines and a number of factors were identified as the dimensions which contributed to the course quality. Of which, Course Content in Major, Courses availability of Electives in Major, Methods of Assessment &Evaluation, Classroom Environment &Class Size, College Facilities &Learning Resources and Teacher Characteristics & Behavior as vital to students' satisfaction (Sinclaire, 2014; Letcher & Neves, 2012; Tessema *et al*., 2012; Peng & Samah, 2006).

The Ministry of Education in Sri Lanka has planned and conducted the number of activities such as awareness programmes for the students, parents, and the public in selecting the Biosystems Technology, capacity building programmes for teachers, and other stakeholders, enhancing infrastructure facilities and career guidance programmes for students etc, in order to uplift the popularity of the programme (Ministry of Education, 2014). Therefore, the declining numbers of students in the year 2015 is a grave concern of the Ministry of Education and the curriculum developers in the National Institute of Education as they are yet to comprehend the reasons for this decline. Unless they are able to ascertain the reason for this decrease, the purpose of introducing this new courses would be defeated in the near future and the students will eventually move out of this stream.

Hence, understanding how perceived course quality can affect students' satisfaction with Biosystems Technology programme was deemed important where the low student enrolment is concerned. Since Biosystems Technology is a new and an evolving discipline in Sri Lanka, there is a lacking of studies which makes it difficult to determine how the course quality can impact students' satisfaction. There is a severe gap in the Sri Lankan context although there are a few studies done in the international context in relation to the Biosystems Technology.

If this gap persists, the aim of Sri Lankan government may be difficult to be fulfilled due to the severe shortage of competent workforce. In the other words, it may limit Sri Lanka's long term development strategies. Therefore, a need arises to evaluate the Biosystems Technology programme in terms of the impact of course quality on students' satisfaction. Indeed, it is a timely need to ascertain the students' satisfaction with the Biosystems Technology programme. This would increase the confidence and satisfaction of the students which will incrementally increase enrolment levels for this programme in the future since

satisfied students will definitely spread the word about the quality of their courses (Teerawut, 2011; Sodolund, 1998).

Therefore, the purpose of the current study was to examine the effects of course quality on students' satisfaction with Biosystems Technology. Furthermore, present study has also paid attention to identify that which dimensions of course quality have the most effect on the students' satisfaction. Thus, findings of present study will be useful for the policy makers to upgrade the policies related to Biosystems Technology programme and also contribute for the curriculum developers in the National Institute of Education and relevant personnel in the education sector in order enhance the course quality. Furthermore, this paper discusses some comprehensive implications for enhancing the quality of Biosystems Technology programme since higher the course quality, higher the students' satisfaction toward the course of study.

Literature Review

The purpose of present study was to examine the effect of course quality on students' satisfaction with Biosystems Technology. Therefore, most important topic presented in the following are perceived course quality, students' satisfaction and the relationship among the dimensions of course quality and students' satisfaction.

Student Satisfaction

The concept of student satisfaction is derived from customer satisfaction, However, Oliver & Swan (1989) debated that the concept of customer satisfaction is an emotional factor while Elliot& Heal (2001) emphasized that student satisfaction is a short term attitude earning from students' perceived experiences. In the sense, satisfaction can be changed according to their experiences. Similarly, Parasuraman, Zeithaml & Brry (1980) pointed out that satisfaction could be equated to the gap between students' life experiences and their expectations. Furthermore, students' satisfaction described by Letcher, & Neves, (2010) as the "favorability of a students' subjective evaluations of the various outcomes and experiences associated with education" (p. 3).Correspondingly, Sum et al., (2010) reported that students' satisfaction as an attraction and positive feeling originated among the students towards the course or institutions whilst Gibson, (2010) highlighted that students' satisfaction is the students' feedback on an academic course or propgramme. Moreover, Teseems et al., (2012) emphasized that students' satisfaction is a key determinant to revisit on the courses whether it fulfil their expectations. Thus, students' satisfaction is difficult to define that what is student satisfaction? since it is a

multidimensional concept. Indeed, several studies highlighted that students' satisfaction is a multidimensional construct (Cronin & Taylor, 1992) though some studies emphasized that it is a unidimensional construct (Hu et al., 2009).

In fact, some studies were conceptualized as satisfaction with curriculum (Tessema et al., 2012), satisfaction with undergraduate programme (Letcher & Neves, 2010; Bauer, 2015; Ramos et al., 2015), satisfaction with service quality in higher education (Hasan, et al., 2008), satisfaction with demographic characteristics (Tessema, et al., 2012), satisfaction with college courses or quality of courses (Sinclaire, 2010; Thapliyal, 2014), satisfaction with online courses (Davis, 2014) and satisfaction with campus climate (Duong, 2016) etc. Thus, the term of students' satisfaction has been conceptualized in different dimensions as a diversified phenomenon. Sinclaire, (2014) has been pointed out that students' satisfaction is coupled with academic performance, learning and recruitment of future students.

Despite, numerous studies done by higher educational institutions, very few studies found in the school education that satisfaction conceptualized as a satisfaction with course, satisfaction with curriculum and satisfaction with programme. However, this study focused on students' satisfaction with the curriculum in the secondary education where it examined how the course quality affected students' satisfaction.

Perceived Course Quality

Quality is an abstract concept which is hard to define. However, most of the scholars explained quality "from the customers' perspective" (p.89). Therefore, quality can be conceptualized based on perceived quality (Sumaedi, 2011). Furthermore, in educational settings, quality can be defined from students' perspective because students are the prime costumers of the academic institutions such as school, college and university (Kuo, et al., 2013) and the curriculum offered to the students is also referred as academic course (Farahmandian et al, 2013).

Indeed, perceived quality of course is considered as students' authentic evaluation about the course which based on students' perceived experiences in their school career (Athiyaman, 1997). Literature on student satisfaction, emphasized that course quality is a key antecedent of students' satisfaction (Serenko, 2010). It is further elaborated by Serenko that a number of individual and environmental factors can also impact students' satisfaction. Individual characteristics may consist of age, gender and ethnicity (Serenko, 2010). Environmental factors comprised in relation to context of studies; subject content in major, subject availability of

electives, classroom environment and class size, teachers' characteristics and behavior, methods of assessment and evaluation, school facilities and learning resources (Duong, 2016; Zakaria, 2016; Baucer, 2015; Mansori, et al., 2014; Sinclaire, 2014; Thapliyal, 2014; Tessema et al., 2012; Lecher &Neves, 2010; Peng & Samah, 2006). All antecedents indicated above is related to a general construct of perceived quality of a course (Serenko, 2010). Since each antecedent mentioned above influences students' satisfaction, the perceived quality of a course may describe the degree of students' satisfaction towards the course.

In fact, course quality of the present study can be conceptualized as students' perceived quality towards the course (Sumaedi, 2011) whilst numerous studies have been described the course quality as students' subjective evaluation about the course. Thus, such studies have shown that the course quality is an abstract concept and is not much easy to define. In fact, Zakaria et al., (2016) focused the course quality as evaluation from the students' perception towards the course and identified that course quality was influenced by several dimensions. Similarly, study conducted by Grace et al., (2012) has also been given attention to measure the perceived academic quality of a course where five dimensions of course quality have considered. Tessema et al., (2012) conducted a longitudinal study and identified 11 factors as the dimensions of the curriculum quality. Peng and Samah (2006) did a study on the quality of education and identified 8 factors as determinants of course quality whilst Sinclaire (2010) evaluated the students' perceived experiences on different characteristics which affect a business degree programme in Thailand.

In general, course quality can be described as a multidimensional concept which is not easy to define. In the present study, the course quality is therefore conceptualized as students' perceived experiences about the quality of the course.

Perceived Course Quality and Students' Satisfaction

The present study mainly focused to explore what kind of relationship exists between the course quality and students' satisfaction with Biosystems Technology programme in secondary schools in Sri Lanka. In fact, a number of empirical studies have been identified that many factors were integrated with course quality since it multidimensionality. Furthermore, the effect of these dimensions might be different according to the area and context of the study.

Zakaria *et al*, (2016) undertook a study to investigate the factors influencing students' satisfaction towards course in a private university. The regression analysis was employed to examine the relationship between student satisfaction (dependent variable) and classroom

environment, lecturer (or instructor), college facilities and services, methods of grading (independent variables). The results emphasized that except the lecturer, all other independent variables affected students' satisfaction. Indeed, it was indicated that one of the most important predictors of students' satisfaction was methods of grading (i.e. methods of evaluation). However, lecturer (or instructor) was not a factor which affected students' satisfaction. Thus, methods of grading lead the students to select the course of study. Therefore, this finding is beneficial for the relevant personnel to enhance the students' satisfaction with the courses offered.

Long et al., (2014) did a study on the relationship between lecturers' competencies and students' satisfaction in a private college Malaysia. This study applied quantitative method to test the proposed hypotheses. They found that there was a relationship between lecturers' competencies and students' satisfaction. The sample consisted of 260 students, who have selected by using stratified sampling method. Multiple regression analysis was used to test the relationship between an outcome variable and predictor variable. The researchers of this study conceptualized teachers' competencies into various categories. Out of them, the results indicated that positive qualities such as subject knowledge, clarity of presentation, interaction with students, teacher's creativity and lecture notes and lecturer's subject knowledge were significant predictors of students' satisfaction. The researchers further emphasized that the positive correlation that exists between lecture notes and students' satisfaction. The lecture note was the most important and essential learning material which contains relevant and complex subject matters. Thus, giving such reading materials (e.g. lecture note, course materials) is important for students to understand the subject matters clearly and effectively for the students to be satisfied with their programme (Long, et al., 2014).

Faranhmandian et al, (2013) investigated the relationship between students' satisfaction and the service quality provided in the International Business School of University Teknologi in Malaysia. This study used qualitative methods and administered a questionnaire to 250 students those who were selected through random sampling method. In this study, students' satisfaction was a dependent variable while five service quality dimensions; student advising, curriculum, teaching quality, financial assistance, and tuition costs and facilities have considered as predictor variables. The results of regression analysis revealed that advising, curriculum facilities and financial assistance and tuition costs have significantly influenced students' satisfaction except for the quality of teaching. Indeed, this study has emphasized that there is not a significant, positive, relationship between teaching quality and students' satisfaction.

However, Hill et al., (2003) found that key factor of teaching quality was the quality of the teacher such as "lecture delivering" and giving sufficient feedback to students in the classroom.

Seng and Ling, (2013) investigated the impact of business school students' satisfaction upon education service quality as perceived by the students of higher education institutions in Malaysia. The service quality was conceptualized with five dimensions; academic courses, students' engagement, instructors and learning resources and assessment. A structured questionnaire was circulated among 250 students who were at higher learning institutions. The analysis confirmed that academic courses, instructors, students' engagement and learning resources had positive, significant impact on students' satisfaction.

Grace et al., (2012) undertook a study related to the perceived programme quality and students' satisfaction at an Australian University where the course experience questionnaire (CEQ) was distributed among 210 students based on convening sampling method. The CEQ was developed to measure teaching effectiveness and perceived academic quality of degree programmes. The researchers examined the relationship between perceived quality of course and students' satisfaction, and generic skills efficacy (outcome variables). Perceived quality of programme comprised with five dimensions which included good teaching standards of programme, appropriate assessment and appropriate workload. The results revealed that perceived programme quality about good teaching and standards have a direct impact on generic skills efficacy and students' satisfaction with Bachelor's degree in business. While appropriate assessment and workload did not have direct influence on the outcome of the variables, the results further indicated that there was a difference between male and female responses. Thus, this study also emphasized that the relationships exist between perceived programme quality about appropriate assessment system and students' satisfaction.

Jiewanto et al., (2012) did a case study which aimed to explore the impact of service quality to word-of-mouth mediated by students' satisfaction and also university image. A questionnaire was administered to 140 students by using purposive sampling method. The data analysis based on the structural equation modeling using AMOS. The findings revealed that five dimensions of service quality (tangibility, reliability, responsiveness, assurance and empathy) had a positive effect to students' satisfaction and university image while word-of-mouth was negatively influenced by students' satisfaction and service quality. Indeed, this study found that the tangibility of service quality had a positive impact to students' satisfaction. In this context, tangibility of service meant the physical facilities, equipment's, laboratories, computer facilities and other communication materials such as text books, practical guides. Thus, this study also

provided an evidence for relationship that exist between school facilities, learning resources and students' satisfaction.

Correspondingly, Tessema et al., (2012) undertook a study to assess the factors affecting college students' satisfaction with major curriculum at Midsized Public University, U.S.A. The sample size was 6,602 students and an electronic survey was conducted during 2001-2009 period as a longitudinal study. This survey comprised 11 factors which affected the overall satisfaction in major curricula. In other words, the survey included 11 antecedents of satisfaction; quality of instruction, major course content, required course availability for major, variety of courses, academic advising, preparation for carrier or graduate schools, capstone experiences, and class size of major courses, courses availability of elective in major, grading in major courses. The correlation matrix indicated that 11 factors positively correlated with satisfaction with major curriculum offered.

Furthermore, Palmer et al., (2011) examined the relationships between students' satisfaction with specific attributes of their experiences in the universities and word-of-mouth. The results of descriptive statistics revealed that students were more satisfied with content of course, which was one of attributes of university experiences.

Similarly, a study conducted by Sinclaire (2010) to examine students' satisfaction with college courses which was carried out at public university in the South East region of U.S.A. The electronic survey was administered to 560 undergraduate students who were in business degree programme in which the students were asked to rate their attitudes related to different course characteristics such as College facilities, classroom, characteristics, course content, and faculty characteristics (instructor characteristics and behavior) methods of instruction, methods of grading and learning technology. The results found that faculty characteristics, interaction characteristics (i.e. methods of instruction, methods of grading) were contributed most to the satisfaction with college courses.

Teerawut, (2011) did a study to investigate the students' satisfaction towards the quality of new education system in terms of knowledge teacher, skills of teacher, curriculum and tuition fee as independent variables via students' word-of-mouth as perceived by the students in 14 public universities in Thailand. The questionnaire was administered to 400 undergraduate students in these universities. The results of structural equation modeling revealed that the knowledge of teachers and curriculum have direct, significant impact on students' satisfaction whilst skills of teachers, tuition fee did not have direct impact on students' satisfaction

furthermore, the results emphasized that skills of teachers and tuition fee did not have direct impacts on students' satisfaction.

In the sense of course quality and students' satisfaction, Ali, et al., (2011) examined the key factors which influence on students' satisfaction with distance learning courses at Allara Iqbal Open University (AIOU), Pakistan where it was focused on the relationship between students' satisfaction and variables related to distance learning environment which were course evaluation, instructor's performance and student-instructor interaction. Data were collected from 245 students at AIOU via a structured questionnaire. The regression analysis confirmed that there was a significant, positive relationship between students' satisfaction and three independent variables.

Malik, et al., (2010) undertook a specific study on students who were at higher educational institutes of Pakistan. The sample size was 240 students of both public and private institutes. This study examined the impact of dimensions of quality services on students' satisfaction. The data analysis was based on structural equation modeling method. The results have revealed that dimensions of quality service have a positive, significant impact on students' satisfaction. Indeed, the tangible facilities like libraries, laboratories, lecture room, other infrastructures needed for successful learning and teaching and class layout and class setup (classroom environment) and decoration of furniture's have a strong impact on students' satisfaction with the service provided. The results also indicated that students' satisfaction was influenced by service quality in different dimensions in terms of the quality of teaching and learning environment of educational institutions. The quality of teaching conceptualized the teachers who are knowledgeable, experts in subject matters, "liberality" and "understanding with course with friendly attitude of teaching" (P.7).

Conversely, Shain (2007) investigated the relationship between students' satisfaction and distance learning environment about instructor support, student interaction, personal relevance, authentic learning, active learning and student autonomy. The sample of the study was 917 undergraduate students at an Anatolian university in Turkey. The findings from regression analysis pointed out that personal relevance is the significant predictor of students' satisfaction. It was further emphasized that students who have personal experience with the course content (e.g. subject content) tend to be more satisfied. This study also found that instructor-support is the second strongest variable which produced students' satisfaction in distance education where it was emphasized that instructor support (e.g. teacher support) as timely help, useful feedback, or easy communication is vital for students' satisfaction. In fact,

instructors who are in distance education should be characterized with easy accessible, provide prompt responses and encourage their students through online learning activities.

Similarly, Peng and Samah, (2006) carried out a study to find out students' satisfaction on quality of education delivered by the University Tun Abdul Razak (UNITAR) and extent their study to analyze which of factors were most significant to students' satisfaction where eight factors as independent variables. They tested students' satisfaction as students' expectations perceived by the students. These factors were instruction medium, facilities, and mode of teaching, assessment course content, social activities, faculty and lecturer. The regression analysis reported that factors; facilities, course content, instruction media and lecturers significantly impacted on the overall students' satisfaction. The most important factor was course content, followed by the facilities, instruction medium, lecturers and faculty. Thus, these factors are main antecedents in examining students' satisfaction with the course of study.

Furthermore, Students' satisfaction was significantly influenced by interaction with lecturer and active discussion among students and the clarity of course design (Swan, 2001). Students suffered from frustration when lecturer did not involve in class decision (Yang & Cornelius, 2004). Thus, such a frustration may lead to a decrease of the students' satisfaction with the course of study.

In brief, there were many factors which have been identified at different empirical studies such as subject content in major, subject availability for electives, classroom environment and class size, teachers' characteristics and behavior, methods of assessment and evaluation, and also school facilities and learning resources. Indeed, these factors might have affected students' satisfaction with Biosystems Technology. In present study, the experts' opinions were considered in deciding which factors should be significant since it was conducted at the different area and the context.

Conceptual Framework of Study and Hypotheses

The conceptual framework of this study (Figure 1.1) consist of two variables where course quality is an independent variable with six dimensions and assumed that it has an effect on students' satisfaction with Biosystems Technology programme. This framework is developed by researcher based on the previous empirical studies and also interview conducted with experts who are responsible for the relevant field of the study.

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┌─────────────────────────────┐
│ Programme Quality of        │
│ • Subject Content in        │                    ┌──────────────────┐
│   Major                     │                    │    Students'     │
│ • Subject Availability      │                    │   Satisfaction   │
│   of Electives              │                    │ with Biosystems  │
│ • Classroom                 │──────────────────▶ │   Technology     │
│   Environment &             │                    │    programme     │
│   Class size of major       │                    └──────────────────┘
│   subject                   │
│ • Teacher                   │
│   characteristics &         │
│   Behavior                  │
│ • Methods of                │
│   Assessment &              │
│   Evaluation                │
│ • School Facilities &       │
│   Learning Resources        │
└─────────────────────────────┘
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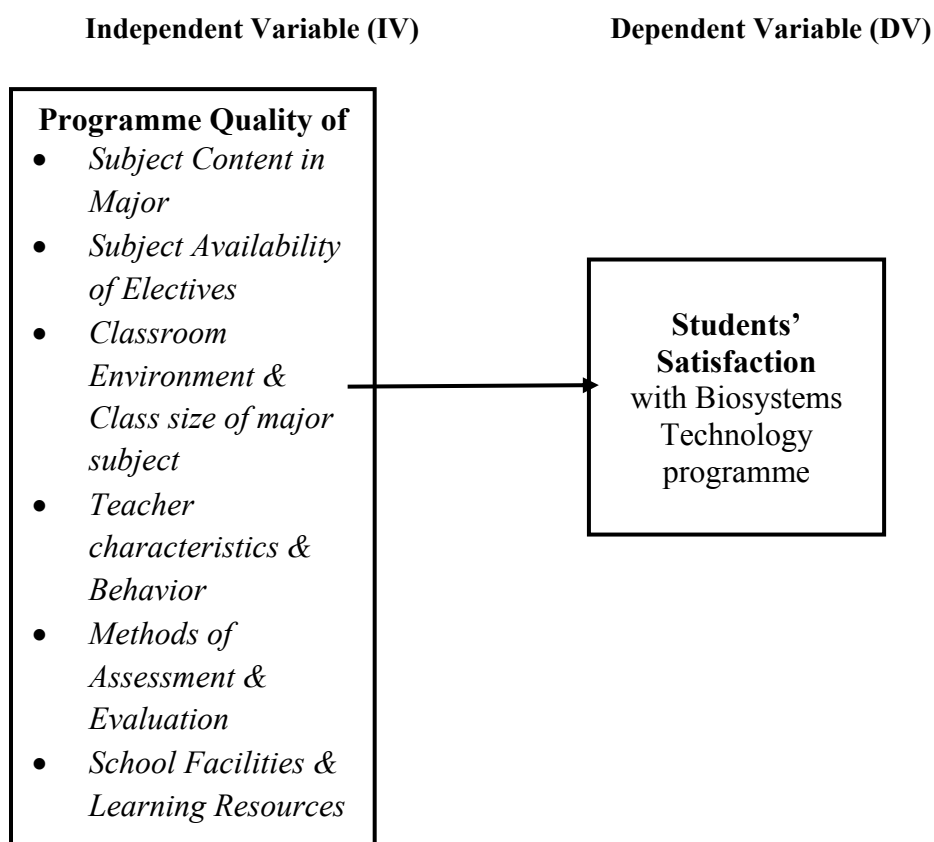
Figure 1 : Conceptual Framework of effect of course quality on students' satisfaction with Biosystems Technology

In operational, subject content in major is defined here as the relevance and appropriateness of major subject content to meet the students' expectations in terms of personal and career development of their life whilst methods of assessment and evaluation are emphasized as the degree to which students are perceived that the method of evaluation and assessments are fair. The course quality of classroom environment and class size in major subjects is measured as the extent to which the classroom environment and class size in major subjects is perceived by the students as helpful in the learning and teaching process. The school facilities and learning resources are considered as the extent to which the students are satisfied with availability and accessibility of the facilities and learning resources necessary to the course such as equipped laboratories, classroom, computers with internet and libraries, text books, resource books and practical guides.

Therefore, to study the relationship between course quality and students' satisfaction in education setting from students 'perspective, the hypotheses below were developed.

H1: The course quality has a positive and significant effect on the students' satisfaction with Biosystems Technology programme (SSBST).

- H1a: The subject content in major dimension of course quality has a positive and significant effect on the students' satisfaction.

- H1b: The subjects' availability for electives dimension of course quality has a positive and significant impact on students' satisfaction.

- H1c: The classroom environment and class size dimension of course quality has a positive and significant effect on the students' satisfaction.

- H1d: The teacher characteristics &behavior dimension of course quality has a positive and significant effect on students' satisfaction.

- H1e: The method of assessment & evaluation dimension of course quality has a positive and significant effect on students' satisfaction.

- H1f: The school facilities & learning resources dimensions of course quality has a positive and significant effect on students' satisfaction.

Research Methodology

Population, Sample Size and Sampling Method

The total population of this study consists of all students who studied Biosystems Technology at senior secondary stage (Advanced Level) of education in the year 2013 and 2014 in Sri Lanka.

Nevertheless, it is not access practical to take samples from all around the country due to the time and cost constraints. Hence, study population of the present study is confined to the central province of Sri Lanka since the central province has the highest student population in Biosystems Technology programme of 1,679 which is close to the student population in the Western province of Sri Lanka. Furthermore, Central province is the only province representing wider ethnic diversity where the number of schools having Biosystems Technology programme is considered. On the other words, the Central province is reported the best combination of schools representing ethnic diversity and the number of students rather than other province of the country.

In this regard, the present study is employed the Krejcie-Morgan table given by Sekaran & Bougie, (2010) when selecting sample size. The sample size of the present is therefore 313 minimum respondents, since the study population is 1679 in the year 2013 and 2014. However,

an assumption had made when the size of the sample decide that the response rate may be 70 per cent. In fact, the sample size of the present study was 410 students (Table 1.1) who studied Biosystems Technology.

Table 1 : Distribution of the students in the sample by the districts (three districts in the Central province) and year of enrolment

District	Kandy		N'Eliya		Matale		Total
Year of Enrolment	2013	2014	2013	2014	2013	2014	
Number of students in the sample (410)	66	98	70	94	41	41	410
Total	164		164		82		410

The sampling techniques used in the present study were stratified proportionate and simple random sampling methods which come under probability sampling design in order to draw the subjects in the sample. Since the study population of present study was all the students who studied Biosystems Technology in Central province of Sri Lanka in the year 2013 and 2014, it makes sense to stratify the population initially on the basis of educational districts (three districts in the Central province) and then the year of students' enrollment followed by the educational districts (Table 1.1(a). Finally, simple random sampling method was employed by the researcher when selecting the subjects in the sample.

Table 1(a) : Distribution of the students in the sample by education districts and Year of Enrolment

District	Year of Enrolment		Total
Kandy District	2013	2014	
No. of students in the study population	235	335	
Proportion	2	3	
	2/5*164	3/5*164	
No. of students in the sample	66	98	164

NuwaraEliya			
No. of students in the study population	279	412	
Proportion	3	4	
	3/7*164	4/7*164	
No. of students in the sample	70	94	164
Matale			
No. of students in the study population	200	218	
Proportion	1	1	
	½*82	½*82	
No. of students in the sample	41	41	82
Total			410

Research Instrument

The instrument (a questionnaire) of the present study was based on past studies. In designing a questionnaire, the researcher focused on three main areas. First, was the wording of the questions while the second, related to categorizing, scaling and coding of the responses. Thirdly, the general appearance of the questionnaire was also important because they helped to minimize the bias in of the research.

In this research, the survey questionnaire was divided into three sections. Section 1 focuses on the student's demographic data such as gender, ethnicity and year of students' enrollment. The purpose of this section is to obtain the demographic information of the respondents who studied Biosystems Technology at senior secondary stage (Advanced Level) of education. The section 2 of the questionnaire asks the students to rate their opinions regarding their perceived experiences with programme quality in subject content in major, subjects' availability for electives in major, classroom environment & class size of major subjects, teacher characteristics & behavior, methods of assessment & evaluation and school facilities pertaining to the Biosystems Technology. Section 3asks respondents about their satisfaction

with Biosystems Technology programme. In sections 2 and 3of the questionnaire, a five-point Likert scale was used to measure the student's perceived experiences (Letcher, &Neves, 2012; Tessema et al., 2012; Sinclaire, 2010; Kelso, 2008; Peng & Samah, 2006). In this scale, 1 represents "strongly agree" and 5 represents "strongly disagree".

Reliability and Validity Assessment

Furthermore, reliability and validity of the questionnaire were assessed in order to ensure the rigor and generalization of the findings. Reliability was assessed by using Cronbach's alpha whilst content validity was tested for the validity of the instrument (Cooper & Schindler, 2011), in which the researcher obtained the opinions from a panel of experts. Based on the experts' opinions, few items were removed and modified to improve the comprehensibility and clarity of the questionnaire. The Cronbach's alpha was computed to examine the reliability of the questionnaire participating 50 students who studied Biosystems Technology. In fact, the Cronbach's alpha for all dimensions of course quality and students' satisfaction were ranging from 0.703 to 0.820 exceeding the cut-off value (α =0.70) and reliability was established. On the other words, all items in the questionnaire are deemed reliable (Zikmund et al., 2010).

Finally, pilot-tested questionnaire was administered to the study sample (410 students) drawn from the three districts in the Central province followed by the year of enrollment to Biosystems Technology programme and 325 questionnaires were returned indicating 78.8 percent response rate.

Results of Data Analysis

The data obtained from the questionnaire were analyzed by using SPSS (statistical package for social science), version 21.0. The the effect of course quality on students' satisfaction with Biosystems Technology were examined by employing correlation and multiple regression analyses. Furthermore, all the assumptions which need to be fulfilled before running multiple regression analysis were met by the data obtained (Chinna & Yuen, 2016).

Descriptive Statistics and Correlation Analysis

The descriptive statistics, in terms of mean and standard deviation and also the Pearson's Correlation amongst the six programme quality constructs are presented in Table 1.2.

Table 2: Descriptive statistics and Person's Correlation amongst six course quality and students' satisfaction constructs

	Mean	Standard Deviation (SD)	SCM	MAE	CECS	TCB	SAE M	SFLRS	SSBS T
SCM	3.774	.506	1						
MAE	3.680	.586	.431 **	1					
CECS	3.656	.692	.379 **	.427 **	1				
TCB	3.886	.515	.320 **	.444 **	.388 **	1			
SAEM	3.872	.583	.275 **	.350 **	.204 **	.213 **	1		
SFLR	3.333	.595	.227 **	.509 **	.390 **	.331 **	.220 **	1	
SSBST	3.998	.424	427* *	373* *	345* *	261* *	426* *	307**	1

* Correlation is significant at the 0.01 level (2-tailed)

(Source: Source; Survey Data, 2016/2017)

In Table 1.2, the mean values for all the constructs are towards 4, which indicates, generally, the students who studied Biosystems Technology disagreed with the statements related to all dimensions of course quality. In the other words, respondents of this study were alarmed that the students (respondents of present study) were dissatisfied with course quality. Furthermore, Table 1.2 indicated that all the constructs had positive and significant correlation ($p<0.01$). It is clearly observed that correlation among the above variables does not exceed the value of 0.85, which means that there is no problem of multicollinearity among the six dimensions of course quality.

Regression Analysis

The main hypothesis (H1) of present study was "the course quality had a positive and significant effect on the students' satisfaction with Biosystems Technology which consisted six sub-hypotheses (H1a – H1f). The multiple regression analysis was performed to test the hypotheses since the purpose of present study was to examine the effect concurrently between one dependent variable (outcome variable) and two or more independent variables (explanatory variable) (Hair et al., 1998). The results of the multiple regression analysis are presented in Table 1.3 and 1.4.

Table 3: The results from simple linear regression analysis for students' satisfaction with Biosystems Technology programme upon course quality

Model	Unstandardized Coefficients		Standardized Coefficients	Sig.	VIF	95% Confidence Interval for B	
	B	Std. Error	Beta			Upper Bound	Lower Bound
(Constant)	1.683	.202		.000		1.286	2.080
SCM	.211	.045	.252	.000	1.346	.123	.299
SAEM	.209	.036	.287	.000	1.170	.138	.280
1 CECS	.075	.034	.122	.027	1.420	.009	.141
TCB	.011	.044	.014	.799	1.353	-.075	.098
MAE	.036	.045	.049	.423	1.795	-.052	.124
SFLR	.078	.039	.110	.047	1.437	.001	.156

a. Dependent Variable: SSBST (Students' Satisfaction with Biosystems Technology)

(Source; Survey Data, 2016/2017)

In the table 1.3, the p-value for subject content in major (SCM), subjects' availability for electives (SAEM), classroom environment and class size (CECS), and school facilities and learning resources (SFLR) are less than 0.05, which indicates that out of six dimensions of course quality (C.Q.) in SCM, SAEM, CECS and SFLR are significant predictors of SSBST. On the other words, this results are further indicated that higher the level of SCM, SAEM, CECS, and SLFR, higher the level of students' satisfaction. However, the p-values for teachers'

characteristics and behaviors (TCB), methods of assessment and evaluation (MAE) are more than 0.05, indicating as insignificant predictors of SSBST. In fact, students' overall satisfaction depends only on C.Q. in SCM, SAEM, CECS and SFLR. On the other hand, independent variables; TCB and MAE (p>0.05) can't be used to predict SSBST. Furthermore, the 95% confident intervals (CI) of TCB and MAE are (-.075, .098) and (-.052, .124) respectively where the value of zero (0) falls within these intervals, indicating once more TCB and MAE are not significant predictors of SSBST (Wijesooriya, 2016). The 95% CI for SCM, SAEM, CECS and SFLR are (.123, .299), (.138, .280), (.009, .141) and (.001, .156) respectively, where the value of zero (0) is not within these intervals, confirming further C.Q. in SCM, SAEM, CECS and SFLR are the significant predictors of SSBST.

Table 4: The Results from stepwise regression analysis of SSBST upon significant predictors (C.Q. in SCM, SAEM, CECS and SFLR)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	1.714	.186		9.213	.000		
SCM	.223	.043	.266	5.224	.000	.813	1.231
SAEM	.216	.035	.297	6.121	.000	.895	1.117
SFLR	.093	.036	.130	2.568	.011	.824	1.213
CECS	.082	.032	.133	2.521	.012	.756	1.323

a. Dependent Variable: SSBST

(Source; Survey Data, 2016/2017)

The purpose of stepwise regression analysis is to recognize the most important predictor(s) of predicted (or outcome) variable. Hence, the results from stepwise regression analysis of SSBST upon significant predictors (C.Q. in SCM, SAEM, CECS and SFLR) are presented in Table 1.4.In the Table 1.4, the standardized beta coefficients show that the most important predictor on SSBST is C.Q. in SAEM ($\beta=0.297$), while the least important predictor is C.Q. in SFLR ($\beta=.130$). Furthermore, the effect of SCM ($\beta=0.266$) on SSBST is two times

more that compared to the effect of SFLR ($\beta=0.130$) and CECS ($\beta=0.133$) on SSBST. The effect of SAEM ($\beta=0.297$) on SSBST is similar like SCM. Thus, these results from multiple regression analysis revealed that C.Q. in SCM, SAEM, CECS and SFLR has direct effect on students' satisfaction with Biosystems Technology programme (SSBST).

Furthermore, the highest VIF value is less than 5, indicating that there is no problem of multicollinearity (Sekaran and Bougie, 2010). The R square value is 0.328, which means 33% of the variation in SSBST is explained by C.Q. in SCM, SAEM, CECS and SFLR. Hence, the effect size of R square is substantial (Cohen, 1988, 1998) which emphasized that course quality is a major factor in determining students' satisfaction. On the other words, 33% of variance indicates that some factors which affect to students' satisfaction have not investigated in this study. The Durbin-Watson statistics of variables is not far from 2, which indicates that there is no problem of autocorrelation (Chinna, 2012).

In brief, there were six sub-hypotheses (H1a – H1f) pertaining to main hypothesis (H1), those were statistically tested by applying multiple regression analysis. The results show that four dimensions of programme quality were significant ($p<0.05$) as perceived by students who studied Biosystems Technology at senior secondary stage (Advanced Level) of education in Central province of Sri Lanka. These are subject content in major (SCM), subjects' availability of electives (SAEM), classroom environment and class size (CECS), and school facilities and learning resources (SFLR).

Moreover, the beta coefficients (Table 1.4) suggest that increasing the quality in these four dimensions will positively effect on students' satisfaction with Biosystems Technology (SSBST). The effect of both teachers' characteristics and behavior (TCB) and methods of assessment and evaluation (MAE) on students' satisfaction were insignificant ($p>0.05$), suggesting that increasing the quality of these dimensions may not positively affect students' satisfaction with Biosystems Technology programme.

In short, the beta coefficient of SFLR ($\beta=0.130$) suggests that SFLR is not perceived as important to course quality as SAEM ($\beta=0.297$), SCM ($\beta=0.266$) and CECS ($\beta = 0.133$) by students. On the other hand, the standardized coefficient of SCM, SAEM, CECS and SFLR describe students' satisfaction with Biosystems Technology programme numerically and also identified that the SAEM ($\beta=0.297$) has the most influential effect on students' satisfaction whilst SFLR shows least important factor in determining students' satisfaction because SFLR has the lowest value of beta which is 0.130.

Discussion and Conclusion

The present study has focused to examine the effect of course quality on students' satisfaction with Biosystems Technology programme at senior secondary (Advanced Level) education in Sri Lanka. Concurrently, it has made an effort to identify the factors showing the most and least influence on students' satisfaction.

Discussion

The descriptive statistics (Table 1.2) is evidently showed that the majority of students studied Biosystems Technology are dissatisfied with course quality because mean score of each construct closed to 4.0. Furthermore, Pearson's correlation analysis showed that the course quality dimensions were related to the students' satisfaction with Biosystems Technology. On the other words, providing a better quality course, higher the students' satisfaction. Furthermore, the results of hypothesis testing confirmed that out of six course quality dimensions, four dimensions namely course quality in subject content in major, subjects' availability for electives, classroom environment and class size and also school facilities and learning resources were the significant predictors of students' satisfaction with Biosystems Technology since β value were 0.252, 0.287, 0.122 & 0.110, P<0.01, P<0.05 respectively. In fact, with higher the course quality in SCM, SAEM, CECS and SFLR, the students' satisfaction would be higher. Further, the students studied Biosystems Technology have perceived that above four course quality dimensions are more important quality parameters where students' enrolment into the course is considered. Correspondingly, the findings further confirmed that course quality in methods of assessment and evaluation and also teachers' characteristics and behavior were not important quality aspects in determining students' satisfaction with Biosystems Technology. On the other words, with higher the course quality in teachers' characteristics and behavior and also methods of assessment and evaluation, the students' satisfaction not positively and significantly higher.

In the sense of significant predictors of students' satisfaction, subjects' availability for electives was the most important factor in determining students' satisfaction with Biosystems Technology. Therefore, this is a very important finding for the relevant educational personnel such as National Institute of Education and also Ministry of Education who have authority for quality improvement of the courses offered since with higher the course quality, students' satisfaction significantly higher. Otherwise, the students enrolling to Biosystems Technology

programme will be more concerned about the elective subjects offered because it directly affects to the cut-off marks of state university entrance in Sri Lanka.

Thus, the findings consistent with the previous studies of Zakaria et al., 2016, Baucer, 2015, Mansori et al., 2014, Teseems et al., 2012, Sinclaire, 2010, Shain et al., 2007. Beside to that, findings is further revealed that teachers' characteristics and behavior, and also methods of assessment and evaluation do not show the effect on students' satisfaction. However, this finding contradict with the previous studies of Grace et al., 2012, & Sinclaire 2010 though consistent with Zakaria et al, 2016 & Grace et al, 2012. Moreover, school facilities and learning resources were the least important predictor in determining students' satisfaction. In fact, this finding is contradicted to some extent with previous study of Price et al., (2003) which revealed that learning resource and facilities has the highest predictive power on students' satisfaction.

Conclusion

In brief, the purpose of the present study was to investigate the effect of course quality on students' satisfaction with Biosystems Technology which is a course of study at senior secondary (Advanced Level) education in Sri Lanka. The findings of the present study confirmed that four dimensions of course quality except teachers' characteristics and behavior and also methods of assessment and evaluation were significant predictors of students' satisfaction in terms of changing satisfaction in positive way. In the other words, that last two dimensions discussed above (TCB& MAE) cannot be directly used for changing students' satisfaction with the course of study. However, though six dimensions of course quality were correlated adequately (Table 1.2), TCB and MAE were insignificant predictors of students' satisfaction with Biosystems Technology.

Thus, these empirical findings contribute to the body of knowledge in terms of course quality and students' satisfaction. Indeed, with increasing the quality of course, the students tend to perceive higher satisfaction with course of study. Therefore, these findings provide a better platform for the relevant authorities to improve the quality of course offered and to be offered. Finally, the conceptual framework used in this study would be useful for the researchers who wish to do an empirical study in different areas and context. Moreover, the scholars would encourage to expand the conceptual framework by identifying a mediating factor which could uplift the relationship exists between the course quality and students' satisfaction.

Implications

The present study aimed to investigate the relationship exists between the course quality and students' satisfaction with Biosystems Technology at senior secondary stage (Advanced Level) of education in Sri Lanka. Indeed, this study would contribute to fill the gap exits in the local and foreign literature with regards to the effect of course quality on students' satisfaction since empirical studies about the subject are limited. Moreover, the validity and reliability assessment performed for the measurement instrument used in this study confirmed that it is reliable to measure the course quality and satisfaction with the course of study.

These findings further confirmed that with increasing the course quality in subject content in major, subjects' availability for electives, classroom environment and class size, and also school facilities and learning resources, students tend to become more satisfied. In this regards, the relevant personnel such as policy makers and other education officials should rethink the quality of present courses and future courses since the improvement of course quality in subject content in major, subjects' availability for electives, classroom environment and class size and also school facilities and learning resources would definitely benefit the students in satisfaction with courses of study.

Limitations and Recommendation for Future Studies

There were few limitations appeared in this study which provide a rationalized environment for further studies. Since time constraints and non-feasibility, this study was confined to the Central Province of Sri Lanka. Hence, the findings cannot be generalized to other provinces of the country and other countries in the world. Therefore, it is suggested that do same study for other provinces in the country. Moreover, the findings may not reflect other industries since present study focused only on the education industry in Sri Lanka. Hence, further studies could be done with other industries. Since the present study concentrated on the effect of course quality and students' satisfaction, it is suggested that further studies should use students' satisfaction as a mediator between the course quality and students' word-of-mouth (Li, 2010). Since this study is a cross-sectional one, further studies could be conducted as a longitudinal study in other provinces of Sri Lanka.

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Learning L2 Vocabulary with Automatic Speech Recognition (ASR): Students' and Teachers' Attitudes towards Learning Vocabulary via ASR

Samantha Wickramasinghe
Concordia University, Portland

Abstract

Learning vocabulary using Automatic Speech Recognition (ASR) is a unique concept since it demands language learners to speak up in order to find word definitions. Two groups of adult, English language learners were given a vocabulary activity which had to be completed using ASRon their mobile phones. The students were given a brief questionnaire eon using ASR in the classroom to learn vocabulary. Then the class teachers were interviewed. The data gathered from students' questionnaire was analyzed under three qualitative evaluation criteria. Then the students' perceptions were compared with the teachers' perceptions. While students cited many advantages of using ASR in the classroom, overall they claimed that mispronunciation of words became a hindrance in learning vocabulary. On the contrary, the teachers thought that ASR helped students to improve their pronunciation. Thus, there was also a mismatch between students' perceptions and teachers' perceptions.

Keywords: L2, Vocabulary, Learning, ASR, Pronunciation

Learning L2 Vocabulary with Automatic Speech Recognition (ASR)

Automatic Speech Recognition (ASR), also known as the voice assisted or voice recognition technology has become one of the most prominent areas for commercial research around the world. Leading tech companies like Apple and Google have incorporated ASR into their mobile phones as a built-in feature by introducing smart assistants like Siri which is operated through voice. With the Apple iPhone, users need to press the home button to activate Siri and talk to the phone but with Google, it is possible to activate ASR capabilities by opening the Google application in the phone or giving the command "Okay Google." ASR software is installed to these phones are capable of doing a variety of things such as articulating definitions of words, giving directions to destinations, telling weather forecast etc. to given voice commands by their users. For the purposes of this study, Apple and Google based ASR software

was used. But apart from ASR assistants based on these companies there is variety of ASR software that can be installed and activated in Personal Computers (PCs), tablets, iPads and mobile phones, Intelligent Personal Assistants (IPAs), PDAs (Personal Digital Devices)which gives consumers opportunity to use ASR in multiple platforms.

With regards to language-learning, the inclusion of ASR in mobile devices computers and IPAs is a breakthrough because they can be used to obtain information, through conversations and verbal commands (Moussalli, & Cardoso 2016).This means ASR allows its users to speak and access information instead of typing on a keyboard or using a digital screen to navigate through information. Some researchers like Dizon (2017) have studied how Amazon's smart assistant Alexa could be used for interactive storytelling. While others like Moussalli and Cardoso (2016) discovered that students enjoyed using Alexa as a learning tool to practice conversations and ask questions. This is a great example of how conversations taking place between human beings and IPAs which operate through ASR can be useful in L2 classroom.
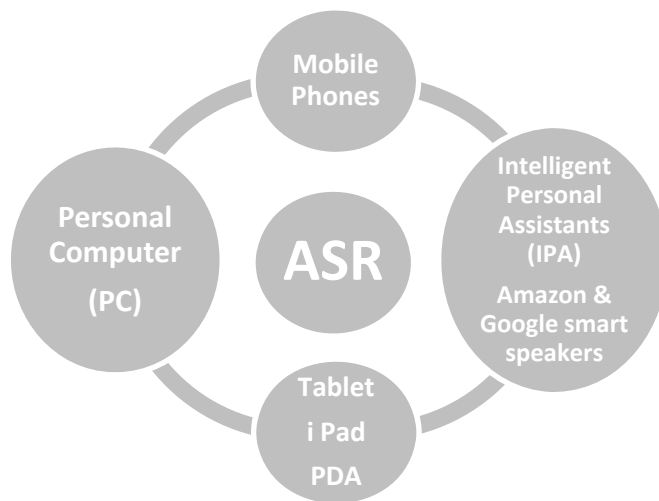
Mobile
Phones

Intelligent
Personal
Assistants
(IPA)

Personal
Computer
(PC)

ASR

Amazon &
Google smart
speakers

Tablet
i Pad
PDA

Figure 1 : ASR technology can be accessed through multiple

Purpose of This Research

The purpose of this research is to understand how students can use ASR to learn L2 vocabulary through a mobile phone with their teacher's assistance and guidance in classrooms. It also investigates students' and teachers' opinions on the challenges and problems that come with incorporating ASR into the classroom for L2 vocabulary learning. Nevertheless, it does not

intend to test vocabulary acquisition of the students nor does it suggest that learning vocabulary through ASR via mobile phone (as it was done in this research) is somehow the best way of learning L2 vocabulary using ASR. In the context of this study mobile phones were the tools that were available for the researcher and the students. Vocabulary learning through ASR can be done with other electronic which have ASR capabilities in their own unique models.

This research was simply designed to assist students and encourage students, by introducing them to a new way of learning vocabulary. Based on the researchers' observations of the experiment in class of doing vocabulary activity, and on the students' and teachers' responses of a survey, the main goal was to answer the following research questions:

1. What are students' perceptions of using ASR in the classroom to learn vocabulary?
2. How do teachers and students respond to using ASR to learn vocabulary?
3. How do students and teachers believe ASR can help them learn vocabulary?
4. What role can pronunciation play in vocabulary learning using ASR?

Literature Review

Using technology to learn (L2) vocabulary has been closely associated with Computer Assisted Language Learning (CALL) and Mobile Assisted Language Learning (MALL).CALL based researchers such as Averianova (2015), Ma and Kelly (2006) have used specialized computer software, and web-based learning platforms to conduct studies on L2 vocabulary learning. Simultaneously, MALL based research on vocabulary learning by Kiernan and Aizawa, (2004), Lu (2008), Mahdi (2018), Nikoopour and Kazemi (2014) emphasized individualized vocabulary learning through text messaging, picture based vocabulary learning and the use of electronic dictionaries in mobile phones. However, in the context of vocabulary learning, the distinction between CALL and MALL as two separate technology-assisted learning systems is not highly significant because the software and the online platforms that are used in personal computers (PCs) could be accessed through mobile phones as well. That's why some researchers like Song and Fox (2008) have used both CALL and MALL systems together as a mixed approach by incorporating web based learning platforms on digital devices such as mobile phones, PDAs (Personal Digital Assistants) and personal computers to study L2 vocabulary learning.

Historically, ASR technology has not been used for research on L2 vocabulary learning. Therefore, using ASR technology to learn L2 vocabulary is a novel idea and it has not been

subjected to study. A variety of reasons for this could be pointed out. First of all, given the fact that ASR deals with human speech, the sole purpose of ASR based studies was to find ways to assist speech/communication and improve pronunciation. Secondly, inclusion of ASR in mobile phones, tablets and IPAs which can be operated by given voice commands, is relatively recent. With early ASR, it was not possible learn vocabulary because computers and mobile phones did not have the capability to take voice commands. However, research on vocabulary learning through mobile phones using technologies other than ASR has been conducted by Lu (2008), Kiernan and Aizawa (2004), Liakinetal. (2015) who focused on L2 vocabulary learning via MALL based methods. They did not have the option to use ASR as a possible technology for vocabulary learning. Instead they used they used text messaging, digitalized flashcards and picture based words to study L2 vocabulary.

Additionally, it took time for many other technologies which were independent from ASR such as wireless internet (Wi-Fi), cloud computing i.e. using remote servers in the internet to store data, to evolve and merge with ASR. As a result of convergence of all these technologies, language learners today can get definitions of words by giving voice commands with instant feedback on the screen of their phones or IPA device. Unlike in the past when ASR was designated to the computer lab for L2 pronunciation research purposes, today language learners from different backgrounds largely have access to all these devices because they are available to be purchased in the marketplace.

Vocabulary Learning and CALL/MALL Based Methods

Vocabulary is a fundamental component of language learning. Without adequate vocabulary, language learners would not be able to master the basics of language. Folse (2004) argued that vocabulary is more important than grammar, syntax, pronunciation or spelling because without knowing words, language learners wouldn't be able to ask for what they need. In the context of vocabulary learning and technology Mahdi (2018) divided vocabulary learning into traditional context and technology-based context. Within the tradition environment, vocabulary is learned through listening to native speakers, using media such as television, radio, print dictionaries, newspapers, books, word lists and word cards. The technology-based environment can be explained as anything CALL or MALL based. This can vary from using specialized computer software, CD-ROMs with pre designed vocabulary games and activities, learning vocabulary through text messaging, online dictionaries, mobile applications to web-based platforms.
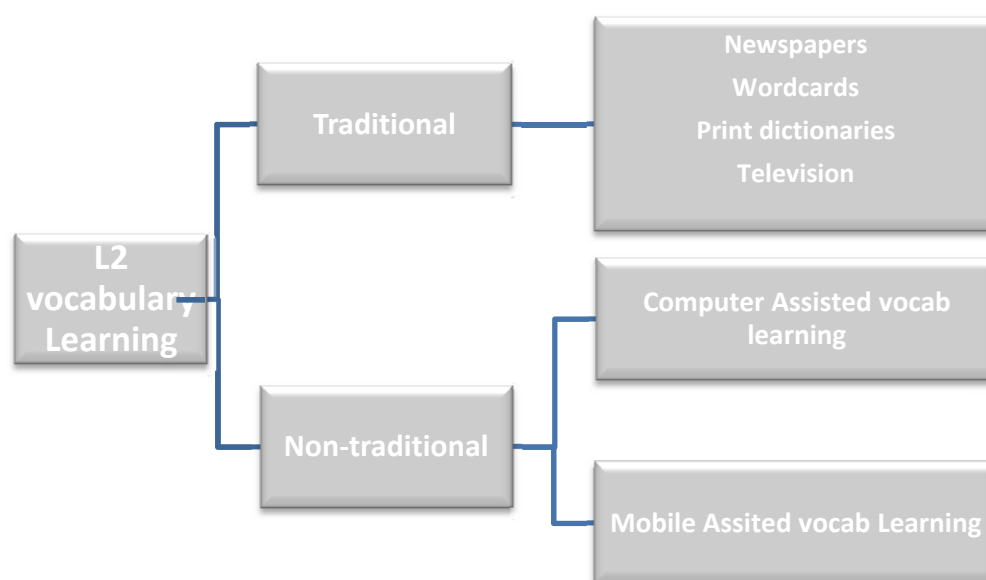
Figure 2 : Traditional and non-traditional methods of learning

Although there is evidence (Bagheri, Roohani & Ansari,2012) to suggest that traditional methods can be effective as much as non-traditional methods, the overwhelming majority of research (Ma & Kelly, 2006; Nikoopour & Kazemi, 2014, Lu 2008) suggest that non-traditional, digitized methods can be much more effective. As a detailed example for this Mahdi (2018) conducted a meta-analysis on 16 studies involving 986 participants about effective ways of learning L2 vocabulary using a mobile phone and then compared traditional ways of learning vocabulary i.e. word cards, dictionary with mobile vocabulary learning i.e. using digital images and text messages (SMS). The results indicated that the use of mobile phones were more effective. Mobile learning appealed to both receptive and productive ways of L2 learning. Receptive vocabulary learning meant using a word while listening to or reading it. Productive vocabulary learning meant wanting to convey meaning through writing and speaking. The study also found that adult learners had more advantages in learning vocabulary using a mobile phones compared to younger learners.

One advantage of using technology-based methods to study vocabulary is that students have access to online study materials when they are away from the class. For example, Averianova (2015) conducted a study on vocabulary acquisition in L2 by using CALL. The Japanese university students who participated in this research studied L2 vocabulary for their TOIEC test. They used an online tool called Word Engine which helped to learn vocabulary through various computer based activities. The students had access to Word Engine in the

classroom and at home throughout their course. After using this program, students' overall test scores were increased and they had high motivation and the general satisfaction in how they performed in the class also increased. Thus, having access to technology in various settings can be seen as an advantage and it can be incorporated to learning vocabulary via ASR. When students learn how to use ASR in the classroom, they have the opportunity to use it at home or in their own private space.

Another usage of technology based vocabulary learning is the capability to overcome special challenges that certain groups of students face. For example, EFL (English as a Foreign Language) students usually do not get many opportunities to listen to native speakers. Ma and Kelly (2006) evaluated computer assisted vocabulary learning software WUFUN to understand how effective it was with language learners. This software was created to help Chinese university students learn English vocabulary which was perceived to be difficult. According to the researchers, Chinese students face difficulties in learning vocabulary because of the rote learning system based on memorizing things that is deeply imbedded in the Chinese culture. WUFUN was created to overcome these problems of the language learners. It is a sophisticated software since it uses various techniques to practice vocabulary for students. It includes pictures, spoken sentences, mini dictionaries in addition it organizes vocabulary through word focus and collocations. Learners can also ask for the Chinese translations of the words that they intend to learn. The authors concluded that WUFUN enabled students to acquire vocabulary with both receptive and productive skills. The majority of the learners said that they liked to use the software.

Although ASR technology in mobile phones is not specialized for a certain group of learners like WUFUN, it is possible to use ASR creatively to develop individual vocabulary learning strategies by using similar components in software like WUFUN. For example, ASR can be used to ask for synonyms, antonyms and pictures related to certain words. The trick is to give a command that addresses your need. If you want to know what a "turtle", looks like, you can give the command "Show me a picture of a Turtle" . For ESL students who don't know the definition of the word turtle, they could see the picture and know the word from their L1. Unlike using Google translate, using ASR involves a much more sophisticated and creative process since the student have to come up with verbal commands and connect images with the words like in the WUFUN software.

When new technologies are introduced to students, they use it for various purposes that the researcher may not have intended. Song and Fox (2008) did a year-long, multiple case study which looked for the uses of electronic dictionaries in PDAs (personal digital assistants) such as

tablets to improve L2 incidental vocabulary learning. The results of the study showed that the undergraduate students who participated in the study used PDAs to learn vocabulary for various purposes including for referential purposes, explorative purposes and conversational purposes. Also students integrated CALL platforms into the process of learning from the PDA and vice versa. Moreover, results showed that the PDAs offered novel and flexible ways for learning l2 vocabulary. Those who are interested in incorporating ASR into L2 vocabulary learning, it is quite possible that students would use it for purposes other than academic. For example, ASR could be quite useful in pragmatic situations like when buying products in a super market.

Learning Vocabulary via a Mobile Phone.

Although learning L2 vocabulary by using ASR via a mobile phone has not been extensively researched, learning vocabulary through text messaging has been a common interest of many researchers. Lu (2008) studied the effectiveness of short message service (SMS) or text messaging in second language vocabulary learning. Two groups of high school students were studied over two weeks. Each group was given a set of words either in print or through SMS messages. After the first week the groups switched. Thus all participants got the exposure to both methods. On the small screens of the mobile phones, text messaging displayed only a limited amount of lexical information in a regular basis. Nevertheless, the results indicated that the students' vocabulary knowledge got better with the SMS method compared to the print method. In addition, interview data from a qualitative questionnaire showed that the students held positive attitude towards learning vocabulary via mobile phones. When compared with ASR, mobile vocabulary learning methods such as text messaging, seems to have a fundamental difference although both ASR and SMS learning is done by using a mobile phone. ASR needs a human voice to function which means that those who use ASR for vocabulary learning need to know the correct pronunciations of the words and they need to know the right questions to ask. On the contrary, learning via text messaging seems to be user friendly and much more effective because students can find the letter symbols on the key board and they can type. In other words, they don't need to know the pronunciation of words to know the meaning of the word.

ASR and Pronunciation

Both CALL and MALL based research by Coniam (1999), Neri, Cucchiarini, Strik and Bovek (2002) Liakin, Cardoso and Liakina, (2015) Derwing, Munro and Carbonaro (2000) have used ASR predominantly to study pronunciation. For example, Neri, Cucchiarini and Strik

(2003) recommended using ASR for specialized language learning purposes such as Computer Assisted Pronunciation Training (CAPT). They argued that ASR could be an integral part of studying pronunciation and particularly learning more about pronunciation through errors which were made by non-native speakers and ESL, EFL students. Consequently, ASR-based pronunciation applications and software were developed under CALL and MALL systems that could give instant, private and individualized feedback on errors to language learners.

However, the proposed CAPT model on learning pronunciation using ASR by Nerietal., (2003) highly relied comparing L2 speakers' speech with native speakers' speech. Their model comprised four important steps such as scoring, error detection, error diagnosis and final feedback.
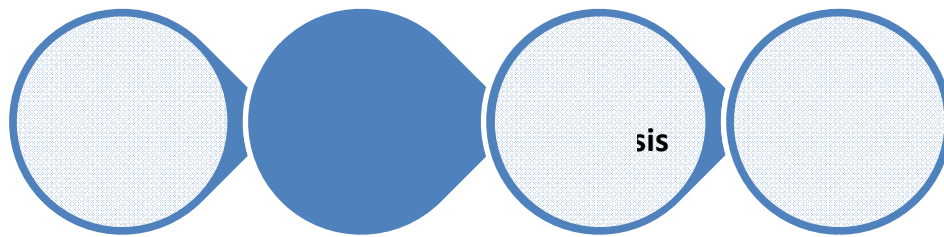
Figure 3 : CAPT model designed for L2 learners to give pronunciation feedback

In the scoring stage, L2 utterances are evaluated by comparing it with native speaker's speech in terms of speech properties like rate, acoustics and it is given a score. In the error detection stage, stored models of native speaker's speech are used as a basis for error detection. Then, in the error diagnosis stage the L2 speech errors are identified and given feedback on ways to improve pronunciation. Finally, an overall score is given with visual feedback, in the feedback stage. The researchers did not consider this model as a perfect model. They were critical about its possible shortcomings and the fact that it was largely based on comparison to native speakers.

This model by Nerietal., (2002), appears to be more explicit and comprehensive when compared with the way of learning vocabulary through ASR, (ASR model that the researcher came up with). The ASR model seems to be less comprehensive in terms of giving pronunciation feedback to the students. There are two kinds of visual feedback that students get on their pronunciation when

they use ASR on their phone. As they are talking to the phone, their utterances turn into text and get displayed on the digital screen. This technology is called TTS (Text to Speech Synthesizers). There is a close connection between ASR and TTS but both of these things should be understood differently. Put simply, TTS is a form of speech synthesizing that converts speech into written text. ASR finds information necessary to the verbal commands given by the user. TTS and ASR work together when students ask for word definitions from their phones. TTS gives a visual feedback to the learner to realize whether she got the pronunciation of the word, or the verbal command right. However TTS screen does not last for a long time. It lasts only for a few seconds until ASR figures out the sentences or the words that the student has uttered.
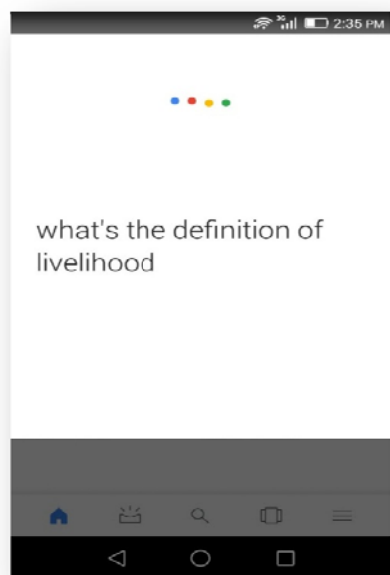

Figure 4 : An example of text to speech synthesizing (TTS) technology on the a smart phone

Students also get visual feedback when the ASR assistant processes the verbal command and finally displays the definition on the screen. An image of this screen with a definition is further discussed on the method section of this thesis. The argument about, ASR model being less comprehensive than the Nerietal., (2002) CAPT model is based on the observation that students do not get a score or a formal evaluation on their pronunciation performance when they use ASR. However, the ASR model gives both auditory and visual feedback on pronunciation like the CAPT model even though the prime purpose of the ASR model is dedicated to find definition of the words. Pronunciation is only a means to achieve this end.
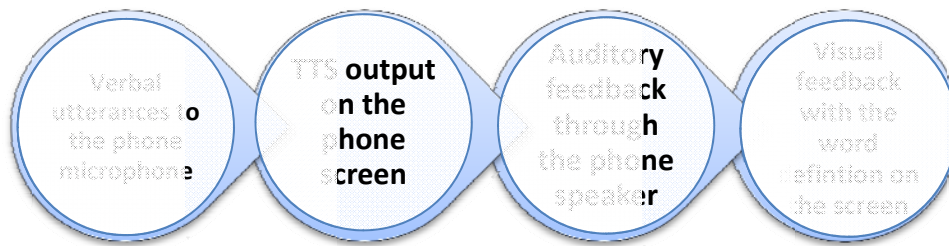
Figure 5 : Learning vocabulary through ASR using a mobile phone

Since the current uses of ASR are significantly different from early uses of ASR, it is necessary to examine the literature that explains the evolution of ASR in L2 language learning over time. In addition, it is necessary to investigate CALL and MALL based L2 vocabulary learning methods to understand how L2 vocabulary-learning has been studied with the use of technology. Thus, this literature review first analyses studies that focus on technology and vocabulary learning using CALL and MALL. Then it discusses how ASR has evolved to the point that it was possible to use it for vocabulary learning. Finally, it investigates what can be learned by these two different histories to improve L2 vocabulary learning via ASR.

Method

Participants

Two groups of adult, upper-intermediate ESOL learners from Portland Community College (PCC) campuses took part in this study. The first group included thirteen students from the PCC Cascade campus. They were Level 7 and Level 8 (lower advanced and advanced) students from a class specialized in building communication skills which was designed to help students to improve their note-taking skills, public speaking skills, academic listening skills and pronunciation skills. After completing it, the majority of students wanted to pursue higher education in universities and colleges in the United States or elsewhere. The second group included nineteen students from the PCC Sylvania campus. They were Level 6 students (intermediate) from a class specialized in reading which was designed to improve reading skills and vocabulary learning skills. Most of them planned to pursue higher education by completing an associate degree at PCC or going to a university. Altogether, 32 students participated in the study from both groups and all of those who participated ascribed to a foreign nationality.

Teachers played a very important role in conducting this research by assisting the researcher. Getting feedback from teachers from both classes was essential because the researcher wanted to integrate the study into to the pre vocabulary lessons which were given to the students. Thus, without the help of teachers this study would not have been possible. In addition, teachers were asked to share information about their personal reflections on the usage of ASR technology and IPA devices in the classroom. They also helped the researcher to conduct the study by providing information about their lesson plans and classroom proceedings. Students and teachers from PCC were selected particularly for this study because a community college like PCC has an organized system that categorizes ESOL students into different levels according to their skills and abilities. In order to move from a lower level to a higher level, students need to show competence in the classroom and score well in the exams. The levels ascend from one to eight (one being the lowest and eight being the highest). According to each level, the study material such as textbooks, online learning tools and visual aid are adapted to provide a better learning experience for the students.

All students who participated in the study had mobile phones (Apple or Android/Google) that supported ASR technology. Other IPAs such as tablets, Amazon or Apple smart speakers or ASR based computer programs like Dragon were not used by any of the students. Thus, Google and Apple software had the control over what information to present for the users. Unlike the level-appropriate material used by PCC teachers, Google and Apple software did not have a specialized method or way of producing material which were appropriate for different levels. Thus, the definitions given by ASR were standardized and cookie-cutter-like. Taking this into account, upper-intermediate level students were picked for this study under the assumption that they had more exposure to learning standardized or generalized definitions of vocabulary compared to lower level students who learned level-appropriate vocabulary through text books which were crafted and designed according to their level or lessons at PCC. Partaking lower level students to this study would have needed providing extra guidance from the teachers' and researcher's end. Thus, students from higher levels were selected considering that their proficiency level was high enough.

Data Analysis

The data gathered in this research included reflections from the researcher, teachers and students about the use of ASR technology in the classroom. It did not include data on students' performance on the vocabulary activity. The primary intent of the research was to analyze students'

comments and teachers' comments qualitatively and find patterns and relationships between the two. Once the data was collected, it was categorized under three evaluation criteria i.e. advantages, hindrances and preferences. After categorizing student comments into evaluation criteria they were analyzed to find dominant themes and dominant patterns. Finally they were compared with teachers' comments. Then the students' comments and teachers' comments were analyzed to find possible relationships that can provide insight to language teachers and students. In analyzing dominant patterns, affirmative relationships were not given priority over contradictory relationships. For example, many students expressed that ASR was great way to learn pronunciation which made their views align with the teachers' views. However the most interesting relationship was the contradictory relationship between students' comments and teachers' comments. The contradictory relationship was problematic because it hi

Results and Discussions

The results section attempted to provide valuable insights to the data gathered by analyzing students' responses under the evaluation criteria i.e. hindrances, advantages, preferences. These criteria "Advantages" and "Hindrances" were based on what students considered encouraging or discouraging in using ASR in their learning process. "Preferences" were identified as personal choices students made in terms of their opinions on how ASR technology should or shouldn't be used. The results section also observed dominant themes among students' comments, similarities and contradictions between students' comments and teachers' comments by analyzing the data that was gathered from the student surveys and teacher interviews.

Table 1 : Evaluation Description and Student's Comments

Evaluation Criteria	Description	Student Comments
Advantages	*Positive remarks and attributions about ASR technology that helped students to learn*	• "It really helps me to get the definition easily" • "It makes you practice pronunciation and you can get the definition faster" • "It's a good way to learn vocabulary" • "ASR is good to learn new vocabulary and it saves time."

Hindrances	*Negative remarks about using ASR that hindered students from learning*	• "It will distract the class" • "it was hard because my phone was set to my own language (first language)" • "Sometimes it wastes time because it doesn't recognize the pronunciation" • "I'm not sure. Teacher might think I'm texting" • "It's useful but I prefer typing because it will bother other classmates" (noise)
Preferences	*Personal choices or attributions (negative, positive or neutral) that students have made with the use of ASR in the classroom*	• "It's a good way but for me I don't like it. You have to say the word right and many times" • "It's helpful but I prefer to use Google translate" • "We (students) should use ASR only for speaking to the phone and finding the meaning." • "My problem is not getting the right pronunciation."

Evaluation criteria example

Hindrances

Under the evaluation criteria: hindrances, student comments revealed that "access" to ASR technology did not necessarily mean that having a mobile phone in their pockets with ASR capabilities was enough to successfully perform the task. While students who participated in this study had access to mobile phones with ASR technology, some of them could not use it conveniently due to technical difficulties and software malfunctions. Therefore, it hindered student learning. For example, Student A, who had an Android phone, didn't have the Google ASR assistant app downloaded and installed to their phone so they needed to download the ASR app from the Google Play Store. Student B from the Reading Level 7 class revealed that they had their first language (Norwegian) as the language of operation on the phone. Therefore, they

had difficulties in changing it to English. Student C from Level 7/8 Communication class had problems with activating Apple's voice assistant, Siri on their phone even after attempting to activate it several times. While all technical problems could not be fixed, some issues with technology could be resolved in the classroom itself. Regardless, a clear majority of students from both groups (Reading 6 and Communication 7/8) used ASR technology without any technical difficulties as such. A dominant theme among the hindrances of learning vocabulary via ASR was having to deal with pronunciation of the words in which made the learning process slow. Students felt that ASR was 'wasting time," since it couldn't understand their pronunciations of words and sentences in the first go. One student distinguished how typing can be faster than ASR. "When I have to search a word which I don't know how to pronounce I need to know the pronunciation to tell Google. Usually Google tells me that words meaning same time." This means that Google in this case gave quicker results to this students through typing or any other non ASR- based method to find the definition of the words. Likewise, the notion that ASR can be a quick way of finding word definitions was challenged by another student who said "If I don't know the words, it takes more time to use ASR." Repetition was another issue that many students talked about. Many students had to repeat the command "give me the definition of the word..." several times although they eventually got it right.

Students' comments also revealed that while ASR could not understand all the words they were uttering to their phones, some words were identified. For example a student wrote, "It clearly understand some definitions". Apart from pronunciation, one student indicated that not knowing word stress can be a problem. "For me identifying stress is important because I don't have word stress in my first language." Therefore, the student expected that ASR would give feedback on word stress. Not knowing pronunciation confused some students and hindered learning in a serious way. For example another student wrote "If you don't have a good pronunciation it can be really confusing." Thus, the majority of comments that hindered learning was connected to pronunciation issues. Evidently, after analyzing students' comments, it was clear that knowing the correct pronunciation was an essential factor of learning vocabulary through ASR for many students.

Another hindrance that discouraged students to use ASR in the classroom was the background noise from their peers who were taking part simultaneously in the study. Everybody was talking to their phones asking for definitions at the same time and it created a lot of background noise. This problem, quite interestingly, was only indicated by Level 6 Reading students' comments. According to Level 6 Reading students, they felt like they were disturbing

their peers by talking too loud to the phone. Therefore this problem appears to be context specific which is evident in the data.
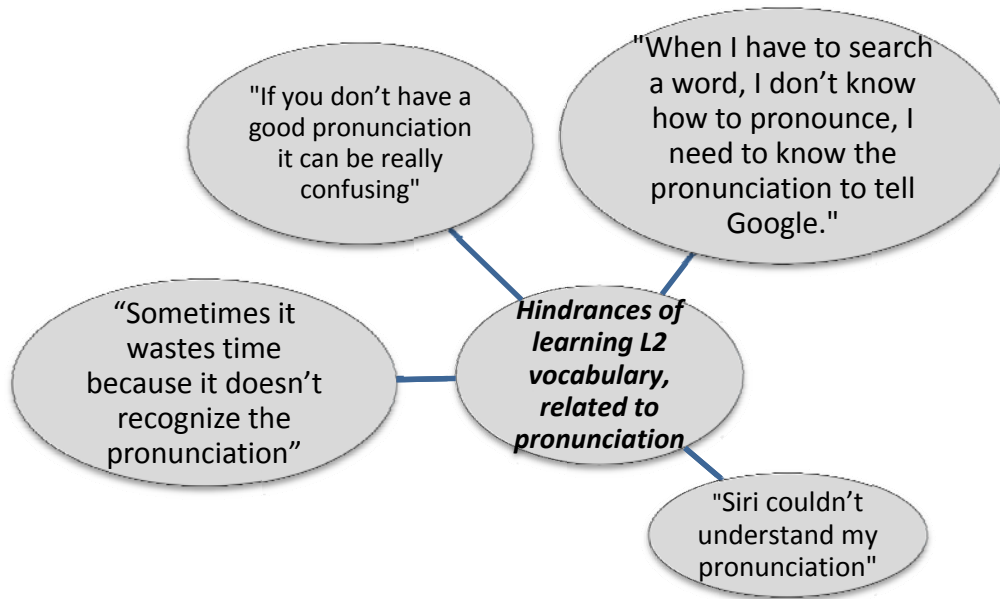

Figure 6 : Students' perceptions on how pronunciation can hinder vocabulary learning via ASR

Through researcher observations it was apparent that compared to Level 7/8 Communication classroom size, Level 6 Reading classroom size was much smaller. Additionally, Level 6 Reading students didn't have a lot of space in between seats with their peers. On the contrary, Level 7/8 Communication students had more space between the seats. This problem is more specifically addressed in the pedagogical implications section.

Advantages

The positive remarks that encouraged L2 vocabulary learning ASR (Advantages) included comments about ASR being convenient, exciting, fast and easier than typing words on the screen. For example Student C wrote "ASR is faster than typing" while another student wrote "ASR is a fast way to learn English. One of the objectives of the researcher and the teachers was to get students used to talking to their phones instead of typing instructions on the screen. Adding validation to this objective, several students recognized that using ASR could be a replacement for typing words on the screen. Some students recognized ASR as being an efficient way of learning pronunciation as

well as learning vocabulary. For example Student J wrote, "The advantages are that we can easily find the definition of words and easily pronounce and we can't get tired of writing and also our pronunciation gets better" These students' comments indicated that they would use ASR to improve their pronunciation. However, one student identified ASR as an effective way of finding "whether the pronunciation was correct or not." This comment quite interestingly corresponds with the findings of Neri et al.(2008). This student identified ASR as a way of troubleshooting pronunciation problems. The evidence from Derwing et al. (2000), Neri, Cucchiarini, & Strik (2003) and Neri, Cucchiarini, & Strik (2008) said that ASR is capable of finding serious pronunciation errors.
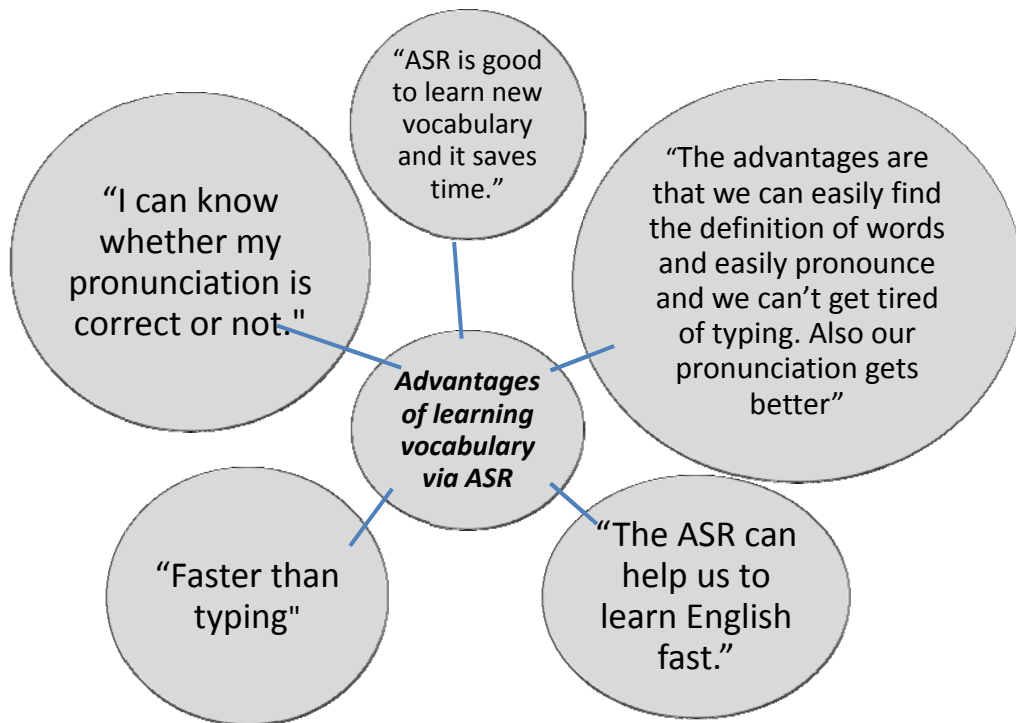
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Some students commented on their emotions while using ASR. They said that they felt "happy" while using ASR. Students also felt that it was a "fun" way of learning vocabulary. Thus the comments about emotions seem to be mostly happy. When it comes to teacher's approval for the use of ASR or a mobile phone in the classroom, many students felt that their teacher should be willing to use technology in the classroom. For example Student D wrote "I think the teacher should agree with using ASR in the classroom." Another student was impressed that mobile phones were used in the classroom. He wrote "Totally new. We were not allowed to use cell phones in my country for any reason."

n	to R	choice
...k the ...er should ...with using ...the ...oom" ...students) ...l use ASR ...or speaking ...phone and ...g the ...ing." ...ly new. We ...not allowed ...cell phones ...country for ...ason."	...'s definitely ...lpful and ...nvenient for ...dents. However ...will be ...nvenient to ...dy. Students ...ll get lazy ...cause they ...n't look for ...rds in context. ...ey will not look ...words by ...emselves." ...m not sure. ...acher might ...nk I'm texting" ...makes you ...pendent on your ...one"	"It's helpful. I prefer to use Google translate" "Personally I don't prefer using ASR. Instead I prefer seeing the word in a sentence and trying to figure out what it means." "I don't think it is helpful for me (for pronunciation) but for others it may be helpful to practice to say the words right."

Figure 8 : The variations of student preferences

When students learn for themselves they make individual choices on how they should or shouldn't use the technology. Under the evaluation criteria "Preferences", students' comments explained the choices they have made to use ASR or not use ASR in the classroom. For example, Student E preferred typing on the phone over talking to it because it was faster and easier. Some comments revealed that students have made clear choices to not use ASR due to preference for another technology (Google translate) which is a tool that helps them to translate words from their L1. There were also students who preferred not using the phone arguing that learning vocabulary through ASR can make them "dependent" on their phones and they will become "lazy". Some students refused to use ASR saying that the best way to learn vocabulary was to "put words in sentences and see whether it makes sense". The dominant theme that came out on the preferences was that students knew what they wanted from ASR the technology and knew whether it was affable for them was or not. Among students' preferences, each comment was analyzed carefully and

identified as whether it would be considered encouraging or discouraging to learn via ASR. Neither encouraging, nor discouraging stances which indicated their pure personal choices to use or not use ASR were indicated as "individual choice".

Teachers' Responses vs. Students' Responses

The teachers played a very important role in assisting the researcher and the students as it was mentioned before in the study. Using ASR for L2 vocabulary learning was a new experience for both teachers from Level 7/8 Communication and Reading 6. For example, the teacher from the Communication 7/8 mentioned in her conversation with the researcher that she felt apprehensive about using ASR in the first place because she had to let students work on their own. She thought that the students would underestimate her for not taking charge in the class. However, in her response to the questionnaire, she mentioned that she gained confidence by observing how students were taking control of their own learning process with ASR.

Both teachers wanted to incorporate ASR in their future lessons. They were open to the idea that ASR could be used for multiple purposes in addition to helping with vocabulary and pronunciation. For example, students could use ASR to practice asking questions, from Siri and Google voice. They could ask questions like "What is the tallest mountain in Japan?" Google voice assistant and Siri can answer these sorts of questions using the internet as a resource.

With regards to effectiveness of using ASR in the classroom, teachers observed that ASR was a "surprisingly effective" way of teaching pronunciation because students kept repeating and enunciating words until they got it right. Teachers also claimed that ASR could be used as a support tool to improve individual learning and pronunciation training because pronunciation activities are difficult to be taught as whole-class activities.
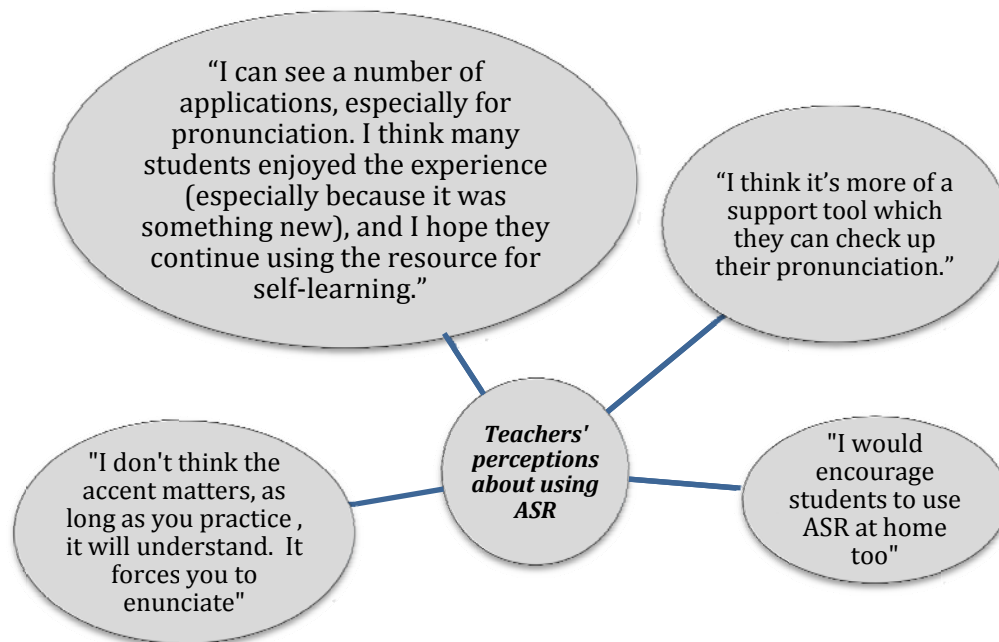
"I can see a number of applications, especially for pronunciation. I think many students enjoyed the experience (especially because it was something new), and I hope they continue using the resource for self-learning."

"I think it's more of a support tool which they can check up their pronunciation."

Teachers' perceptions about using ASR

"I don't think the accent matters, as long as you practice , it will understand. It forces you to enunciate"

"I would encourage students to use ASR at home too"

Figure 9 : Teachers' perceptions about ASR are largely based on pronunciation

Teacher from the Reading 6 class felt that the accent of the students' didn't really matter as long as they "pronounced the word correctly. "She felt that the students were "practicing pronunciation" by attempting to say words multiple times. As indicated above in the Hindrances section teachers' positive perceptions on pronunciation were not shared among the students in general. Many students felt that pronunciation was a hindrance to learn L2 vocabulary. Therefore, there was a contradiction between students' perception of ASR and teachers' opinions on how ASR can be useful.

According to both teachers and students, pronunciation plays an essential role in learning vocabulary via ASR unlike learning vocabulary through (reading) a dictionary. While teachers believed that ASR could be used to improve pronunciation, many students felt that pronunciation could become a hindrance to learning. According to Neri et al. (2008) ASR can understand mispronounced speech and give corrective feedback to its users on erroneous pronunciations. This partially supports the teachers' claim that ASR could help students learn pronunciation, given the fact that ASR can give instantaneous feedback to students when they have erroneous pronunciations. This means that many students were not aware that they were improving their pronunciation skills or they did not see the long terms benefits of repeating and

practicing their pronunciation with ASR. However, the lack of research that focused on learning L2 vocabulary through ASR adds to the dilemma whether erroneous feedback could really help students to overcome the pronunciation issue and focus on the vocabulary learning.

On the other hand, teachers were not able to communicate in detail what students were supposed to do in the activity. They saw that the students were improving with their pronunciation but could not convince the students that they were improving their pronunciation. The fact that ASR could help students to learn pronunciation as well as vocabulary could be seen as an advantage of the technology. The positive remarks by some students and teachers on ASR being a way of learning vocabulary along with pronunciation shows that ASR can be a multi-purpose or multi-dimensional way of learning language in the classroom and more studies need to be done on the subject. But with the scope of this research it is not possible to prove or provide any evidence to suggest that this claim is true. If pronunciation hindered learning vocabulary, or pronunciation alone became the most important factor of using ASR, the purpose of the study was not fulfilled because its primary intention was to find ways to learn vocabulary through ASR.

Pedagogical Implications

What teachers can learn from this study is one of the major achievements because it was designed to assist students in the classroom and this section discusses some of the ways to deal with problems that comes with using ASR. It also discusses some alternative ways that ASR can be used to encourage creative learning. A common accreditation that technology-based language learning methods always get is that they are capable of encouraging self-learning. However, one of the risks of encouraging self-learning through technology-based platforms is that the teacher's role in the class may be perceived to be not very important by the students given the fact that technology could take a good chunk of their attention. As a consequence teachers might feel that they are not in charge of the classroom or the lesson. After all, technologies like ASR cannot replace a teacher but only can help her to make lessons more efficient. Thus, teachers should keep in mind that ASR can only help students to learn. In addition, Ma and Kelly (2006) pointed out that learning vocabulary through CALL software could give too much freedom to choose what to learn and how to learn and students might feel quite lost. Since not all students learn the same way, some students may need personal assistance of teachers little more than others. If teachers are not sure whether they should conduct vocabulary learning lessons using

ASR, they should introduce it as a learning strategy or a troubleshooting device to use when individual students or groups of students struggle with vocabulary learning, pronunciation etc.

According to the results of the current study it is quite clear that the teachers need to define their objectives, on what they want to achieve i.e. pronunciation or vocabulary when they use ASR in the classroom. Students became frustrated with pronunciation because their objective was to find the correct word and put it in the blank. They were not prepared to deal with pronunciation. If they didn't know the pronunciation of the word, they couldn't find the definition. Arguably, this is why some students went on their own way by typing or using Google translate to find the definition. As a solution to this problem, teachers can break down their objectives and ask students to do activities step by step by setting goals for pronunciation and vocabulary separately.

The results also indicated that there were students who were not comfortable talking to their phones due to various reasons. One of them was the noise issue. Using several phones in the classroom at the same time could create a lot of noise. If teachers don't act carefully, this can become a serious hindrance for many students. Teachers could incorporate ASR based homework assignments, or group assignments. Maybe then the noise issue could be overcome. Students could also be encouraged to use headphones when they are using ASR. Teachers also should try to get the students into the habit of using ASR outside the classroom by assigning homework vocabulary exercises with the use of ASR or assigning group activities. At the end of the day when students make a habit to learn from ASR, they will continue to use ASR. Given the fact that ASR has proliferated the tech industry, it is certain that voice activated goods and services will be available in the market to be purchased, therefore getting students used to using ASR is a good investment on their education.

Teacher

"I think it's more of a support tool which they can check up their pronunciation."

"The best way to use ASR is probably pronunciation."

Student

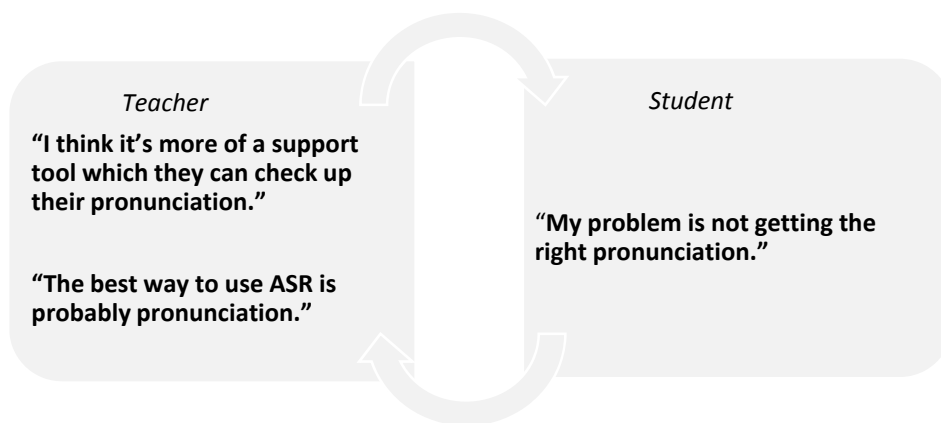"My problem is not getting the right pronunciation."

Figure 10 : There is a mismatch between students' perception and teachers' perceptions about learning pronunciation with ASR

Limitations of the Study

The shortcomings of this research design included that it could not track student progress given the limitations of time and resources. Without having any evidence on vocabulary acquisition, it was difficult to know whether ASR was making students remember the words that they were learning. Thus, this research should not be confused with vocabulary acquisition. It focused on creating a model that works for vocabulary learning. Nevertheless, it collected a wealth of data that pointed towards possible theories and hypotheses that can be tested in future studies. For example it would be interesting to do a study that tests whether ASR based methods help students to learn vocabulary.

In addition, the process of learning vocabulary through ASR discussed in this study was designed incrementally as giving a voice command at first, listening second, reading the definition on the screen third and so on. But it is not realistic to say that these things happen in order. Some steps may not take place at all. For example, students might not choose to listen to the vocal feedback from the voice assistant. Instead they might just look at the screen and read the word definition. This the incremental process of ASR- vocabulary learning offered in the study should not be interpreted literally.

Conclusion

ASR technology that is included in mobile phones, IPAs, tablets will get smarter and smarter everyday given the fact that there is strong corporate interest in making ASR built-in many tech products. ASR based devices are becoming accessible for more and more people. Therefore, using it for educational purposes is a very smart decision and an investment. Learning vocabulary through ASR can be a fast and efficient way. It is not necessary to type words on a screen or scroll through pages to find word definitions. Verbal commands can do the job. In this study, students got the opportunity to speak up and use give verbal commands to their phones demanding word definitions. However, many students struggled to get their pronunciation right and it hindered their L2 vocabulary learning.

On the contrary, teachers who participated in this study felt that ASR was a great way to teach word pronunciation which could give instant feedback to students and help them to enunciate words. But the majority of students' perceptions were different since they couldn't get done with vocabulary activity without knowing the correct pronunciation of the words. Therefore, teachers need to set goals and standards for students on what they expect from them and make sure that their main objective is met. Learning L2 vocabulary through ASR is a novel

idea. Therefore, more studies need to be done on this topic. This study hopefully can provide some insight to the topic and can encourage other researchers to try it in a different way.

Acknowledgement

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An Evaluation of the Current Status of Inclusive Education in Primary Schools in Vavuniya District in Sri Lanka

P. Vineathajini

Department of Special Education, National Institute of Education, Sri Lanka

Abstract

The aim of the study was to evaluate the implementation of the present state of Inclusive Education(IE) in primary schools in Sri Lanka. In this regard, school policy guidelines, funding & resources, teacher education seminars, accessibilities for curriculum/physical resources & support from administrators & parents to enhance inclusive education, and strength & weakness of inclusive education were assessed. The study was carried out based on the evaluation model of "Input-process-outcomes". The study used quantitative and qualitative data collection techniques. Data from 87 stakeholders using questionnaire, interview and observation were collected. Vavuniya South and Venkalachettikulam Education Division of Vavuniya South Education zone was the sample selected for the study. The findings showed that IE was not properly implemented in the schools. The main problems with IE implementation were the absence of an adequate number of trained teachers to handle the children with special education needs and the failure of teaching methods to be developed. Providing awareness about policy guidelines of IE, allocation of sufficient fund and resource, an effective primary teacher training program in the relation of IE, IE classroom teaching-learning activities were the suggestions. The stakeholders who benefit from this study are policy makers, teachers, principals, education officers, parents, students and representative of Government and Non-government organizations.

Keywords: Inclusive education, evaluation, primary education, policy guidelines, teacher education, accessibilities, school community

Introduction

Globally, education systems have changed tremendously in the last few decades, especially in educating younger children with special needs in regular mainstream schools has become an important goal in many countries. A huge development to include pupils with special needs in regular mainstream school settings instead of referring them to the special schools is best described with the term 'inclusion'.

The concept of Inclusive Education (IE) is an excellent opportunity for every nation and the policies related to this concept would be beneficial for children with special educational needs. Many internationally declared policies such as human rights, child rights, Education for All (EFA) and Salamanca Declaration have supported to achieve this concept. The aim of the idea of IE is to succeed the education for all to enhance the educational opportunities for children with special educational needs and to increase the school participation of children with special educational need. The Universal Declaration of Human Rights, ratified in 1948 by the United Nations, affirms that every individual has the right to get an education (United Nations, 1948). A cornerstone of the right to education concept is the fact that everyone has the right to access education without distinction of any kind, which includes racial, color, sex, language, religion, political opinions as well as any disabilities. Metcalfe (2001) holds that an inclusive classroom is an environment which emphasizes providing value to individual talents and skills amongst differences and facilitating embracement of individual differences, especially in learning requirements for academic success. Thus, the classroom environment itself should provide the necessary tools, the environment itself should be motivating and positive, and the classroom size should be sufficiently small. Some of the physical factors of a class could be wheelchair accessibility, widened doors and hallways, ramps to access upper floors, adjustment of height where equipment is placed, assistive devices such as computers and multimedia (Wadsworth & Knight, 1999). Florian and Kershner (2009) state that the objective of IE is to move away from the segregated teaching and learning systems with the focus of accepting differences among students as a prevailing party of human development. IE has been implemented in schools around the world, after the Salamanca Conference in 1992. Many nations have built their frameworks for inclusive education and have applied these with varying degrees of success. According to Hettiarachchi and Das (2014), the concept of inclusion remains a debated, contentious and complex concept among educators, professionals and governments worldwide. The lack of clarity of this concept is particularly severe in developing nations. In the present study the current situation of IE in Sri Lanka was evaluated.

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Literature Review

IE is relatively new to some countries like Singapore. Yeo, Chong, Neihart, and Huan, (2014) presented the nature of IE from Singaporean educators' perspective. As their research shows, a large number of Singaporean teachers indicated that only children with minor disabilities should be included in the mainstream educational system.

The United States has been at the forefront of enforcing equal rights to educational opportunities. One of the key laws in the USA is the Individuals with Disabilities Improvement Act (IDEA) and No Child Left Behind (NCLB) Act, which make it mandatory for school administrators and officials to ensure students with disabilities are treated equally as everyone else (Vasquez, 2010). China adopts a model known as Learning in Regular Classrooms (LRC) to respond to the need of IE in the country (Ministry of Education of China, 1994, cited in Ministry of Education in Beijing, 2006).

In Sri Lanka, where the research is primarily focused, special education has a lengthy history. The Sri Lankan Government started nationalizing private and religious schools in the 1960s. In 1964, the first school for physically and mentally challenged children was established. By 1965, there were ten such schools in Sri Lanka, but these schools primarily focused on educating the visually or hearing impaired (Matthews et al., 1977, cited in UNICEF, 2003).

According to a UNICEF study (2003), some of the key issues faced in IE in Sri Lanka were access to education, gender issues, skepticism, not accepting IE in practice and lack of resources. Many Sri Lankan schools, although in agreement in principle about IE, tend to set up special units to regular schools with special teachers. However, that goes against the philosophy of IE, as noted by the UNICEF (2003) report. On a positive side, the National Institute of Education (NIE) Sri Lanka has taken leadership in developing educator training programs to discard myths among educators themselves on inclusion.

A study by Hettiarachchi and Das (2014) aimed at determining the level of perception of competence amongst teachers in special education in Sri Lanka and also to determine the amount of teachers' knowledge and competence in dealing with IE. The research population was teachers of the Western and Northern provinces of Sri Lanka. The research results indicated a high standard of competency in IE but the participants in the study all agreed that there was a lack of knowledge in supporting children with special needs. Sri Lankan studies, such as Furta (2006) stated, during 1960-1980 the Sri Lankan Government and foreign aid organizations have

taken many steps for disabled children but there is no any statistically significant evidence about the progress of these children.

All conventions emphasized that all children should be given the equal opportunity of education, so Sri Lanka emphasized this stand in level policy documents but the reality it seems is different. The main reason could be the lack of training for teachers or lack of emphasis on the learning activities for children with special education needs (SEN). In the curriculum also, the lack of accessibility and awareness on IE is apparent (Lopez, 1999; Furta, 2006; Hettiarachchi & Das, 2014).

There are few studies conducted in Sri Lanka on the theme of IE in identifying special education related issues in Sri Lanka especially provincial wise practices are not studied in depth creating a knowledge gap on IE. Therefore, the present research evaluates the current status of implementation of IE in primary schools with the guideline to set legal and operational frameworks at regional and national level. From the research the above knowledge gap can be filled with regard to a specific district in Sri Lanka.

Educational and Related Issues in Vavuniya District, Sri Lanka

Sri Lanka comprised of 25 districts and the district of Vavunuya was part of the core of the 30-year ethnic conflict in Sri Lanka. The district remained disconnected from the rest of the country for over a decade during the conflict and was deprived of many facilities and development enjoyed by the rest of the country (Kelegama, 2011). Due to the conflict, a significant amount of infrastructure and assets were destroyed. The population was displaced, and livelihood of the population was negatively impacted.

Therefore, the main focus of the present study is to gather relevant data to create scientific evidence base, primarily on reconciliation of the school curricula, rehabilitation of ex-child combatants, creating infrastructure such as buildings and laboratories, assigning teaching resources and providing basic psychological support to the students.

There are few studies conducted in Sri Lanka as part of a much wider study or as part of identifying special education- related issues in the country. Further, due to the conflict in the Northern Province of Sri Lanka, nearly all studies conducted in the country related to education have almost always omitted this province.

It has been merely five years since the end of the civil conflict, which lasted 30 years and the focus has been on studying the infrastructure development and rebuilding rather than on studying the success or failure of inclusion.

Objectives of the study

The aim of this research was to evaluate the current status of implementing IE at the Primary school level in Sri Lanka and in this regard, the factors such as school policy guidelines, funding and resource, teacher-training, administration and strengths and weakness of implementation were studied.

Theoretical framework and Model

For the current research was chosen as its theoretical framework, beliefs and behaviors related to "Theory of planned behavior" which was used to measure the belief and behaviors in Sri Lankan educational administrators, principals, teachers, and parents. This theory was developed by IcekAjzen in 1954. Later on martin Fishbein and IcekAjzen jointly improved this theory.

According to Ajzen (2011), the theory of planned behavior deals with attitudes to general concepts regarding situations, policies, racial as well as other groups and other objectives. Furthermore, he has suggested two types of attitudes; these are general attitudes toward behavior and attitude toward performance.

The present research can apply the above theory and asses the status of implementation of IE in primary schools through the administrators, principals, primary teachers, and parent's general attitudes and attitudes toward the performance of IE in the context of the school.

As well as Input, process and outcome model suggested by Kyriazopoulouand Weber (2009) was relevant for the IE. It has two key results: firstly, the development and implementation of a bottom-up approach to identify relevant indicators based on the consensus of experts from a Agency member countries.Secondly, an initial set of indicators in this field with indications on how to make them measurable (Kyriazopoulou, & Weber, 2009).

Later on, in 2013, Loreman adapted the above model for measuring IE inAlberta (Canada). According to Loreman (2013), Kyriazopulou and Weber recommended examining each area of the model on three different levels: micro, meso, and macro.

Based on the adapted model, Loreman (2013) includes some criteria and themes related to his study regarding input, process and outcome model and three levels. Figure 1 shows the Loreman adapted model with details.
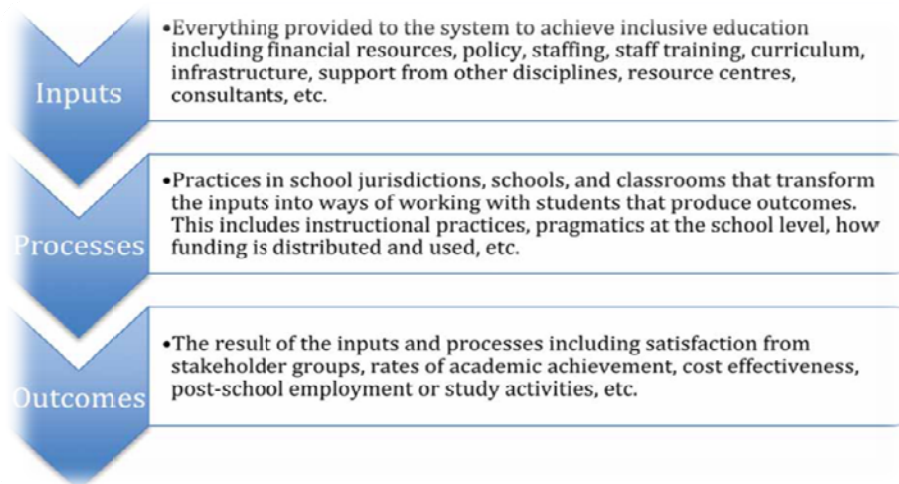

- **Inputs**: Everything provided to the system to achieve inclusive education including financial resources, policy, staffing, staff training, curriculum, infrastructure, support from other disciplines, resource centres, consultants, etc.

- **Processes**: Practices in school jurisdictions, schools, and classrooms that transform the inputs into ways of working with students that produce outcomes. This includes instructional practices, pragmatics at the school level, how funding is distributed and used, etc.

- **Outcomes**: The result of the inputs and processes including satisfaction from stakeholder groups, rates of academic achievement, cost effectiveness, post-school employment or study activities, etc.

Figure 1: The inputs-processes-outcomes model based on
Kyriazopoulou and Weber(2009) adapted Loreman (2013)

Accordingly in the present study, based on the above three main themes, the current status of implementation of IE in Sri Lankan primary schools was evaluated. In the input evaluation, the school policy, financial resource, the opportunities for IE teacher training, infrastructure (accessibilities), relevant curriculum and support receive from administers; parents were studied. Based on these themes a questionnaire was developed to achieve the objective of the research with regard to input evaluation. In the process stage, the way of practices, as well as the challenges in the school/ classroom context were identified through the interviews with the stakeholders (principal, administrators, parents and teachers) and questionnaire was used to collect data from primary education teachers.

In the outcome stage, input and process were compared, and finally, the strength and weakness of implementation of IE were identified.

The reason for choosing the model was that this model was used for measuring an IE. Similarly, the research was evaluated the implementation of IE in primary schools in Sri Lanka through the stakeholders' opinions based on the theory of planned behavior. Furthermore, it will apply to the Sri Lankan school IE classroom context.

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Methodology

The research design employed for the research was mixed mode (Creswell, 2012).For sampling, the study employed the stratified random technique. As a thumb of rule, 10% (percentage) of the population is sufficient to represent it. "a good maximum sample size is usually around 10% of the population as this does not exceed 1000" (Practical tools for international development, 2016, p. 1). Which idea has been justified by (Gall, Borg & Gall 1996) too. Therefore, 12 schools were selected out of 86schools which were included in all type of schools in the two education divisions from Vavuniya South Education zone.

The population covered all type of schools in the two education divisions from Vavuniya South Education zone (Table 1)

Table 1: Selection of stakeholders from Vavuniya South Zonal Education (Two divisions)

School type	Total no. of schools	Selected no. of schools	Selected no. of Principals	Selected no. of Teachers	Selected no. of Parents
1 AB	6	1	1	5	1
1 C	12	2	2	10	2
TYPE – 2	24	3	3	15	3
TYPE – 3	44	6	6	30	6
Total	86	12	12	60	12

12 observations (one from each classroom at each school) were conducted during the second term of the school year 2015. The researcher visited the school and got the permission from the school principal for observation. Researcher sat at the back of the classroom in a way easier to observe the important events taking place during the lesson. The notes were taken and the classroom was audio recorded on the same day. Recording was heard and the gaps were filled. Then the classroom notes were analyzed qualitatively.

As well as the Primary education, special education directors and in-service advisors (ISA) were chosen from the Northern Province and Vavuniya South education zone who have represented the sample of this study. Table 2 shows the summary of stakeholders and type of data collection instrument in the study.

Table 2: Type of instrument for data collection

Stakeholders	Total number of Sample	Type of instrument
Primary education teachers	60	Questionnaire
Principal	12	Interview
Administrators	04	Interview
Parents	12	Interview
Teachers	10	Interview
School/Classroom	12	Observation

After the validity and reliability process, the researchers got the permission from the Provincial Educational Director, the Zonal Education Director and the school principal through writing a letter mentioning the purpose of the study. When permission granted, an appointment was made with the school principal and teachers. Following these procedures, the data collections were started from selected stakeholders.

Quantitative and qualitative techniques for analyzing data were followed. Quantitative techniques of frequency, percentages and means were used to analyze the data collected from selected stakeholders (administrators, principals, primary teachers, and parents) descriptively. Salkind (2014) emphasized that "descriptive statistics are used to organize and describe the characteristics of a collection of data" (p.8). The Statistical software (SPSS version 16.0) was used to find out frequencies, percentages and means and interpreted by using graph charts. Qualitative techniques were used for coding and categorizing the data collected from the interviews. The data were analyzed to identify specific themes. All data were analyzed based on the Input-process and outcome evaluation model of IE. Thus, the quantitative and qualitative data were tallied with each other's responses and triangulated.

The Results

General Information of stakeholders

The following table shows that 50% of the sample represented in Vavuniya education division while other 50% represented Vengalachchittikulam division.

Table 3: Stakeholdersbackground information

No	Item	Percentage
Education division	Vavuniya education division	50%
	Vengalachchittikulam division	50%
Gender	Male	10%
	Female	90 %
Education qualification	G.C .E. A. L	81.7 %
	G.C .E. A. L	18.3 %
Professional qualification	Teacher trained	66.7 %
	Diploma in Education	16.7%
	Bachelor degrees	15%
	Postgraduate Diploma in Education.	1.7%
	One year experience in teaching	3.3%
Teaching experiences	Between 1-5 years experiences in teaching	23.3%
	Between 6-10 years experiences in teaching	21.7 %
	Between 11-15	16.7 %
	More than 15 years' experience in teaching.	35%

It is noteworthy to mention that 90 % of the samples were female and only 10 % of them were male. Furthermore, 81.7% of the sample had G.C.E. (A.L), 18.3% of the sample had basic degrees. The following percentages emphasized the professional qualification of the sample. Of all, 66.7 % of the samples were trained teachers, 16.7% of the teachers had Diploma in Education, 15% of them had a Bachelor's degree and 1.7% of the sample had a postgraduate Diploma in Education.

Policy guidelines to promote Inclusive education

Overall, the first theme of the study was awareness of policy guidelines that are requested for the enhancement of IE. According to interviews, half of the principals were not aware of the policy guidelines that are required for the improvement of IE. However, it was revealed that 10% of the teachers were aware of it. It means the lowest mean value (2.31) indicating that teachers agreeing in implementation of IE in their schools. At the same time, interview with primary teachers showed that they had gained enough awareness of the policy guidelines regarding the implementation of IE, but they don't have a chance to follow this program in their school.

Both in-service advisors of the sample were conscious of policy guidelines. However, the zonal education director stated that, as she was newly appointed, she has got only a basic understanding.   Eleven parents are totally unaware of those policies.

By observing the academic behaviors of the principals and the primary teachers of one of the 1AB schools, it was clearly seen that they have no idea about IE. However, when they were made aware, they responded positively and agreed to the principle guidelines about IE.

In developing nations, such as Kenya, there were policies in place as well as some learning resources for inclusion of differently-abled students. The policies are mostly at a high-level rather than at an operational level. For example, policies may be in place, but procedures were not (Buhere & Ochieng, 2013). When the question was raised whether school performance was according to the policy guidelines, all the principals answered that not all the guidelines was implemented, but some of them were, but 5.0% teachers replied that they were implemented, and further 61.7% (mean value 3.68) stated that this is a right of students with special educational needs (SEN), to be in the normal classroom. Most of them were very much appreciated the policy regarding implementation of IE. However, through the qualitative outcome, data could be sum up as each one had different idea and opinion about Policy guideline of IE. On the whole, it was revealed that the policy guidelines were not successfully implemented at present owing to multiple issues.

Teacher Education Programs and Inclusive Education

When the mean values for the each item on 'teacher education training programs to promote IE' were calculated item on 'I received knowledge and practices of IE through the

National Institute of Education teacher training program' was got the highest mean value indicating the success of NIE intervention on IE education.

The items on 'Each and every teacher training program should include the concept of IE' and ' I am always concerned about the active participation of all the children in the teaching - learning activities for all children' had the second and third places based on the mean values. Although the national level contribution to the teacher development is high, the provincial level contribution is low according to the teachers' response to the item (mean value was 2.77). When compared with the NIE, MoE contribution is low but its contribution is higher (3.05) than provincial level contribution (2.77) on teacher training on IE. As a whole more opportunity to participate adequate teacher training seminars on IE should be provided by NIE, MoE, provincial and zonal level authorities.

Overall, the data analysis showed that in every teacher education program, should include IE throughout the Province, MoE, and NIE level. Only 23.4 % (Mean value was 3.15) of the teachers were of the favorable opinion that they had an opportunity to participate in a seminar on IE. There was a small number of training programs for principals regarding IE.

It was seen during classroom observations that the knowledge given by teacher education training was insufficient and not useful to provide knowledge and experience to enhance IE. Even though both in-service advisors accepted that the funds allocated for IE are sufficient, they stated that they are not satisfied with the teacher education, special teaching aids and providing fundamental needs for IE.

Mwanza (2010) in Zambia and Najjingo (2004) in Uganda, stated that the key problems which they faced are: the lack of knowledge of professionals and the community, lack of teacher education, conflicts amongst specially trained teachers and regular teachers.

Totally, the idea got which collected by different tools, illustrated the similar opinions which had exposed the importance of IE teacher education program and the weakness in implementing IE in Vavuniya South.

Funding and Resource to Promote Inclusive Education

Regarding the classroom activities, lower degrees of mean value 1.97 (13.3%) of the teachers, fund the allocated budget, adequate. Allocating physical resources (2.85) and human resources (2.67) are sufficient but based on the equity policy, children with SEN are not receiving adequate support from the government (2.87). Overall, they indicated that allocated

funds were adequate for their inclusive classroom, but the resources (physical and human) was not.

Considering funding and resource, many principals stated that the allocated budget for IE was not sufficient. There was a principal who expressed the idea that "There are not adequate funds allocated for promoting IE in Sri Lanka" (P4).

The idea of the in-service advisers and the director was that all the human resources and funds were given to promote IE. By contrast, many principals expressed that inadequacy of the funds was the big issue.

The director stated that the resources from NGOs could be used to enhance IE. Moreover, she said that human resources, tables, chairs and Braille slides were also received from NGOs. It was seen in school observations that, though there were facilities for the implementation of the function of IE in 1AB schools, in 1, 2 and 3 type schools the physical and human resources were poor. One of the most significant inputs for the implementation of IE is funds and resources. However research revealed that the funds and resources were not sufficient for this purpose.

According to adopted model of input-process-outcome, one of the most significant inputs for the implementation of IE were funds and resources it was revealed from the present research that the funds and resources were not sufficient for the implementation of IE. It is the idea of the majority of the stakeholders.

Physical Accessibilities

Regarding utilizing the physical resources, mean values of the teachers' responses for each item according to their responses for supporting physical accessibilities to promote IE were calculated to assess the teacher ideas on the theme. Accordingly although 'all children of schools have easy access to the toilet and water facilities' and in classroom environment (mean values3.6), all children can be mobilized to achieve their learning needs' (mean values 3.28), specific facilities related to IE are not available at classrooms and school. Principals (P1, P9, and P11) stated that the physical resources were useful to enhance the IE in their schools. At the same time, only 18.3% of the teachers have agreed to make use of the physical resources in enhancing the IE. Regarding facilities they stated that general needs and physical facilities are sufficient, in fact, they are were enough to enhance IE in school.

In-Service advisers include that the physical facilities are provided, and toilets, water, classroom space are given consideration, and the planning is done to start a project to make requests for providing necessary facilities such as toilets, water, classroom, tables from the Ministry of Education. Responses received from the interview conducted with the selected primary teachers are thus, teachers T1, T2, T5, T6 and T 9 stated that their schools have only limited space in each classroom to conduct the IE.

Director of education (zone) stated that "It is tough to obtain special equipment for IE. The most problematic area, according to NEREC (2013) was the lack of human and physical resources. School principals faced some issues such as lack of teachers, poor attendance of teachers and lack of advisors even for mainstream students. As a result, they were unable to give adequate focus to the children with special needs.

Totally, Physical accessibilities are necessary for achieving the successful implementation of IE. This was another significant input in the adopted input-process-outcome Model for the implementation of IE. As above mentioned qualitative data analysis even quantitative data analysis also exposed the fact that the insufficient of the physical accessibilities for the implementation of IE.

Curriculum to Promote Inclusive Education

According to mean value calculation, majority of teachers are negative towards the special instructions for the children with special educational needs in the curriculum preparation for the children with SEN (mean values2.65) and on the inclusion of special teaching strategies applicable to all the children (mean values2.97). As similar matters, flexible curriculum and instruction manual were also identified through the interview. Many of the parents stated it was not a flexible curriculum for work with their children. The interview response from a primary teacher (T6) is thus. "Current curriculum needs to be flexible for the special need children".

About the adaptability of the curriculum in teaching all children, 60% of the teachers have agreed, and only 10% had disagreed with the statement. Totally, as qualitative data regarding the curriculum; quantitative data is also revealed the similar problem. As above mentioned reasons, teachers are unable to match the normal teachers' guide according to the requirements of the students with SEN.

Principal and School Staff Support to Promote Inclusive Education

When the mean values were analyzed for each item of the theme 'supporting from school principal and school staff to promote IE', all the items had mean values higher than 3.5 indicating school principal and other teachers are positive towards the IE education. The highest positive statement was 'The school principal agreed to enroll all children including children with special educational needs without any restriction' (mean values 3.77) indicating the management level attitudes towards the IE.

The following responses were received from the principals regarding the reasons for not receiving the support from the teachers for the function of IE in their school.

- Some teachers were not aware of IE. It was the idea of the eight (P3, P5, P6, P7, P8, P9, P11, P12) of the principals.

- One principal stated that the reason for not receiving support from provincial level is, due to "not maintaining good rapport with the provincial education office".

Furthermore, many of them indicated that the in- service advisers are given instruction at the administrative level, and four of them said that it is not sufficient. Another four of them stated that the directors take action to provide financial support, and four indicated that they offer teacher training.

Overall, it was revealed from quantitative data that teachers were satisfied with their principals' support for the implementation of IE. However, qualitative data showed that the principals were unsatisfied with their teachers' activities for the improvement of IE.

Support Received from Provincial Level / Zonal Level

Mean values on the four items related to support from provincial level/Zonal level clearly indicate the perception of teachers on the support from provincial level/Zonal level for the IE at school level. Accordingly primary education-in service advisor and special education in service advisors in are too agrees with the statements related to the support from provincial level/Zonal level.

When the interviewer found out the fact under the theme of the support given by the staff of the school from provincial level & zonal educational level, the principals' responses were as follows;

- Some teachers give support as ten principals have stated.

- Three principals expressed that some teachers do not have knowledge about IE

- Three principals stated that the zone gave support

- Four principals stated that support provided by provincial level was low

- Support is not given; stated another four of them

Five Principals mentioned the reasons for receiving or not receiving zonal & provincial level support in the following way. Lack of connection with the provincial office as they are situated far away, substantial connection with the zonal office as they are located near the school were the idea of four principals (P3, P4, P6, P8). Three principals (P1, P2, P5) stated that they are unaware of it. Slightly more than half of the teachers (56.7%) stated that the instructions are given to implement IE, and they are motivated.55% have said that the special education officers provide directions and motivate teachers.

According to the data, the conclusion could be thus, according to the interview it is revealed that the support gets from zonal level is satisfied than the provincial level. While the survey revealed that the teachers were pleased with the assistance of principals.

Parents' Supports

According to the mean values of perceptions of teachers, parents should agree with the concept of IE (mean value 4.1) and their participation is necessary to implement the IE for the better implementation of IE at school level (mean value 4.23). However their support is not at the level as expected (mean value 3.28).

All the parents stated that there's a good relationship with parents of the students with SEN. Almost all the parents believe that the principals help while giving guidance to teachers to enhance IE. Ten principals stated that the parents provide support to enhance IE. Wong, Poon, Kaur and Ng (2014) studied the parental perception IE in schools in Singapore. One of the major concerns of Singaporean parents was the worry whether their children will emerge as productive members of society after completing their education.

Overall, it was revealed that supporting by the school society (Principals, ISAs, and Directors) and community (parents) are another least significant input for implementation of IE.

Findings, Conclusions and Suggestion

Average of the people in the Education Field do not possess a deep understanding of the policy guidelines that is meant to uplift IE. 03 teachers and in-service advisors have identified IE as teaching in a special education unit who was trained in special education. On the other hand, parents do not have an awareness of it at all. Therefore, it can be suggested that it is necessary to provide proper teacher education and provide the opportunity to acquire knowledge about policy guidelines and awareness to develop the concept of IE through responsible institutes such MoE and NIE.

According to the findings, people in the education field are not satisfied with the resources and funds allocated for the implementation of IE. Thus, the Government has to allocate necessary funds and resources to implement IE effectively, at school levels specially trained teachers in IE have to be appointed to handle the student with SEN.

The parents have positive attitudes regarding the teachers and administers towards of IE. However, parents do not have proper knowledge of policy guidelines related to IE. Even though parents give support to implement IE at school, there is a lack of support at the provincial and zonal level.

There were obstacles in implementing the Inclusive education in schools, i.e., lack of infrastructure and special teaching materials. In functioning IE, space in the classrooms was not sufficient, and it was tough to obtain special equipment for the students with special needs.

All the people in the education field hold the view that it was very difficult to implement the syllabus of IE in the classroom as it was designed for normal students and there are no special instructions given in the teacher's guide. Thus, it could be suggested, that as every child has individual needs and individual attention, they need special curricula or adaptation of curricula to suit the child with special needs.

Overall, it can be suggested that the stakeholders of special education are the education policy makers, Teachers, Principals, Education Officers, Parents, Students, representative of Government and Non-government organizations. etc. Apart from these, MoE, NIE, Teacher Training College, Ministry of Social Services, Ministry of Health Children's Authority stand behind the children with SEN for the right practices of IE.

Recommendations and Future Directions for Research

The study recommends that provide sufficient of awareness program related to policy guidelines of IE, the government has to consider allocating adequate funding and resources for

implementing IE, increase the primary level teacher training program in IE with adequate IE classroom teaching-learning activities, accommodate the accessibilities for implementing the IE, necessary actions have to be taken to provide sufficient knowledge instruction about the equipment for implementing of IE.

This study was designed as a mixed method located within specific context in Sri Lanka, therefore limiting the generalizability of the finding to the other contexts. As well as the present study was conducted at the primary school level and it also needs to be evaluated in the higher education levels.

Further research studies are necessary in the following areas such as, achievement level of SEN children in regular classrooms, suitable curriculum for SEN children, situational analysis of attitudes, effectiveness of teacher education program to enhance IE policy and practices, and Situation analysis of monitoring & supervision of IE at the national level.

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