BITE-SIZED TEACHING STRATEGY: EFFECTIVENESS FOR STUDENTS ENGAGEMENT AT SECONDARY LEVEL

BY

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THESIS AND DEFENSE APPROVAL FORM

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Candidate of **Master of Philosophy** at the National University of Modern Languages do hereby declare that the thesis **"Bite-Sized Teaching Strategy: Effectiveness for Students Engagement at Secondary Level"** submitted by me in partial fulfillment of MPhil degree, is my original work, and has not been submitted or published earlier. I also solemnly declare that it shall not, in future, be submitted by me for obtaining any other degree from this or any other university or institution.

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ABSTRACT

Title: Bite-Sized Teaching Strategy: Effectiveness for Students Engagement at Secondary Level

The objectives of the study were: to explore the practice of bite-sized teaching strategy, to measure the level of students' engagement and to find out the effect of bite-sized teaching strategy for student engagement at secondary level. The conceptual framework of the study was based on two models. Bite-sized teaching strategy model by Manning et al. (2021), having four components (Learning unit, relevant content, refined delivery, and peer teaching). While student engagement model by Wang et al. (2016) was consisted of four sections (behavioral, emotional, cognitive, and social). The researcher used the quantitative approach, Correlational design was followed in this research study. Population was based on 2855 science students enrolled (Session 2021) at 26 Secondary schools of Islamabad. Proportionate stratified sampling technique was used. The sample was consisted of 13% of the entire population, which was 386 students (Urban I=179, Urban II=207). The researcher used two sets of adapted close ended questionnaires. The reliability of Bite-Sized Teaching Strategy Scale was .96 and reliability of Student Engagement Scale was .95. Total 386 questionnaires were distributed by the researcher and 363 questionnaires were returned. Thus, rate of return was 94%. Thus, the results were interpreted, and recommendation were suggested. The study results showed that means values were neutral about bite-sized teaching strategy. Which mean that respondents were undecided about their practices at secondary level. Result also showed that majority 59.2% average level of student engagement. It was revealed that there was significant effect of bite-sized teaching strategy for students' engagement at secondary level. It is recommended that teachers need to enhance bite-sized teaching strategy in a better way by allowing students to use digital content, participate in activities and timely feedback and to improve students engagement teacher may provide healthy competitive environment like different type of quizzes competitions, discussions, brain breaks activity and project work. . It is recommended that teachers may split up detailed learning material into smaller topics which help students in focusing and concentrating on single learning objective.

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LIST OF ABBREVIATIONS

ACER	Australian Council of Educational Research
ASE	Auckland Student Engagement
BITE	Bite-sized Information for Teaching
BSAT	Biology Students Achievement Test
BSL	Bite-sized Learning
BST	Bite-sized Teaching
BSTSS	Bite-sized Teaching Strategy Scale
FDE	Federal Directorate of Education
HOTS	Higher Order Thinking Skills
HSW	How Science Work
ICT	Information Communication Technology
MLSM	Microteaching Lesson Study Model
PRS	Personal Response Systems
SDT	Self Determination Theory
SEM	Student Engagement Model
SES	Student Engagement Scale
SPSS	Statistical Product and Service Solution
SRES	Student-Report Engagement Scale
STEM	Science Technology Engineering and Mathematics

LIST OF APPENDICES

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Kainaat Khan

DEDICATION

This research thesis work is dedicated to my beloved, supporting and hardworking Father and Mother for their patience, endless support, and encouragement.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Educational institutions are developed for the transmission of knowledge from one generation to another. Although over time new teaching methods or strategies were introduced according to the mental level of the learners aiming at the active participation of the students in the classrooms. The teaching profession is highly effective and important, just like many other professions. Today teaching also needs new strategies, skills, techniques, methods, etc. for effective teaching. Additionally, the responsibilities of teachers are also increased to fulfil students' social needs and economic demands. It sets the base for the development and improvement of the teaching-learning process. The use of technology makes educational institutions more effective and productive by facilitating the process of teaching and learning (Akpan & Itighise, 2019). Additionally, in this era, the use of technology in every occupation is not a lie, especially its use in education to facilitate the process of teaching and learning. It is also particularly important to know how teachers and students perceive its use in the classroom for improving the teaching process. The demands of the 21st century such as the use of Information communication technology and life-learning skills call for a change in the teaching-learning process. Still enhancing 21st century skills is considered as much needed strategy in this era to sustain our educational standards.

Digital lifestyles and instant communication technologies have changed day to day in the 21st century, so students would gain opportunities to become energetic learners. Having such a very professional approach towards learning. Thus, the teaching method needs to be reconstructed to bring advancement. Moreover, 21st century skills are also known as innovative teaching strategies. It has been noted that 21st century skills indulged learners in the thinking process to understand the concepts to be more productive.

Now the teaching methods are expected to shift from traditional teaching to the bite-sized teaching (BST) strategy while the modern age demands active approaches to manage the classrooms effectively. These active approaches involve the students which may lead to more active participation and uniqueness in the learning process. To present traditional concepts in a unique and new way in front of the students is known as a bite-sized teaching strategy.

A recent study has noted that given retention of knowledge of students which are declined after ten minutes in a traditional lecture (Bradbury, 2016). However, in every lecture at the beginning and the end, retention is the highest material. Short, focused material has been recognized as an effective target to improve student satisfaction and knowledge retention (Sawatsky et al., 2015).

Bite-sized learning and micro learning are interrelated with each other. Both terms mean dividing the information and knowledge into chunks and pieces, in other words, detailed learning material now present in short meaningful pieces, helps students to understand and

memorize learning subjects for a lengthy period. It helps the learner's mind remarkable ability to retain and recall their knowledge by using a bite-sized teaching approach in a traditional classroom. Bhaduri (2016) defined that 'bite-sized' is the right size to provide an interactive and meaningful learning environment where students think critically as well as participate in-class activities.

The bite-size teaching strategy in a traditional classroom in which the participation of students is more active and effective in the learning process. Such a method of teaching focuses on a theoretical approach as well as on practical implementation. Additionally, it helps students to effectively collaborate and communicate in the teaching and learning process.

Teachers' engage students in the classroom through modern technologies which helps to balance the instructional process which is an essential effort. To change the patterns of student engagement with learning, alternative teaching strategy helps like effective educational practices of bite-size teaching strategy in a traditional classroom. It is also important to know how students learned through Bite-sized teaching strategy. Similarly, when Cates, Barron, and Ruddiman (2017) found that the effectiveness of "micro-learning" focused on non-language learning. Moreover, it was found that relationship between information retention and the physical location of the study session but a Bite-sized teaching strategy for science teaching is important and fertile in such a subject, students must be seeing things more creatively and critically. Sarker et al., (2019) also explained that by using technology-based innovative teaching methods teachers can develop the minds of the students in a way that they can think critically and solve problems

simultaneously. It is simple and easy to deliver a lecture on various issues to a large group of students.

Among various fields of educational psychology, one of the most important study fields is students' engagement in the classroom or at the campus level. Student engagement has no single universally accepted definition; it can be in the form of access and attendance, emotional engagement, or overall course engagement. Some people thought that engagement is just being active in a task but it is more than that. Instead of only being active in a task student's feelings related to the task and their willingness to do a task are also a part of student's engagement (Pachler, Kuonath & Frey, 2019).

Student engagement indicates the level of participation in learning tasks and how well their participation can improve their learning. Different researches indicated that students' learning can enhance when they get engaged in class (Goss & Sonnemenn, 2017). Disengaged students usually face boredom because they do not complete their home works, pay less attention to lectures, and are less participative in extra-curricular activities. In the end disengaged students preferred to leave the schools because they feel classroom activities are boring (Fredricks et al., 2019). Furthermore, most of the students do not get engaged within the class and do not pay attention to what their teacher told them. Lack of engagement leads towards less concept clarity and understanding of students and it force students to rote memorize the concept. When a student rote memorizes a concept he/she will not be able to apply that concept in a new situation. That is why it is necessary to engage the students in the classroom by utilizing various teaching methods that involve students' active participation.

Student engagement is considered as a multi-dimensional term, classroom engagement of students and campus engagement of students' are considered as major two dimensions of students' engagement (Gunuc & Kuzu, 2015).

The term campus engagement indicates that to what extent students are obeying campus rules, participating in various activities held at the campus, and how much they are emotionally attached to their educational institute (Lau, Garza & Garcia, 2019). Furthermore, cognitive engagement, emotional engagement, and behavioral engagement are important components of classroom engagement (Gunuc & Kuzu, 2015). The most important component of class engagement is cognitive engagement which includes how well a student is contributing in his learning and to what extent he is giving value to the learning needs, learning goals, and how he plans to achieve those goals (Ben-Eliyahu et al., 2018). Whereas, emotional engagement includes feelings, attitude, and interest of students towards learning and their responses towards teachers, peers, and overall course content. Traditional teaching methods are less engaging for students in contrary to this, modern teaching methods support the active participation of students within class and learning activities. Students' participation in classroom activities not only increases their learning to create an environment of learning by doing and improves their grades but also socially engages and motivates them. This statement could be proved by the following research findings mentioned afterward. Student engagement or involvement encourages the student's interaction and participation in learning activities in a better way which helps students in learning and their professional progress. In addition to this, behavioral engagement refers to students' participation in in-class activities. Furthermore, it also includes how much a student is putting his efforts into learning and to what extent he is

attending the classes (Yu et al., 2019).That is why this study was focused on investigating the bite-sized teaching strategy: Effectiveness for students' engagement at secondary school level.

1.2 Rationale of the Study

Koh, Gottipati, and Shankararaman (2018) examined the effectiveness of pedagogy like bite-sized lectures used for students learning outcomes at the school of information technology. The findings of their study reveal that students learn better through bite-sized lecture as well as teachers using these methods in the classroom to facilitate the comprehension of concepts among students proved that bite-sized lecture is right and offered many advantages over traditional lecture.

A study by Fitzgerald and Tisdell (2019) found that the teaching micro-content "bite-sized instructional videos" results significantly impacted high student engagement, positive feedback in the classroom, improved confidence, and interest in learning. Additionally, improve academic self-efficacy and student's performance.

Manning et al. (2021) defined 'Bite-sized teaching' as a pedagogical strategy used for postgraduate medical education. Further, they discussed elements of the bite-sized teaching method by splitting these into four components (brief focused learning unit, content, presentation/delivery, and peer teaching). Additionally, the study explained that bite-size teaching incorporates bite-sized learning as well as teachers having detailed learning material in 3 or 4 parts called a focused break in their 45 mint lectures. Moreover, learners can digest small pieces of information due to their short attention span as well as for teachers to use short content to help structure their classes, and increase students learning outcomes.

A large amount of research work is done on students' engagement. According to the study conducted by Axelson and Flick (2011**),** Student engagement is defined as the involvement of students in studies and their behavior toward their learning environment. Students' level of motivation, attention, interest, passion, and participation in their learning process. Can they get all the information and understanding of the program/content given to them? Can they achieve learning aims? Have they progressed in their studies etc? Additionally, the main three kinds of engagement are (a) Emotional, (b) cognitive, and (c) behavioral (Schindler et at., 2017).

Social engagement is another type of student engagement. Social engagement is defined as the level at which learner puts effort into their learning, and improves the quality of social interaction with teachers and peers as well as to comprehend information and create relationships while teaching (Wang et al., 2016).

A research study carried out by (Mehmood and Rehman, 2011) investigated the teaching methodologies and their effective use by teachers for learners at the secondary school level in Pakistan. The result of the study revealed that teachers proved effective teaching at the secondary level by using strategies of lectures, inquiry, query, giving home assignments, discussions, maintaining attentive contact with students, and using audio-visual aids materially in the classroom to promote comprehension of concepts among students.

In Pakistan, most of the teachers are still adopting this method however it has various drawbacks included students' inactiveness in the classroom, only communication on the part of the teacher, or one-way communication because the teacher delivers lectures and students only take notes because of students' least participation in this method they forget the concepts in less time (Raja, 2018). Therefore, it can be noticed that all the previous

researchers examined the effect of inquiry teaching methods, discussion methods, and lecture methods of teaching on different variables. Current study was examined on secondary school science teaching which has focused on the effect of bit-sized teaching strategy on student engagement in Pakistan.

A bite-sized teaching strategy offers an effective alternative to traditional lessons. This approach currently rising in higher education, but it also needs to address science education at the secondary level in Pakistan. ‘Bite-sized Teaching strategy is defined as an instructional method that was implemented within the syllabus. These are just a few examples of today's substantial number of research done in this field. A recent study has noted that secondary school of Islamabad students regarding bite-sized teaching on student critical thinking skills. The sample of that research consisted of three hundred students and used experimental study to analyze the results that students response were agree on the statement about the dimension of bite-sized teaching and found that teaching of bite result significantly impact on student critical thinking skills, that they remember, understand and apply whatever they see in a short, easy and simple concepts (Shazad, 2020).

The existence finding highlighted the practices of bite-sized teaching, current study continue to reveals the effect of bite-sized teaching strategy for student engagement. That is helpful in effective teaching and learning in science. However, a study in Pakistan found the effect of a bite-sized teaching strategy for student engagement at the secondary level.

1.3 Statement of the Problem

In Secondary Schools in Pakistan traditional approach to teaching is more common. Students are passive learners in this approach which is why their classroom engagement in terms of cognitive, behavioral, emotional, and social engagement may be less. For

enhancing students' engagement, teachers can use more technology-based pedagogies in their teaching. As the current research offered an effective alternative to traditional lessons in the secondary school of Pakistan through a bite-sized teaching strategy. Bite-size teaching incorporates bite-sized learning as well as teachers having detailed learning material in 3 or 4 parts called a focused break in their 45 mint lectures. Moreover, learners can digest small pieces of information due to their short attention span as well as for teachers to use short content to help structure their classes, and increase students learning outcomes. The current research was focused on effective the bite-sized teaching strategies for student engagement. Therefore, it captured the attention of the researcher to find out the effect of bite-sized teaching strategy on students' engagement in science at the Secondary level. Consequently, the researchers centered their attention on students' cognitive, emotional, behavioral, and social engagements at secondary school levels, and bite-sized teaching is being used in the classroom.

Keeping in view the importance of the bite-sized teaching strategy for the teaching of science subjects, the researcher selected the area of bite-sized teaching strategy for conducting the research. The study was designed to explore the practices of bite-sized teaching strategies at the secondary level and assess the level of student engagement in science teaching at the secondary school level. The researcher also planned to find out the effect of bite-sized teaching strategy for students' engagement at secondary level.

1.4 Research Objectives

1. To explore the Practices of bite-sized teaching strategy at secondary school level.
2. To measure the level of students' engagement at secondary school level.

3. To find out the effect of 'bite-sized teaching strategy' for students' engagement 'at Secondary level.

3a. To find out the effect of "Learning unit" for students' engagement at Secondary level.

3b. To find out the effect of "Relevant content" for students' engagement at Secondary level.

3c. To find out the effect of "Refine delivery" for students' engagement at Secondary level.

3d. To find out the effect of "peer teaching" for students' engagement teaching at secondary level

1.5 Null Hypotheses

H_o1 There is no significant effect of 'Bite sized teaching strategy' for 'students' engagement' at secondary level.

H_o1a There is no significant effect of "learning unit" for students' engagement at secondary level.

H_o1b There is no significant effect of "relevant content" for students' engagement at secondary level.

H_o1c There is no significant effect of "refine delivery" for students' engagement at secondary level.

H_o1d There is no significant effect of "peer teaching" for students' engagement at secondary level.

1.6 Conceptual Framework

The current study comprised a conceptual framework that was based upon the combination of two models. One was based on the Bite-Sized Teaching strategy Model by Manning et al. (2021). The Bite-Sized Teaching strategy Model comprises four components; Learning unit, relevant content, refined delivery, and peer teaching and second model was based on student engagement by Wang et al. (2016)**.** The student engagement model comprises four sub-sections, behavioral, emotional, cognitive, and social. The below diagram explains the conceptual framework of the study.

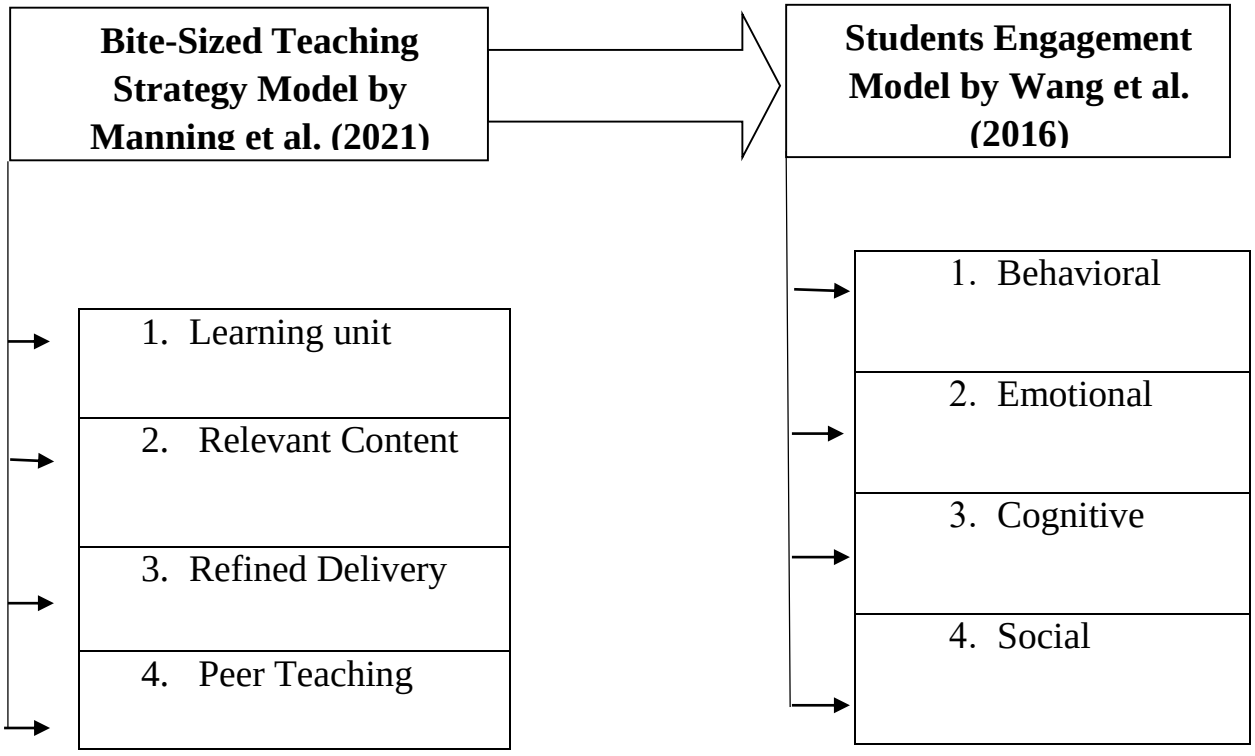

Figure No.1.1 Conceptual Framework of study

1.6.1 Bite-Sized Teaching Strategy Model by Manning et al. (2021)

The bite-Sized Teaching strategy model is independent variable in this research. The Conceptual framework bite-sized teaching strategy was based on the research of Manning et al. (2021) that how to engage learners, how to improve the learning process in postgraduate medical education and how to measure the effects of 'Bite-sized teaching' (BST). The termed BST is a pedagogical strategy that incorporates micro or bite-sized learning as well as teachers have detailed learning material which divide into three to four short, focused learning units on topics. This strategy ensures a positive relationship between the process of teaching and learning to develop creative, and distinctive capabilities among students by using information about students' attention spans, and engagement in the teaching and learning process. Four elements of the Bite-sized teaching strategy model are mentioned below:

a. Learning unit

b. Relevant Content

c. Refined Delivery

d. Peer Teaching

1.6.1.1 Learning Units

According to Manning et al. (2021) represents brief, short, focused multiple talks around one main learning objective. Teachers start with a broad area of interest and then deconstruct this into its constituent parts. Teachers continue this process until they have deconstructed it into a single conceptual teaching point for the students.

1.6.1.2 Relevant Content

According to Manning et al. (2021) provide relevant educational content, including digital textbooks, videos, practice material, interactive games, and assessment and classroom activities to the students to achieve learning objectives and non-essential content is removed. The teacher builds a framework or schema to support and explain their teaching point. Using bite-sized learning principles, complex content is broken down and distilled into discrete, manageable units focused on relevant knowledge schemas**.**

1.6.1.3 Refined Delivery

According to Manning et al. (2021) use digital technology like laptops, projectors, clickers, tablets, speakers, UPS, screens, and mobile broadband. Teachers can use PowerPoint slides with text and pictures and 7-8 minute videos for students' attention in the classroom.

1.6.1.4 Peer Teaching

According to Topping (2015), the term peer teaching is defined as a fellow teacher who instructs other students in a group under the direction of a well-qualified teacher in teaching and learning.

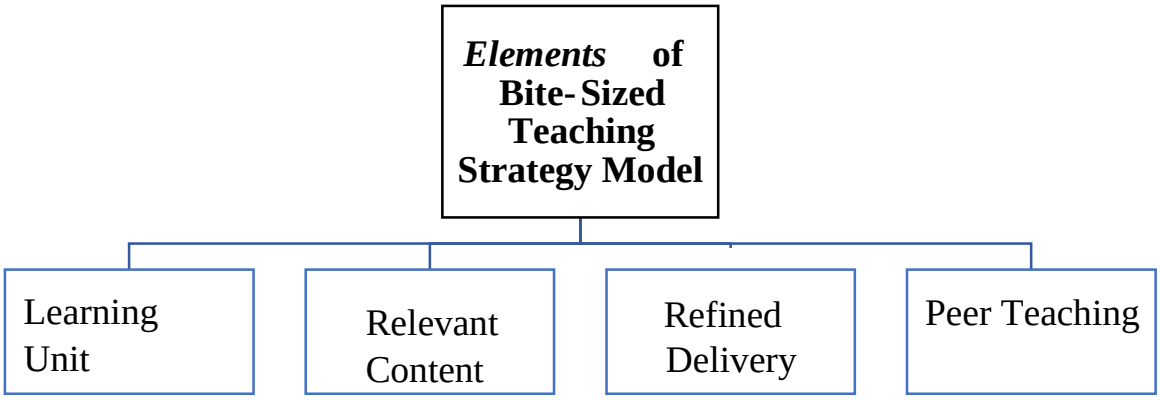

Figure No 1.2 Elements of the Bite-Sized Teaching Strategy Model

(Manning et al., 2021)

1.6.2 Student Engagement Model by Wang et al. (2016)

The Conceptual framework for student engagement in this study was based on the model presented by Wang et al. (2016)**.** In this research, student engagement has been taken as the dependent variable. Here student engagement means a degree of confidence, interest, consideration, and excitement for learners to exhibit when they involve in the teaching process. Which encourages the student's interaction and participation in learning activities. To address Student Engagement, the conceptual framework is based on the presented study by Wang et al. (2016) types of student engagement**.** The four main types of student engagement are:

a) Behavioral

b) Emotional

c) Cognitive

d) Social

1.6.2.1 Behavioral

Yu et al., (2019) indicated that behavioral engagement is the extent to which students take part in classroom activities. Furthermore, it is also relevant to the extent to which students may put their efforts into tasks as well as how many classes they are attending.

1.6.2.2 Cognitive

According to Pohl (2020) cognitive engagement is to measure it directly but its indicators can be observed in students through, utilizing surveys/questionnaires, discussing with students, and by observing students directly or in real-life situations.

1.6.2.3 Emotional

Emotional engagement primarily clarify the concept of student's "positive" and "negative" feelings, feedback in the classroom, school, and the interaction with the teacher and peers (Appleton, 2006).

1.6.2.3.4 Social

According to Lu and Churchill (2014), social engagement refers to actively participating with others by interacting and sharing ideas and knowledge through collaborating on learning activities and tasks that have a meaningful purpose of co-constructing information and creating a positive feeling as a sense of learning community.

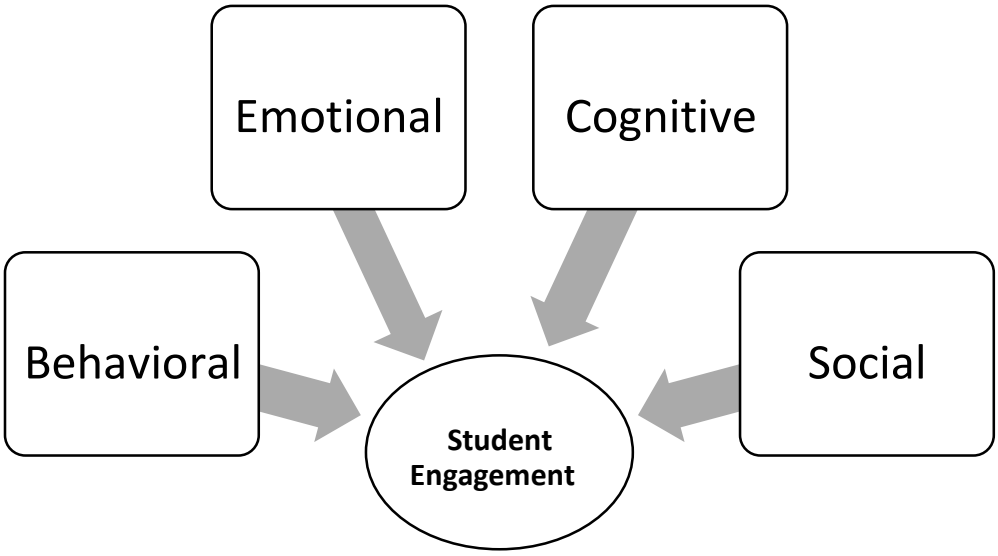

Figure No 1.3 Conceptual framework of types /kind of 'students' engagement' by Wang et al. (2016)

1.7 Significance of the Study

The current research offered an effective alternative to traditional lessons through a bite-sized teaching strategy. In such a way, one can also create a healthy competition between students in the same class and between sections wise and among higher courses of the school. This study utilizes new techniques and methods in traditional lessons, including a technology-based classroom, to encourage student engagement.

This research might be helpful for curriculum developers because this study indicated the effect of bite-sized teaching strategies for enhancing student engagement in the classroom. They can make technology-based changes in the curriculum by creating a part of bite-sized teaching strategy a part of the curriculum.

This research is beneficial for educational stakeholders directly or indirectly involved all stakeholders in understanding the importance of bite-sized teaching strategy in the

curriculum to achieve the intended learning outcomes and improve the quality of education service at the secondary level.

This study might be highly effective for science teachers by allowing them to use digital content, activities, and assessments in traditional classrooms. This approach improves the learner's performance, increases attendance, and decreases withdrawal and failure. It allows the learner to achieve success in science teaching.

This study would be helpful for students' engagement Bite-sized teaching enhances student cognitive, emotional, social, and behavioral engagement within the traditional classroom.

A bite-sized teaching strategy develops cooperative and collaborative learning among students. Hence, bite-sized teaching methods improve the students' social and communication skills because they can efficiently deliver their thoughts and ideas through active participation in-class activities. Practical experience was achieved by using the Bite size teaching strategy, which encourages the learning process. Self-directed learning motivates students who would be helpful to compete in the global economy by being part of a skilled workforce. Moreover, this study helped the students understand the concept, increase their confidence, and easily express their ideas and thoughts.

1.8 Methodology

1.8.1 Research Approach

The study's quantitative research approach involved interpreting the collected data using numbers. Furthermore, the Researcher used Statistical product and service solution (SPSS) to analyze collected data. The Researcher has selected this approach because it enumerates the problem by creating numerical data which can be converted into useable statistics. Moreover, it facilitates more structured research patterns, so that's why researchers have prioritized it Researcher was interested in

collecting the data in a structured form, so the Researcher used this approach for study according to the nature of the research objectives and hypotheses.

1.8.2 Research Design

The correlational design was followed in this research study. A survey method was used to find out the "Effectiveness of bite-sized teaching strategy for students' engagement at the secondary level,". Which is most commonly used in education to conduct research studies for data collection. The survey method was considered beneficial in social science studies are preferred to employ. It also includes the different ways to collect data through instrumentation. Survey research studies are the information collected from the respondents by getting their responses from the numerically rated questionnaire in research projects. The Researcher visited the field personally in the survey and collected the respondents' reactions.

1.8.3 Population

The population consisted of individuals with one or more attributes in common about which the researcher was interested in collecting information. This study finds out the effectiveness of a bite-sized teaching strategy for students' engagement at the secondary level. Jazz innovative schools are those of the Federal Directorate of Education (FDE), which greatly facilitated digital technology, including (laptops, multimedia projectors, clickers, screens, UPS, and speakers). Therefore, the bite-sized teaching strategy can only apply to jazz smart schools. For the current study, the population was based on 2855 science students enrolled in (session 2021) at twenty-six Secondary level schools in the public sector of Islamabad City (Urban I & II). These include thirteen secondary level schools in Urban I and thirteen

secondary schools' level in Urban II of Islamabad City. The below table explains the population of the study.

Table No 1.1

Population of the Study

Sr. No.	Population (Secondary School)	Number of Schools	Numbers of Students (Session 2021)
1.	Urban I	13	1392
2.	Urban II	13	1463
	Total	**26**	**2855**

Table No. 1.1 explains the number of secondary level schools in Islamabad City; Urban I, and II was 26 (Urban I secondary level school = 13 and Urban II secondary level school = 13). The numbers of Students enrolled in (Session 2021) was 2855 (Urban I Science students enrolled = 1392 and Urban II Science Students enrolled = 1463).

Source: - List of Jazz smart schools of Federal Directorate of Education (FDE) which is attached in Appendix H.

1.8.4 Sampling Technique

For the current study, the researcher used a proportionate stratified random sampling technique. The data was taken from two strata of secondary school level Urban I and Urban II of the Islamabad on area wise. The researcher has taken equal ratios from both sides.

1.8.5 Sample Size

At the secondary school level of Islamabad city (public) sector, 2855 Science students enrolled in the Secondary level school. The researcher took the sample size by using

Krejcie and Morgan's (1970) table to determine the sample size from a target population (N=2855). According to below table, the sample size of the current study was n=386 of 2855; that is 13% of the population was taken from each group which is 386 science students, 189 science students Urban I, and 197 science students Urban II.

Table No. 1.2

Sample size of the study

Sr. No	**Science Students**	**No Respondents**
1	Urban I	179
2	Urban II	207
	Total	**386**

1.8.6 Instrumentation

1.8.6.1 Bite-size Teaching Assessment Scale by Manning et al. (2021)

The bite-size teaching assessment scale was adapted from the work of Manning et al. (2021) to measure the "Effect of Bite-Sized Teaching (BST) on learner engagement. The below table explains the initial construction of the tool.

Table No. 1.3

Description of Bite-sized teaching Scale

Scale	Sub-variable	Items
Bite-sized teaching strategy	Learning unit	1,2,3,4,5,6,7,8,9,10
	Relevant content	11,12,13,14,15,16,17,18,19
	Refined delivery	20,21,22,23,24,25,26
	Peer teaching	27,28,29,30,31,32,33,34,35,36
Total Items		**36**

Table 1.3 represented the bite-size teaching assessment scale based on 36 items that comprises on four components, 1-10 items of learning unit, 11-19 items of relevant content, 20-26 items of refined delivery, and 27-36 items of peer teaching which are used in questionnaire.

1.8.6.2 Students' Engagement Assessment Scale by Wang et al. (2016)

For assessing students' engagement researcher has adapted a scale developed by Wang et al., (2018) to measure "The math and science engagement Scale". Below table explains the initial construction of the tool.

Table No.1.4

Description of Student Engagement Scale

Scale	Sub-variable	Items
Students Engagement	Behavioral	1,2,3,4,5,6,7,8
	Emotional	9,10,11,12,13,14,15,16,17
	Cognitive	18,19,20,21,22,23,24
	Social	25,26,27,28,29,30,31,32
Total Items		**32**

Table 1.4 represented the student's engagement assessment scale based on 32 items that comprises on four components, 1-8 behavioral items, 9-17 emotional items, 18-24 cognitive items and 25-32 social items. The total number of questions is 32. Which are used in the questionnaire.

1.8.6.3 Validity of Instruments

The termed Validity means "a test is valid what it is supposed to be measured. Researcher presented the tools to five experts from the field of education to check the tools' validity. The list of experts was presented as (Appendix- F).

1.8.6.4 Reliability of Instruments

For concerned study the researcher had administered tool to 40 science students at secondary level schools for pilot trial, and data which was collected through pilot trial was analyzed by applying Cronbach's alpha reliability, inter-section correlation and item total correlation. Weak items were amended/excluded from the tools.

1.8.7 Collection of the Data

The researcher collected data from science students by distributing the 5 point Likert scale questionnaires to the students at public secondary schools level of Islamabad city both (Urban I & II).

1.8.8 Data Analysis

Researcher analyzed data through Statistical product and service solution (SPSS) 22nd edition. The researcher used various statistical tests like reliability, Mean, Individual Score, item-total and intersection correlation, and regression analysis. Below table explains the Description of Research objectives, Hypothesis and Statistical Analysis.

Table No. 1.5

Description of Research objectives, Hypothesis and Statistical Analysis

Research Objectives	**Null Hypotheses**	**Statistical Tests**
1. To explore the practices of bite-sized teaching strategy at secondary level.		Mean
2. To measure the level of students' engagement at secondary level.		Individual Score
3. To find out the effect of **'Bite sized teaching strategy'** for **'students' engagement'** at Secondary level.	**H_o1**.There is no significant effect of 'bite-sized teaching strategy' for students' engagement at secondary level.	Linear Regression

Statistical tests were seen in table No 1.5 which shows that three hypotheses were applied. To respond to the first and second hypothesis, Mean, Individual Score was applied, to answer Hypothesis No. 3, and its further sub section 3a, 3b, 3c, and 3d regression was applied. Linear regression was applied to check the one-way effect.

1.9 Delimitations

As the consequences of time and resources the current research was delimited to:

1. Geographically Islamabad city includes (Urban I and II) public sector secondary level schools.

2. Only Science groups' students were included in the study.

3. 9^{th} and 10^{th}grade students enrolled in public sector educational institutions only.

4. The following public sector secondary school that were using 'Bite-sized Teaching' in Urban I are:
    a) IMSG (Islamabad Model School for Girls) VI-X, sector F-6/1
    b) IMSG (Islamabad Model School for Girls) VI-X, F-7/2
    c) IMSG (Islamabad Model School for Girls) VI-X, sector G-7/1
5. The following public sector secondary school that were using 'Bite-sized Teaching' in Urban II are:
    d) IMSG (Islamabad Model School for Girls) VI-X, G-7/2
    e) IMSG (Islamabad Model School for Girls) VI-X, G-6/2
    f) IMSG (Islamabad Model School for Girls) VI-X, sector G-9/3.

1.10 Operational Definitions

1.10.1 Bite-Sized Teaching Strategy

It is an instructional strategy that represent an effective up-and-coming method in traditional classroom in which teachers have detailed learning material divided into three to four short, focused learning topics.

1.10.2 Learning unit

It is a way to represent 4 to 5 brief, short focused and multiple, few minutes learning talks on single topic.

1.10.3 Relevant Content

It is a way by providing refined and relevant content to the students to achieve learning objectives.

1.10.4 Refined Delivery

It refers to the use of digital technology like laptops, multimedia projectors, clickers, screens, UPS, and speakers. As 7-8 minutes' videos and presentation slides was produced by instructor / teacher to increase attention span of student in classrooms.

1.10.5 Peer Teaching

It refers to a group activity that helps the peer to learn from the other group member, to promote positive relations with other peers and teachers.

1.10.6 Student Engagement

It refers to the degree of confidence, interest, attention, curiosity, and excitement that learners enjoyed and took part in learning process.

1.10.7 Behavioral

It is defined as the levels to which students actively participate in learning activities, follow instructions, responding to questions, regularity in their class attendance, and no distractions.

1.10.8 Emotional

It refers to the degree to which students put efforts to improve affective reactions like interested, inspired, and enthusiastic about bite-sized teaching topics, methods, and learning activities.

1.10.9 Cognitive

It defined as the levels to which students put efforts in their learning tasks and improve their intellectual power to acquire knowledge.

1.10.10 Social

It refers to the degree to which students put efforts in their learning and improve quality of social interaction with teachers and peers.

1.10.11 Public Sector School

Schools that are planned, founded, funded and controlled by the government of the State.

1.10.12 Secondary School

In Pakistan, schools providing education from grade 6 to 10 are considered as secondary schools.

1.10.13 Urban I & II Secondary School

In Islamabad City, schools that are divided into area wise like urban and rural area. Urban area are further divided into two parts according to sectors Like In Urban I and II. Thirteen schools providing education are considered as Urban I secondary schools. Thirteen schools providing education are considered as Urban II secondary schools.

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

As the Current study is meant to explore the “Bite-Sized Teaching (BST) strategy: Effectiveness for students’ engagement at secondary level.” In this section, literature related to bite sized teaching strategy and student engagement is discussed. The current section also includes related theories, various models and previous research work related to bite sized teaching strategy and student engagement. Primarily bite sized teaching strategy will be discussed and then student engagement will be discussed in the context of literature. Various research proposed different sorts of definitions of bite sized teaching strategy and student engagement.

Section 1 General Introduction of Research Variables

2.1 Bite-Sized Teaching Strategy

Bhaduri (2016) defined 'bite-sized' as the proper size to provide an interactive and meaningful learning environment where students think critically and participate in in-class activities. Moreover, today's 'net generation' learner has short attention spans and, therefore, reduce the explicit content material that needs to be delivered in short, focusing on bite-sized pieces to meet the needs of their working memory (Barnes, Marateo& Ferris, 2007).

Mohammed, Wakil, and Nawroly (2018) Bite-sized learning, also called micro learning teaching aids, divides the information and knowledge into small chunks or pieces, helping students to understand and memorable learning subjects for a lengthy period. They also examined the effectiveness of micro-learning methods used by primary school students. The findings of their study reveal that the micro-learning method is 18% better learning than the traditional method.

A recent study has revealed that bite-sized teaching refers to a simple, brief lecture along with significant material and focuses on learning outcomes that are short in numbers per module (Schwartz et al., 2019). Lenz et al. (2015) examined various methods to improve the quality of large-group lectures. The findings of their study reveal that a traditional lecture can be divided into breaks inserted every 15-20 minutes to facilitate the comprehension of concepts and renew attention among learners. Bartram et al. (2017) spent enough time managing a ward-based work to conduct short, focused tutorials based bite size teaching as a training tool to promote practical knowledge among physical health practitioners.

According to Cates, Barron, and Ruddiman (2017), the term 'micro learning' refers to studying for a brief time instead of a more comprehensive study. Moreover, non-language learning through micro-learning provides interactive and practical learning to engage and facilitate the comprehension of material among students.

Kam and Csete (2010) assert teaching as BITE' Bite-sized Information for Teaching with E-technologies' that result in the use of technology to promote teaching and learning in higher institutes. A sample of 1600 teaching staff analyzed BITE with four sections naming: Blogs, Podcasting, Twitter, and Wikis. The result of teaching staff support

'innovative professional development format' (BITE) concluded that it successfully promoted the use of technologies among teaching staff.

2.2 Components of Bite-sized Teaching Strategy

Gray (2015) emphasizes the need for "Developing Effective Online Staff Development through Short, Regular, Bite-Sized Tasks" various articulated principles of bite-size learning (BSL) (a) short course length, (b) each day delivered one task and (c) short task, (around 30 minutes). Further introduced the flexibility of BSL in three characteristics, defined as changeable in time, flexibility in (location), and flexibility in (mode of expenditure). Moreover, the findings of their study reveal that staff members learn better through bite-sized effective learning over traditional methods. Manning et al. (2021) defined BST (Bite-sized teaching) as an instructional strategy for postgraduate medical education. Further, they discussed the constituents of bite-sized teaching methods by splitting these into four components. These are: -

2.2.1 Learning Units

2.2.2 Relevant Content

2.2.3 Refined Delivery

2.2.4 Peer Teaching

2.3 Technological Innovations in Federal Educational Institutions of Pakistan

Islamabad 19 February 2018, in support of the Government's Vision 2025, Jazz Foundation is set to use innovation in imparting education to 75 schools in the Federal Capital under its 'Jazz Smart School' program. Launched in partnership with the Capital Administration and Development Division (CADD) and the Federal Directorate of Education (FDE), the 'Jazz Smart School program introduces an innovative learning solution to the traditional

schooling system through a digital learning platform. Knowledge Platform provides the program with a digital learning platform, customized educational content, training, and support. At the same time, Jazz Foundation has set up digital learning centers with hardware kits that include laptops, projectors, clickers, tablets, speakers, UPS, and mobile broadband. The program's educational content includes digital textbooks, videos, practice material, interactive games, and assessment and classroom activities. The Jazz Smart Schools program has recorded significant improvement in five areas: student learning outcomes; teaching quality; student engagement, expanded use of technology, and improved accountability and monitoring of results. In the federal capital, educational institutes now have technology-based pedagogies that are beneficial not only for students but for teachers.

Akçayır and Akçayır (2017) also highlighted that education and fields related to education are also getting benefits from new technological inventions which are positively contributing to improving students' knowledge and skills.

2.4 Bite-sized Teaching Strategy in Federal Capital Educational Institution of Pakistan

Bite-Sized Teaching (BST) is an instructional approach representing a practical and upcoming method in a traditional classroom. Teachers divide detailed learning material into four short, focused learning topics in the secondary school of Islamabad, where the innovative jazz schools project provided technology-based rooms to the teachers where teachers used this technology which is significant for the third component of BST. With the technology-based room, the BST is possible. BST had four parts, including a learning

unit, relevant content, refined delivery, and peer teaching; all these components replaced a 40 to 50- min teaching session with 4 to 5 brief (8 min) teaching micro-sessions.

2.4.1 Learning Units

In the learning unit session, where teacher represents brief, short, focused multiple talks around one main learning objective. Teachers start with a broad area of interest and then deconstruct this into its constituent parts. Teachers continue this process until they have deconstructed it into a single conceptual teaching point for the students. National Curriculum (2006) discussed the definition of a general statement of objectives. These are written in the form and selected, indicated relative weightings, and organized. Moreover, how to achieve these objectives for this they determined several ways. (1) By grade, (2) By strands, (3) In units, and (4) In sequential levels of instruction. The National Curriculum for biology, on the whole, specifications of objectives have the following benefits:

a. They encourage students to state, exemplify and interpret the concept.
b. They help to determine the appropriate mental and motor abilities among students.
c. They direct the student's attention and motivation and increase their persistence to recognize the nature and Constraints of scientific activities.
d. They encourage learners to be involved in and aware of the influences of science and technology in science.
e. They help to develop the ability to work with others.

Zohrabi (2008) defines the term objectives are one of the prominent features of any program or course. Brief focused instructional objectives or learning units at the

beginning of the program which usually determined in the curriculum. Additionally, objectives interpret the language skills or components during the program students might teach (Brown, 2011).Similarly, instructional objectives or goals are things we try to achieve at the end of the program (Van Blerkom, 2013).

Learning units are a course's goals that attempt to bring drastic change among students in the learning process. Therefore, instructional objectives in any program determine the goals and offer complete guidelines for the teachers and students (Richardson & Newby, 2016).

2.4.2 Relevant Content

In relevant content sessions where teachers provide relevant educational content, including digital textbooks, videos, practice material, interactive games, and assessment and classroom activities to the students to achieve learning objectives and non-essential content is removed. The teacher builds a framework or schema to support and explain their teaching point. Using bite-sized learning principles, complex content is broken down and distilled into discrete, manageable units focused on relevant knowledge schemas**.**

According to Lunenburg (2011), the curriculum can be divided into three significant aspects: objectives, relevant content, subject matter, and learning experiences. The term objectives define "where" we are going as a road map, whereas content is the "what" of the curriculum. In this regard, content is helpful for the science teacher in planning and guiding instruction, but more is needed for behavioral objectives. Therefore, content must be linked to behavioral objectives. Students achieve objectives through the relevant content or subject matter they

learn. Similarly, Technological pedagogical content knowledge helps improve teaching and learning. The concept to understand the technology (laptops, personal computers, tablets, audio-visual aids, etc.), contents (subject matter or relevant content that is to be taught), and pedagogy (methods, strategies, practices, and processes in teaching and learning) merged to make the unique domains to improve students' learning (Archambault & Barnett, 2010).

Williams (2011) introduced How Science Works (HSW), looking at the background to this perspective of teaching science to explore methods for effectively delivering the content among students.

Mishra and Koehler (2016). Content knowledge refers to the contents or syllabus of a particular subject matter, further how the teacher delivers the idea about the content. However, teachers must know the kinds of different content (e.g., knowledge of Math, science, and Arts, etc.).Furthermore, the concept of pedagogical content knowledge is the same as the idea of teaching methods explained by Shulman (2018) that can be implemented in different content. Pedagogical content knowledge is the basis of effective teaching with technology, supporting content-specific instructional strategies by representing the use of technology specifically in the Science Classroom (Koehler et al., 2013; Qasem, 2016).

2.4.3 Refined Delivery

In refined delivery sessions, teachers use digital technology like laptops, projectors, clickers, tablets, speakers, UPS, screens, and mobile broadband. Teachers can use PowerPoint slides with text and pictures and 7-8 minute videos for students’

attention in the classroom. Expanded use of technology significant improvement in student engagement and quick assessment.The use of technology makes educational institutions more effective and productive by facilitating the process of teaching and learning (Akpan &Itighise, 2019). Research has indicated that technology is vital for bringing effective results in the teaching and learning process. Odom, Marszalek, Stoddard, and Wrobel (2011) have concluded a study that educators support and integrate technological ideas into the curriculum to enhance learners' achievement.

Several studies indicated the importance of digital technology and that it can help facilitate teaching and learning by connecting it with real-life situations (Tinio, 2002).Tinio further explained the importance of technology as it accelerates, polishes students' skills, increases their concentration, helps in the application of learned material, provides economic favor to the future generation, and connects the school environment with the real world.

Along with all other aspects of instruction which effect of digital technology on learners' Higher Order Thinking Skills (HOTS) is now capturing the attention of scholars and researchers to a great extent. Miri, Ben-Chaim, and Zoller (2007) expressed that HOTS involves critical thinking, precariousness, using different criteria, etc.

The effective use of technology tools in the classroom can help students to think constructively, as Subran (2013) has confirmed the efficiency of ICT in promoting HOTS. In the cognitive domain of Bloom's taxonomy, the HOTS are those included at the upper end, such as synthesis, application, and evaluation (Barak and Dori (2009).

In this era, the use of digital technology in every social class is not a lie, especially after the spread of COVID-19. It is considered as crucial as breathing to be alive in every field, including education, to facilitate teaching and learning. It has been a powerful tool to facilitate any country's social, political, and other fields (Adedeji, 2010).

2.4.4 Peer Teaching

In peer teaching session where students may face difficulty understanding the concept or have a low score on the quiz, instead of helping every student one by one teacher conduct group activity that allows the peer to learn from other group members and provide the solution to the problem and shares it with the whole class at once and save class time for other activities. Dueck (2014) believes that peer teaching enhances students' learning in many ways. These are to assume liability for investigating, strengthening, and coordinating existing knowledge existing, understanding the existing structure, finding out the gaps, and giving suggestions about its implications after reformulating information in a new logical way. Additionally, to increase the learning of peers by assisting those who need it and support from their friends by empowering them to upgrade their learning process without reliance on educators. However, peer teaching assists learners and grabs the opportunities to encounter and explore that "instructing is the best educator" (Farivar & Webb, 2012).

In this regard, Whitman and Fife (2018) peer teaching plays a significant role in expanding a specific branch of knowledge on the certainty means that teaching something must be learned twice. Transferring learning skills and knowledge

among students through Peer teaching serves as an approach for learners to teach each other collaboratively and, e.g., teaching methods based on Vygotsky's theory (Nind et al., 2020; Engels et al., 2018). Instruction, peer teaching is not only one different instructional approach (Boud, 2010). There are diverse ways to implement peer teaching in the classroom.

According to Topping (2015), the term peer teaching is defined as a fellow teacher who instructs other students in a group under the direction of a well-qualified teacher in teaching and learning.

For example, one student teaches other students in pairs or learns about their group's members (Secomb, 2008; Lockspeiser et al., 2008). In some instances, Peer teaching techniques can be helpful to compensate for when lacking of teachers in schools or colleges (Korner & Hopf, 2015). According to Olle and Durning (2007), Peer teaching can have a more significant impact on small group members instead of teaching in large groups of people at higher education levels.

Additionally, peer teaching helps students learn effectively and improves the quality of education in the teaching and learning process (Boud, 2010). Nevertheless, it is not a substitute for planned and organized activities by trained teachers for the instructional process. In this regard, successfully implementing peer teaching in the classroom, the teachers not only focus on the knowledge aspects but also consider the social aspect (Raisanen et al., 2020; Engels et al., 2018).

Kayode (2021) examined the "effect of peer tutoring on students' achievement in biology used for students at senior secondary schools in Ekiti State." A sample of

56 biology students' achievement tests (BSAT) was used as an instrument. The result revealed that students performed better through the peer tutoring teaching strategy.

A research study was conducted by Kalu-Uche and Ogbonna (2021) to know the effectiveness of peer tutoring teaching strategy on secondary-level school slow learner achievement in biology. A sample of 77 low learners in biology was selected from two selected schools. The result concluded that there was an enormous difference between instructional strategies. Those taught by peer tutoring strategy and those taught by the conventional teacher-led discussion

To meet the 21st-century challenges, we must train our students by adopting instructional strategies that boost learners' teamwork, collaboration, active participation in classroom discussions, and adequate preparation before examinations. Technologies facilitate the classroom, enabling collaborative group learning and peer teaching with digital materials and immediate access to knowledge (Samsa and Goller, 2021).

Bite-sized teaching is the best option for teachers who wants to facilitate students learning in the school and best solution for teachers who are facing a shortage of time in conducting learning activities for students in class because bite-sized teaching replacing a 40 to 50- min teaching session with 4 to 5 brief (8 min) teaching micro-sessions that teachers can use to deliver content in less time. It is an effective teaching because it saves time for both teachers and students’ which is impossible for teachers who use the traditional lecture approach for teaching. On

the whole, it is not wrong to say that if we want to reduce the workload of teachers, increasing the participation and engagement of students in class, enhancing learning accessibility for students, and making students autonomous learners then bite-sized teaching is the best choice. Knowledge clip is a short 5-6 minutes' video

2.5 Benefits of bite-sized teaching strategy

According to Singh (2021), bite-sized or micro-learning is a massive benefit for training strategy because learners are motivated and involved. The benefits of bite-sized teaching or micro-learning for today's students produce a positive change. These are as follows:

2.5.1 Improves Learner Participation/Better Engagement

Students better participate with content using strategy bite-sized teaching. It makes the utilization of quizzes that rinse out of every single sub-topic. This helps the students to understand and learn the concept quickly.

2.5.2 Increased Retention/Effective Absorption

Bite-sized teaching or micro-learning attracts students' attention through flowcharts, animated videos, interesting theories, and much more. Thus, using better engaging and catchy content designed for students lead to paying better attention to content.

2.5.3 Easy to update Content

In the bite-sized teaching or micro learning-based E-Learning system, the content is split into minor length sub-topics, which help update the content. And not affect other topics by updating the sub-topics. It also saves time and effort consumed in updating content.

2.5.4 Diversified Learning through Single Objective

The use of diversified kinds of content like Infographic, attractive theory, bite-sized animated videos, etc. Bite-sized teaching or micro learning is effective as it helps focus and concentrate on a single objective.

2.5.5 Optimal Utilization of Time

Bite-sized teaching or micro learning is one of the benefits of dividing time into small intervals of 5-15 or 10-20 minutes which is helpful to consume even the smallest amount of time and quickly digest the content.

2.5.6 Increased Efficiency

Bite-sized teaching or micro learning automatically improves learning and students' efficiency due to shorter time intervals. It is designed to scatter the syllabus and topics into smaller topics divisions and understand those in a shorter period, benefiting students.

2.5.7 Faster & Sequential Access

Due to today's standards, access to study material is relatively easy. The course is divided into topics and sub-topics with keys like doubts, revision, bookmarks, quizzes, notes, exercise, etc., which leads to quick and immediate access to content.

2.5.8 Enhanced Personalization

In bite-sized teaching or micro learning, highlights are always given to embodiment as this technology ensures the record of every click and tick. Personalization helps the student to know the difference between learning and expert concepts.

According to Peterson (2020), the benefits of bite-sized learning and how to make the learning environment more effective and interactive are as follows:

a. Heightened involvement of students and information confinement

Strategy of Bite-sized learning is rising daily. Thanks to their potential and capacity to take hold of information and shape it through knowledge preservation and managing the time point of view. Nevertheless, identifying which type of information is significant and what is unimportant and can be omitted in transforming your instructions into bite-sized learning is one of the hardest. It takes much effort, work, potential, and transmission with the team to satisfy and guarantee that your material is impactful and brief.

b. Lessen and shorten

Teachers have stored it already, which can be remodeled into bite-sized teaching or micro-learning training content. Teachers can get an organizing start on creating their bite-sized learning by either shortening content or by illuminating unnecessary and extra information that can cause your training to slow down. For example, you can brief your half-hour recorded online seminar into ten minutes for the most relevant and essential information. Teachers could shorten the video into skill-specific five- six modules. The best way is to brief the information instead of shortening it because shortening is about cutting down material, whereas briefing allows you to pick the most relevant and necessary information.

c. Generating Bite-Sized Learning Content

Teachers may take what was once a page of 10-plus program of text and summarize it into a 5-minute video. Teachers must be deliberate in delivering their method of

training. In this process, they need constant communication with their content expansion group in the strategy of content designing phases and all around the process as you also must build revisions and thorough reading so it can make them satisfied that critical information is included.

d. Focus On Must-Learn Content

The most common example was when you were in school. It was challenging to outline or highlight the whole chapter as necessary. In bite-sized learning, this is what you absolutely must avoid. Prevent throwing entire novels at them. Being precise in what teachers wish for their students must know it is essential, so each module should stand around five-seven minutes.

e. Aligning Content with Training Needs

Extra noises and drive arrangement are cuts by effective bite-sized teaching or micro learning. Due to your tiny window to grab the attention and control of the audience, the most important thing is to know the target of what you speak to the audience. While some learners may succeed in receiving information in which information is great for videos, other information may be better in the process checklist. Your training will be practical by knowing students and their needs.

f. Using Learning Activities

In a safe environment learning aids like serious games, learning based on the scenario, and playing a role in helping to stimulate learners of what they are learning by making they apply. Active learning is advantageous because it ensures that

content is memorized and can be applied in several contexts within a student's daily work after extended training.

2.6 Rules of Bite-Sized Teaching

An online organization named Vivid us published eight rules of bite-sized learning on September 30, 2016 that are as follows:

2.6.1 Simplistic thing at onetime Content

Conventional eLearning paths would carry out several learning objectives and run for 30-60 minutes. One learning objective is involved in modules of Bite-sized learning. This intention is to extant a single concept that directs the need for single learning. Learning must be allowed to recognize and sound one module before going afterward. Improving subject retention and efficiently delivering information figures is proven.

2.6.2 Bore courses should be kept away

Remove, and unvaried courses collapse before they even make progress. A student's attentiveness towards a short module is disengaged and needs to be adapted easily. The teacher is, however, requiring being more innovative with their content and presentation to capture the curiosity and concentration of students. The involvement of students in all respects ensures the course relinquishes the preferred analysis. Students have indicated they prefer small modules; therefore, it is on teachers to fabricate involvement content for students so they can put forward a plan of action.

2.6.3 Engaging and accessible styles

Teachers also consider that students need more time to be more relaxed, and it is they will retrieve modules on cell phones or TABS making it more straightforward for them to find out their requirements for rapid load times, Design of friendly users, and smartphones enhance search.

2.6.4 Building a sense of individualization

Students' efforts are the finest step towards their own, therefore arranging time in their notepad to take the inclusive path that may need to be more relevant and inefficient. Bite-sized learning authorizes teachers to bestow their student's entirely suitable content they can engage at the place and different times of their selection. Students customize their learning by skipping irrelevant courses and selecting the learning solutions that fulfill their requirements.

2.6.5 Efforts to Be Concise

Micro learning is all about relevant and unique knowledge. If the information is not giving the necessary outcome, then it is irrelevant, so the teacher must exclude it. Teachers must be direct by knowing honesty about how efficient learning in media is involved by replacing diagrams with a short video in their study.

2.6.6 Substantiate the use

Students usually prefer to have suggested information rather than merely students desire to acquire what they can easily approach. Teachers must avoid Empty hollow objectives of courses by expressing openly what kind of data in the module can be applied to sort out real learning problems.

2.6.7 Smart groups

Grouped knowledge with relevant information is frequent to understand. Easy to understand if there is a natural connection between them. Students are not excited to absorb information for hours at a specific time which is why so many wise teachers bring in mnemonic devices. Duplication is a convenient learning method, but when it is in an absorbable pattern. Therefore, the teachers must play an active role in defining the single learning takeaways they want, as well as a mandatory specific task. Content relevant to these tasks must be concerned with the group that content into micro-size chunks.

2.6.8 Suitable time for absorbing the learning

Productive learning happens when learners have sufficient time to absorb the latest information before going to the upcoming course. A teacher desires to permit much time for students to learn to adjust to the new knowledge or skills in the schools when the students begin to learn other irrelevant activities. The short module is like committing information to memory which is the most remaining way, not just specified, with learning more in the same amount of time.

2.6.9 Helpful in finding suitable consequences

In learning of Bite size, it allows educational solutions in a straightforward way to process the practical applications for the student's learning. Teachers introducing bite-sized learning into their schools can quickly educate and improve their skills in the most constructive way for average students.

2.7 Steps to Promote Bite-sized Learning Environment

Emtinan (2021) reported three steps to promote bite-sized or micro learning environment that are as follows:

2.7.1 Determine learning goals

2.7.2 Divide content

2.7.2.1 A single learning goal

2.7.2.2 Learning in small units

2.7.2.3 Length

2.7.3 Create mini class activities and assessment

2.7.1 Determine learning goals

The teacher could put effort and set the standard for students. They play an efficient role in their learning, while at the end of class time and walking out of their classroom, students may feel they have given a productive lecture or must remember it. Therefore teachers need to use straightforward content, including learning of students and their ability to apply this learning in future

2.7.2 Divide content

The preceding segment creates a micro-learning condition, shattering and dividing the content into mini pieces. Micro learning is planning to avoid the intellectual overburden that can happen when excessively much material is delivered to learners all at once. The plan here is to introduce current knowledge, instantly revise it and actively use the material to attract learners and remember it for the long term.

2.7.2.1 A single learning goal. Respectively the micro-learning lesson should capture the attention of just one specific learning goal. So, the result that teachers want their students to achieve by the end of the lecture is promoting the best learning strategies.

2.7.2.2. Learning in small units. The teacher Breaks down the content into mini units to accommodate micro-related activities that short comprehension checks or short quizzes can follow.

2.7.2.3 Length. A single micro-learning unit should be at most 15 to 20 minutes. Each micro-activity takes the students about 3 to 5 minutes to finish. Teachers should design a micro learning unit in such a way that it transfers essential information to the students.

2.7.3 Design mini-class activities and assessment

Micro learning unit assessment is essential at this stage to reinforce information, correct misunderstandings, and thus affect future learning. The teacher breaks down students' units into various micro-related activities depending on the content they determined in stage two. Micro-related activities are categorized into different segments, including critical and creative thinking among students, problem-solving, and assessments.

2.8 Student Engagement

Over the years, researchers also found different conceptualizations and models of student engagement and how it explains with the help of models, and how it used have occurred further as used terms and different definitions (Fredricks &McColskey, 2012; Finn & Zimmer, 2012; Skinner & Pitzer, 2012). Some people considered students' engagement as their participation in classroom activities but in actual it is more than that. Students'

engagement is usually considered as student thinking, feeling, and doing during learning (Zepke, 2010).

Axelson and Flick (2011) defined the term engagement that "It is an important means by which students develop feelings for their peers, professors, and institutions that give them a sense of connectedness, affiliation, and feeling of belonging, while at the same time offering great opportunities for learning and development." Engagement is recognized as a set of connections between student and school community; learner and peers; student and the adults; teaching and learner and learner; and lastly, the student and syllabus (Yazzie-Mintz, 2010).

According to a study done by Axelson and Flick (2011**)** Student engagement is the involvement of students in studies and their behavior toward their learning environment. Students' level of motivation, attention, interest, inquisitiveness, passion, and participation in their learning process. Can they get all the information and understanding of the program/content given to them? Can they achieve learning aims? Have they progressed in their studies? Etc.

Kuh (2003) defined the term students engagement as "the time and effort learners devote to classroom activities that are factually linked to desired outcomes of college and what institutions do to persuade students to participate in classroom activities." student engagement refers to the student broad intended experience to encompass academic and non-academic aspects including "active learning and participation in academic activities, communicate well with academic staff, connection through educational experiences, and creating feeling authorized and supported by university learning communities" (Coates, 2007). Moreover, Barkley (2010) used two words to describe student engagement one is

“passion” and the other is “excitement” and further suggested a student engagement model. This definition provides a one-aspect student engagement approach while improving their learning.

Fletcher (2015) defined student engagement as “any sustained connection a student has towards any approach to learning, school or educational institution”. Student engagement is the standard of successful classroom instruction (Fletcher, 2015) and a criterion of educational or institutional quality (Axelson and Flick, 2011). Parsons et al., (2018) also highlighted a substantial association between students’ engagement and their academic achievement.

2.9 Types of Student Engagement

Fredricks et al. (2004) defined student involvement in three large dimensions like (a) behavioral, (b) cognitive and (c) emotional, as an evolving and multi-dimensional structure. Behavioral includes students' active participation in academic and extracurricular activities, second dimensional consist of student affective reactions like positive and negative response towards teachers and peers. While the third cognitive engagement includes learner’s readiness to learn difficult skills.

Schindler et at., 2017 examined the main three types of engagement (a) Emotional, (b) cognitive, and (c) behavioral and they suggested following nine indicators.

a. attitudes, interest, and ethics

b. inspiration

c. persistence

d. deep processing of knowledge

e. sense of association

f. interaction with others

g. participation in learning activities

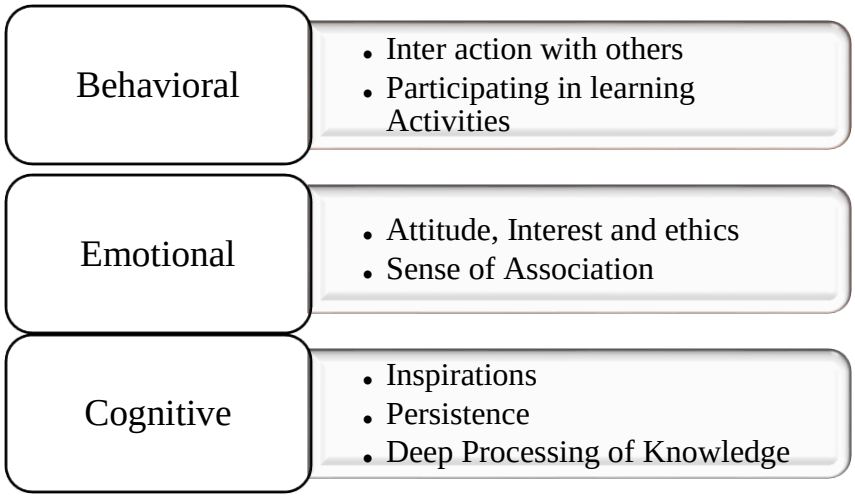

Figure No 2.1 Student Engagement Types and Indicators by (Schindler et al., 2017)

2.9.1 Behavioral

Yu et al., (2019) indicated that behavioral engagement is the extent to which students take part in classroom activities. Furthermore, it is also relevant to the extent to which students may put their efforts into tasks as well as how many classes they are attending. Furthermore, Shernoff (2013) indicated that behavioral engagement is also related to how students behave in class, their interest in tasks, and their participation in learning tasks and

activities. There are three dimensions of behavioral engagement among students which are: behaviors, participation, and interest of students (Nguyen, Cannata & Miller, 2018).

According to Kahu (2013), behavioral engagement refers to the degree to which students actively participate in learning activities. Student participation in learning activities needs some aspects of behavioral engagement, which include such as effort and time spent (Kuh 2003; Lam et al. 2012; Lester, 2013) and built relationships with staff, department, and companions (Zepke and Leach, 2010; Wimpenny & Savin-Baden, 2013).

Several definitions focused on active involvement in the classroom and academic activities, including asking good questions, awareness, persistence, concentration, and contribution to class discussion (Skinner et al., 2009a). Many definitions are similar between several types of behavior, such as active participation of the students in academic and non-academic activities at the school level. In this regard, much research regarding classroom involvement in classroom investigations proves differences in behavioral typology (Fredricks et al., 2004).

2.9.2 Cognitive

According to Pohl (2020) cognitive engagement is to measure it directly but its indicators can be observed in students through, utilizing surveys/questionnaires, discussing with students, and by observing students directly or in real-life situations. Cognitive engagement involves students' interest in learning, motivation towards learning, setting learning goals, and using self-regulated learning techniques. Students have desired to invest and make effort to complete the task on time, and how long they continue (Richardson & Newby 2006; walker et al., 2006). Cognitive engagement is directly associated with the academic as well as behavioral engagement of students. Pohl (2020) in

his study indicated that cognitive engagement, academic and behavioral engagements are directly associated. Cognitively engaged students within the classroom showed good results, performed better in classroom activities, completed the assigned tasks on time, and were more likely to attend classes regularly.

According to Appleton (2006) defined the term cognitive engagement refers to measures what extent of learner's homework completion, attendance of students, active engagement in academic and non- academic activities, and discussion in classroom. The idea of cognitive engagement includes multiple aspects like flexibility to solve real word problems, willingness to work hard, positive attitudes towards hardships and knowing how to face failure. In this regards Skinner and Pitzer (2012) defined similar concepts of cognitive engagement enclose focus, attention, participation, and willingness to think and go beyond what is needed. Moreover, cognitive engagement is dependent on the task at hand, it determines the student's freedom. For example, students working in class groups and engaging in discussions kept searching relevant material, communicating ideas, and listening to a lecture all these include various levels of engagement because it provides various levels of autonomy to students (Rotgans & Schmidt, 2011).

2.9.3 Emotional

Some definitions of emotional engagement primarily clarify the concept of student's "positive" and "negative" feelings, feedback in the classroom, school, and the interaction with the teacher and peers (Appleton, 2006), while others ideas it is recognized with the institution, or belonging and valuing it like an appreciation of success in school outcomes, student attitudes, feelings towards school, teacher, work; liking and disliking school; feeling sad or happy in school (Fredricks et al., 2004). Emotional engagement is also

associated with the cognitive and academic achievement of students. It is also indicated that a relationship between emotional engagement and cognitive engagement is cyclic, not linear or EE is a result of CE. Moreover, the importance of emotional engagement for cognitive engagement and academic achievement was also reported by the researcher (Manwaring, 2017). Students' motivation also builds emotions, including values and interests (Fredricks et al., 2004). When learners possess emotional engagement, they take an interest in learning and attending classes in schools (Lam et al., 2012).

Lester (2013) clarifies the concept of emotional engagement by defining a learner's affective responses toward learning. Similarly, aspects of emotional engagement include values, interests, and attitudes toward learning and assessing the feeling of attachment in a learning society (Kahu, 2013; Witkowski & Cornell, 2015; Fredricks et al., 2004). however, emotional engagement provides insight into show-how, learner's experience about a relevant topic, pedagogies, and teachers in learning.

2.9.4 Social

Social engagement is another type of student engagement. Social engagements are defined as a level to which learners put effort into their learning and improve the quality of social interaction with teachers and peers, comprehend information, and create relationships while learning.

According to Lu and Churchill (2014), social engagement refers to actively participating with others by interacting and sharing ideas and knowledge through collaborating on learning activities and tasks that have a meaningful purpose of co-constructing information and creating a positive feeling as a sense of learning community.

Palincsar (2003) emphasized the need for social dimensions such as social interaction and participation in the learning community. He goes on to say that these socio-emotional factors build a collaborative learning environment which is essential for the communicative exchange of knowledge and make collective groups resolve intellectual conflicts through dialectic nature which is possible through participation.

The Community College Survey of Student Engagement has its definition of engagement. It refers to engagement as active participation in meaningful educational activities that precisely measure the students' perception based on items including "time and energy" which students spent on these educational activities (McClenney, 2007). However, several research studies support traditional insight about engagement; the more academically and socially engaged students in learning, the more successful better changes transfer through experiences (Laanan, 2006; Flaga, 2006).

2.10 Characteristics of Student Engagement

Edunindex News (2020) , a website of an educational news that provides online books reviews, news and punlished articles on particular topics like, education, learning, literature, news analysis, news update, and training etc. In the article student enagagment in learning and teaching discussed twelve attrbutes or charactersiticsof student enaggement. These are follows:

2.10.1 Self Determination

2.10.2 Peer Interaction

2.10.3 Autonomy

2.10.4 Problem solving

2.10.5 Collaboration

2.10.6 Self Efficacy

2.10.7 Curiosity and interest

2.10.8 Satisfaction

2.10.9 Immersion in learning task

2.10.10 Enjoyment

2.10.11 Positive attitudes

2.10.12 Willingness to respond

2.10.1 Self-determination

It means the teacher takes control of organizing; setting goals and timelines, deciding what students want to learn and when they must give information regarding their desirable course.

2.10.2 Self-efficacy

The self-esteem of a teacher needs to be high, they must belief in their abilities, capabilities, persistence and be prepared to take risks.

2.10.3 Autonomy

Teachers should encourage students to be able to work alone, or with peers, make their own decisions, independent of the teacher.

2.10.4 Collaboration

Teacher facilitates students and fully involves them in groups so that they can work with others to create something and make decisions with peers.

2.10.5 Peer interaction

Teacher needs to set standards to be achieved for students to enhance their connecting, communicating skills as well as their sharing with peers.

2.10.6 Problem-solving

Teachers welcome the challenges, errors, and mistakes regarding the action in which students face failure therefore they enhance the students' abilities to sort out challenges independent of teacher and asking for their assistance.

2.10.7 Immersion in learning tasks

Teachers modify the interest, curiosity and learning involvement of students.

2.10.8 Curiosity and interest

Students are motivated to learn and seek out information by their teachers, who creates curiosity and interest in studies.

2.10.9 Enjoyment

Student's learning is regarded as fun in making them active and versatile, which is better at increasing student's attention towards learning new things.

2.10.10 Positive attitude to learning

Students are motivated to be self-organized and willing to participate in the learning process.

2.10.11 Satisfaction

One of the main objectives of learning is to make students happy psychologically, by giving them mental satisfaction so they can quickly adapt to understand things with their learning experience.

2.10.12 Willingness to respond to challenges

Students' participation in class must considers and concerns by enabling them to enjoy being questioned, problem-solving and when expected to do better next time.

2.11 Student Engagement Strategies for a Captivating Classroom

Best (2020) suggested following twenty student engagement strategies for a captivating classroom.

a. Ask good questions
b. Encourage students to share their work
c. Encourage friendly competition
d. Use mixed media
e. Gamify learning
f. Laugh together
g. Start topic with introductory hooks
h. Emphasize inquiry and discovery
i. Allow for think time
j. Be personable
k. Emphasize group work and collaboration
l. Focus on student interest
m. Connecting learners to the real world

n. Give students a choice to say

o. Get student moving

p. Read the room

q. Task with checkpoint

r. Brain breaks activity

s. Shake things up

t. Fill “inactive time”

Section 2: Models and theories on Bite-sized Teaching Strategy and Student Engagement

2.12 Micro Learning Design Model by Dillon (2021)

An online organization named Logic Earth Learning Service published an article about Micro learning or Bite-sized learning model-8 steps of success proposed by of Dillon (2021). The following diagram explains these steps of bite-sized or micro learning design model.

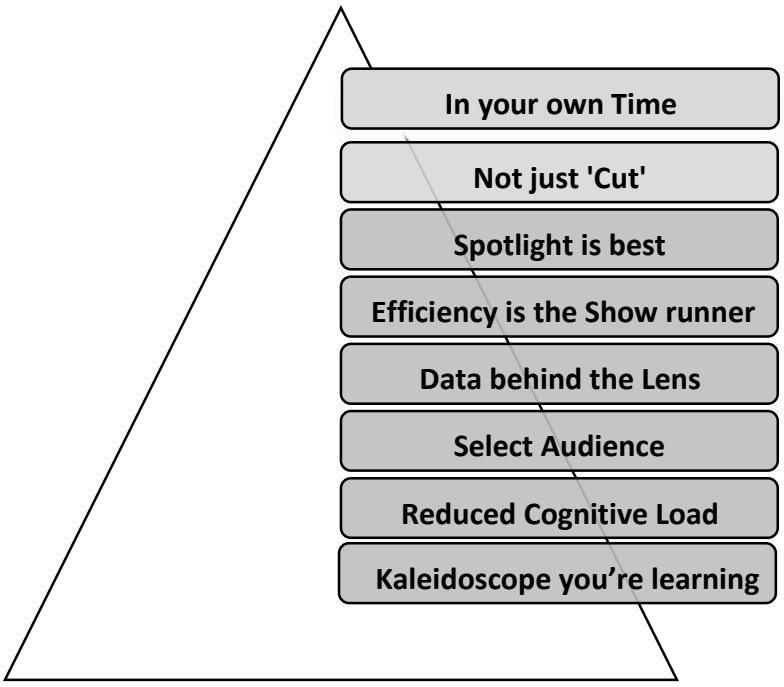

Figure No2.2 Micro Learning Design Model by Dillon (2021)

Dillon (2021) presented the following eight steps of success as Bite-sized or micro learning, one of the modern teachings.

a. In your own Time
b. Not just 'Cut'
c. Spotlight is Best

d. Show runner efficiency
e. Data behind the Lens
f. Select Audience
g. Reduced Cognitive Load
h. Kaleidoscope your Learning

2.13 A Model of Micro Teaching by Wahyu et al. (2016)

Wahyu et al. (2016) presented a model named, Microteaching Lesson Study Model (MLSM) to highlight the important aspects of microteaching. This model explains three main stages of microteaching lesson study as follows:

2.13.1 Plan

In the first stage of microteaching model students are divided into groups of four and planned the lesson together. In this stage students share these ideas about lesson plans, collaborating in teaching aids, improving assessment preparation, and lastly building their confidence.

2.13.2 Do

In the second stage of microteaching modeling teacher performed as a role of modeling teacher and presented the lesson while the rest of the class observed the lesson.

2.13.3 See

The last stage of this model is called reflection which gave positive feedback on the lesson to the modeling teacher.

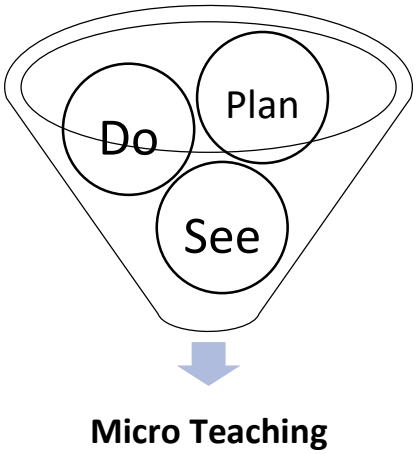

Figure No 2.3 A Model of Micro Teaching by Wahyu et al. (2016)

2.14 A Model of Bite-sized Teaching by Manning et al (2021)

This Concept of bite-sized teaching is based on the research of Manning et al. (2021) that how to engage learners, how to improve the learning process in postgraduate medical education and how to measure the effects of BST (Bite sized teaching). The term BST strategy integrates bite-sized learning fundamentals and mutual learning. It takes advantage of many, well-defined talks given by the students as well as delivered within the staying syllabus. This strategy reduces 40-to-50-minute teaching session with 8 minutes (4 to 5) small focused or micro teaching session design and delivered by students. Below table explain the components of BST. These are:

a. Brief focused Learning unit
b. Distilled, Relevant Content
c. Refined presentation and Delivery
d. Peer Teaching

Table No. 2.1

D*escription of Elements of Bite-sized Teaching*

Components	**Description**
Brief focused Learning unit	Different, 4 to 5 brief (8)-minute micro or small focused learning conversation threaded thematically restore traditional lesson.
Distilled, Relevant Content	Give refined & Relevant Content (RC) which focused only on one specific learning objective. Categorized the refined relevant content in knowledge schemas for students.
Refined presentation and Delivery	Order use of multimedia, audio visual aids (AVA) to capture the attention of learners during refined presentation and conveyance.
Peer Teaching	Inhabitant lecturers create and promote talks to listeners of peers/companion

Bite-sized learning is the process of rebuilding and deconstruction ideas and facts. They use these components, which focus on a single construct and give a focused Bite-sized Teaching talk. Each BST talk has focused on simple and short key instruction objectives. It is manageable for lecturers with a detailed area of domain quickly deconstruct into its different components as well as explains a single teaching point. The benefit of BST is to remove irrelevant and non-essential content with the help of their faculty coach. It is the process of refined content and, considering students' expertise, finding out the gaps in students' understanding of relevant content is dividing hours of lecture into 3 to 4 parts (8) minutes or distilled content which is essential and relevant to the students. After that, students use audio-visual aids for presentation and refined delivery. The topic is presented not only in text form but also representable in pictorial for the learners, which is helpful

for them to retain knowledge in their learning; at the end, resident lecturers create and deliver talks for listeners of peers. Below figure depicts the process of bite-sized teaching talk.

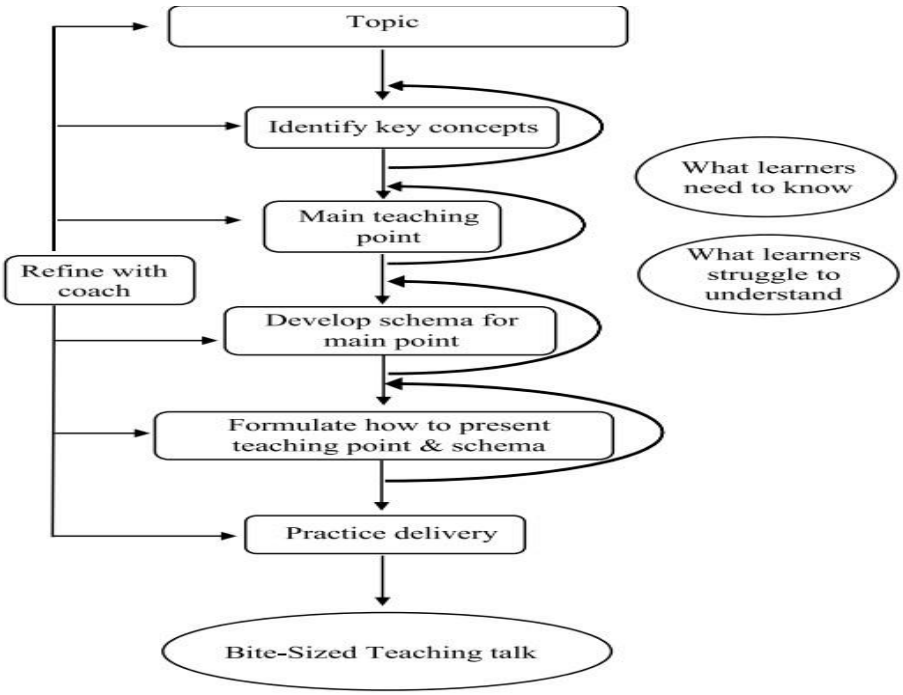

Figure No 2.4 The process of bite-sized Teaching (BST) Talk

2.15 Applying Micro learning Principles to Traditional Learning by Middleton (2021)

An online organization named Logic Earth Learning Service published an article about applying Micro learning principles to traditional learning proposed by Middleton (2021). The following diagram explains these principles of micro learning.

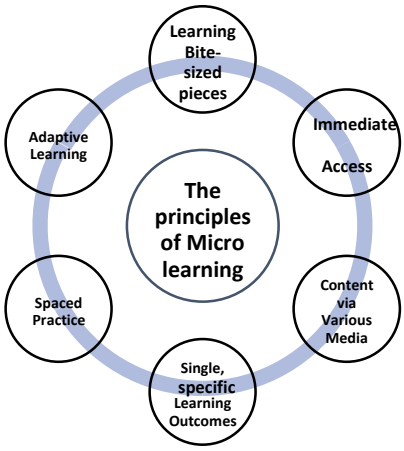

Figure No 2.5 The Principles of Micro Learning by Middleton (2021)

Middleton (2021) presented the following six principles of micro learning to bring innovation and change in traditional learning.

a. Learning bite-sized pieces

b. Immediate access

c. Content via various media

d. Single, specific learning outcomes

e. Spaced practice

f. Adaptive learning

2.16 Student engagement Model

The student engagement model is described by Appleton et al. (2006) based on observable engagement, and internal engagement. The model explains four basic components of student engagements. These are:

a. Academic engagement

b. Behavioral engagement

c. Cognitive engagement

d. Effective engagement

In observable engagement they focus on academic engagement and behavioral engagement. Further they have identified eleven elements around observable engagement. These are as follows:

a. Task on time

b. Credit hours towards graduation

c. Homework completion

d. Engaging in class activities

e. Grade

f. Standardized test performance

g. Passing basic skills tests

h. Attendance

i. Participating in school activities

j. Being on time

In internal engagement they focus on cognitive engagement and effective engagement. Further they have identified seven elements around internal engagement. These are as follows:

a. Perceived relevance of schoolwork

b. Personal goals and autonomy

c. Values of learning and success in school

d. Identification with school

e. sense of belonging

f. School Connectedness

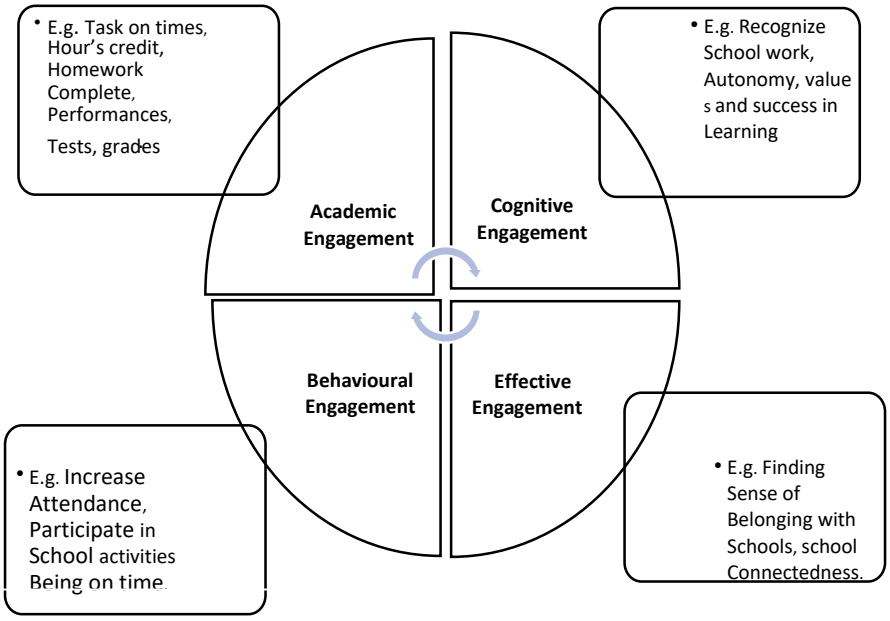

Figure No 2.6 Student engagement Model (Appleton et al., 2006)

2.17 Nora's (2006) Student Engagement Model by Lucero et al. (2017)

Lucero et al. (2017**)** examined the persistence effect of students in higher education at flagship state. They presented the framework of student engagement model (SEM)

proposed by Nora and Ramirez (2006). In the context of this model explains six major components. These are as follows:

1. Pull factor which is also called precollege
2. Sense of purpose & loyalty of institutions
3. Experiences about academic and social
4. Analytic (cognitive) and non-analytic (non-cognitive) outcomes
5. To determine the goals
6. Persistence

They recognized these six major components as the fundamental and the most essential components of Nora and Ramirez (2006) student engagement model. Further they have interested in identifying the category of third and first element "pull factor" and "Academic and social experiences" with several factors. These are as follows:

a. Academic and mentoring interaction among staff members and faculty
b. Class participation/ involvement
c. Peer teaching/ interaction among peer group
d. Institution climate
e. Validating experiences

2.18 Auckland Student's Engagement Model by Hayam-Jones (2016)

Hayam-Jones (2016) presented a model with the name the Auckland student engagement (ASE) model. The model is quite simple in teaching and learning but highly

effective and dynamic in process. In the context of this model explains the interaction across three domains of engagement. Those are as follows: Behavioral, Cognitive and Emotional. Further researchers identified four main potential confounding factors of student engagement in classroom. These are as follows:

a. School condition
b. Support of the peer
c. Support of the teacher
d. Background of the student
e. Academic achievement

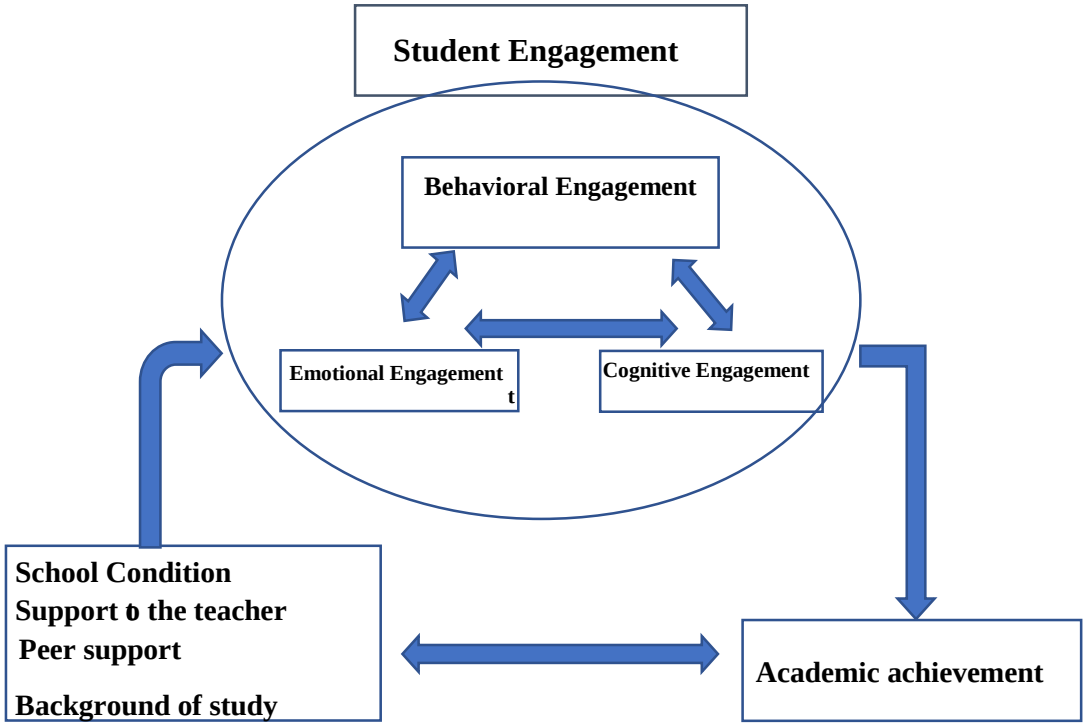

Figure No 2.7 Auckland Student Engagement Model by Hayam-Jonas (2016)

2.19 The Student Engagement Model by Wang et al. (2016)

Wang et al. (2016) have given an idea about how to engage learners, encourage students' interaction and participation in learning, and improve the learning process through activities in the classroom. Student engagement defines the degree of confidence, interest, attention, and excitement that learners exhibit when they are involved in the educational process. The measurement of student engagement to enhance math and science engagement among the few and poor (low-income) youths in STEM courses. Further, they used to examine a transparent Bi-factor model of secondary school students' math and science engagement. They investigate the effectiveness of instruments for student engagement in science and math for teachers and middle and high school students in the United States. A sample of 3883 students from grades 6^{th} to 12^{th} enrolled, and the teacher's sample includes 65 from middle and 65 teachers from high school. The student-report engagement scale (SRES) was used for students. Student engagement measurement invariance test by SES level was evaluated through Confirmatory Factor analysis (CFA). Their study compared bi-factor models along second-order CFA for the student's reports items. Four types/kinds of engagement are as follows:

a) Behavioral

b) Emotional

c) Cognitive

d) Social

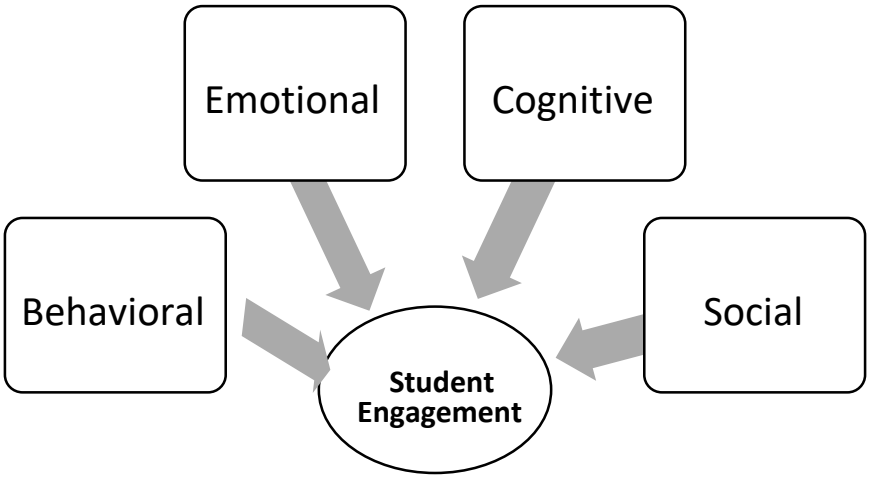

Figure No 2.8 Types/Kinds of student Engagement Model (Wang et al., 2016)

2.20 Model for Student engagement by Korhonen et al. (2019)

Korhonen et al. (2019) presented a model for student engagement based on the relationship between students and their education context. They developed a multidimensional process model of student's engagement. Further they have identified six dimensions of student engagement. These are as follows:

a. Meaning of studies

b. Academic skills

c. Participation

d. Social practices

e. Identity

f. Sense of belonging

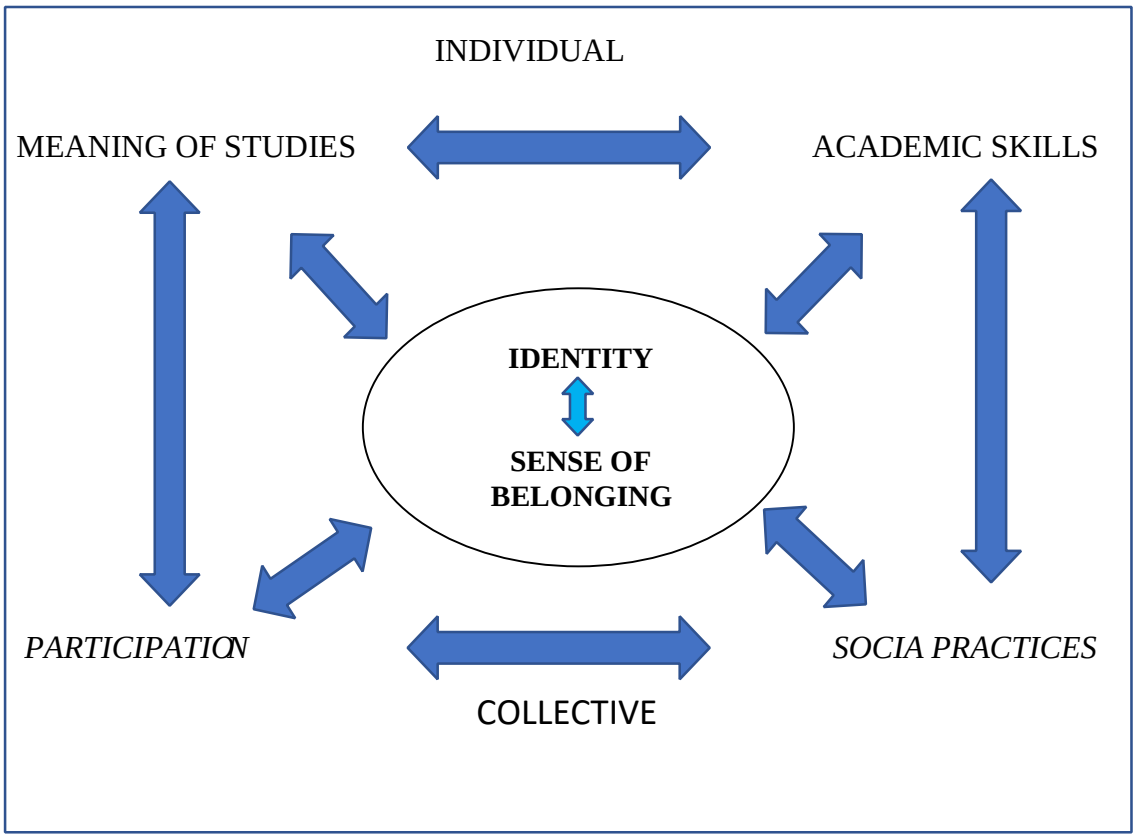

Figure No 2.9 Model for Student Engagement (Korhonen et al., 2019)

Section 3: Review of Related Researchers

Science teacher's study showed much concern in science education (Okebukola, 2005). Science as a subject has presented a challenge for teachers and students to be taught and learn. Content, skills, and inquiry process to understand science is also a challenging task for students, as it also involves the time and energy of the students to think critically (Hadzigeorgiou & Schulz, 2019).

Now trends have changed from outdated versions and dimensions to the latest version and dimensions, and simple changes happened in the field of natural sciences (Okebukola, 2005) examined research in science teaching in Nigeria. Nwagbo (2010) highlighted many

issues that need to be addressed in the learning faced by students, particularly in science subjects, towards accomplishing instructional goals.

Oludipe (2014) identified that the main weakness in our schools and education system is the inflexibility presented in our science education. The nation's scientific and technological development depends on science education, which plays a vital role in the lives of individuals (Alebiosu & Ifamuyiwa, 2008).

Godec et al (2017) point out that engagement refers to enjoyment, interest, and motivation toward learning science. Moreover, engagement is the degree of student active participation and intensity in science-related activities (Atikson & Mason, 2014). Meanwhile, we have interpreted student engagement with the intensity of such involvement in classroom activities (Barriault and Pearson, 2010).

According to Jimerson, Campos, and Green (2003), the engagement model is based on these three dimensions (a) Affective involves emotions of school institutions, teachers, and peers, for example, supportive towards fellows. (b) Students' behavior involves noticeable performance and effort; for example, students actively participate in academic and extracurricular activities. (c) The third component of cognitive involvement relates to the learning investment of students. It includes aspects like the ability to spend time understanding and mastering challenging work using suitable learning techniques (e.g., the application of growth rather than memories by students).

Audas and Willms (2010) presented another engagement model consisting of two dimensions (a) Behavioral and Psychological. The behavioral aspect is almost the same for all, which is related to participating in school-related activities, for example, attending class and completion, completing homework, and participating in extracurricular activities such

as sports. In comparison, psychological aspects involve a sense of belonging, interactions with teachers and peers, and learning outcomes.

Schaufeli et al. (2012) introduced three characteristics but defined them as dedication, vigor, and Absorption. Vigor includes Persistence, strength, and effort in the face of challenges, Absorption involves Absorption of learning tasks and events, and dedication includes Inspiration, pride, and passion for academic research. In addition, the fourth dimension of engagement has been suggested by (Appleton, 2006; Reeve &Tseng, 2011). Appleton (2006), which covers aspects such as completing assignments and working time, referred to the fourth dimension as 'academic participation.' However, in most previous research, this (i.e., academic) dimension has been integrated into behavioral participation. On the other hand, Reeve, and Tseng (2011) have suggested the agent dimension as a new element of the interaction structure; however, much further research is needed to validate this different concept. Furthermore, teaching strategies influence student engagement by creating a learning environment (Bond & Bedenlier, 2019; Fredericks et al., 2016). In Nigeria, senior secondary level schools offered biology as a science of life, capturing the attention of both science and arts students (Nwosu, 2006). Student achievement and its effects on identified complex concepts in Biology in senior secondary school Nigeria. The result concluded that little research finds out the difficulty of concept mapping as a teaching strategy in biology (Agboghoroma & Oyovwi, 2015).

Oludipe (2012) discussed in his research work the effectiveness of cooperative learning strategy in introductory science courses on Nigerian secondary-level students' attitudes towards learning. In his study, the quantitative method and quasi-experimental design were

used. The result indicated that cooperative learning strategies enhanced students' attitudes toward science more than lecture methods.

Tanner (2013) suggested twenty-one equitable teaching strategies that designed learning environments in biology for the students, which helps students to participate actively. All students provide opportunities to verbally participate, given time to think and share their ideas which are developed based on their constructed knowledge of biology and welcomed into the intellectual discussion in the classroom, promoting student engagement in the classroom learning environment. In the constructivist approach, student intention has been maximized by the teachers by making structured classroom environments and by using equitable teaching strategies in the classrooms, but learning is the student's task (Bransford, Brown & Cocking, 2000; Matthews, 2015).

In this regard, Tanner (2013) suggested key variables by promoting a learning environment for the student. As such, encouraging students to participate, students' prior experiences, motivation towards learning, and increased confidence through group interaction in the classroom support them in learning.

In this modern era, possibility to learners to construct their information through several factors, such as classroom culture, social interaction, dialogue, argumentation, representation for the use of modeling and analogies, showing interest and motivation in learning and applying new knowledge to new contexts (Tytler et al., 2013; Hadzigeorgiou, 2015).

Day-by-day teaching of the 21st century is persistently demanding digital teaching technologies and the increasing diversity of student engagement in teaching and learning. Some pressures push teachers to enhance their wide range of competencies and skills to

use the latest methods persistently, techniques, approaches to teaching, and learning styles (Tait, 2009). In this regard, one of the possibilities is that effective learning outcomes in science subjects are taught to the students by adopting active teaching methods or strategies in the classroom (Velasco et al., 2012).

Alqurashi, Gokbel, and Carbonara(2017) analyzed microlearning with three elements: Content, pedagogy, and technology. Although this triad is the conscious congruence of these three educational elements, research studies treat them as separate entities. Therefore, there is a need to align learning experiences for the effectiveness of micro-learning and better learning outcomes. Moreover, it was found that short learning content and short activities enhance students' satisfaction, increase engagement, and positively impact the learning environment.

In their research, Fredricks et al. (2016) discussed how to know about student academic achievement and long-term participation in math and science courses. This study used qualitative methods and surveys for teachers and students of Pittsburgh's middle and high school districts. The sample consisted of 106 students from Grades) 6th to 12th) and 34 teachers. The result concluded that to develop and validate a student engagement scale to measure student academic achievement and long-term participation in math and science courses.

A research study was conducted by Greene (2015) to know the relationship between domain knowledge and cognitive engagement among students. The result concluded that measurement of self-report scales was used for examining student perception of their motivation and engagement in science, technology, engineering, and mathematics (STEM).

According to Finn (2012), there are two dimensions of engagement (a) Behavioral and (b) Emotional. Behavior is related to participation in classroom and school activities. For example, doing assignments and responding to the teachers' questions. Emotional is related to identifying affective reactions like interest, Inspiration, and enthusiasm about topics.

Vaughan's other research (2014) investigated 'student engagement' and 'blended learning approach' to outline and support assessment activities. Further observed digital technology plays an influential role in increasing students' engagement in science courses as well as "Personal Response Systems" (PRS) include clickers that are used for learning like group discussion, group activity, and quiz competition prompts in Biology. The result concluded that they increase students' commitment to course concepts, leading to learner success and satisfaction through effective educational practices not only in higher education but also at the secondary level.

Heilbron, Lakhal, and Belisle (2021) investigated how teachers promote student engagement with the help of an innovative blended learning approach at the university level students. Further observed blended learning, i.e., synchronous and asynchronous activities. Therefore, the study proposed comprehensive ideas about teaching strategies and how they enhance student engagement in blended learning. Additionally, they classified student engagement dimensions (cognitive, behavioral, and emotional) linked with strategies. The result concluded that different digital tools engage emotionally and behaviorally undergraduate students. On the other hand, engagement cognitively and emotionally of graduate students targeted knowledge sharing in the classroom.

Cents-Boonstra et al. (2020) researched student engagement for students within lessons by applying Self-Determination Theory (SDT). The researcher found that using motivating

teaching behaviors, supports, and guidance in classroom activities for about ten to fifteen minutes showed students the highest level of engagement and focused on activating their students through working on assignments. In this regard, some students engaged in learning activities include making efforts and paying attention to assignments, while some students need to take an interest in learning activities (Biggs, 2012).

In trendy transferring knowledge existing in the textbook's material is needed to develop critical abilities among students. Nowadays, the importance of student engagement should contribute to the classroom for current and future success; active student involvement is essential (Quin, 2017).

Fitzgerald and Tisdell (2019) found that the teaching micro-content "bite-sized instructional videos" results significantly impacted high student engagement, positive feedback in the classroom, and improved confidence and interest in learning. Additionally, improve academic self-efficacy and performance. A recent study has noted that students' retention of knowledge declined after ten minutes in a traditional lecture (Bradbury, 2016). However, in every lecture at the beginning and the end, retention is the highest material. Short, focused material has been recognized as an effective target for improving student satisfaction and knowledge retention (Sawatsky et al., 2015).

Arjomandi et al. (2018) examined active teaching strategies and student engagements for diverse groups of students. In this study, an active teaching strategy refers to the intended complement rather than alternatives for traditional teaching methods and modes. This study highlighted the strong connection between active teaching strategy and student engagement for traditional students compared to non-traditional students, which shows the weak

relationship between them. Therefore, there is a need to design active teaching strategies for greater inclusiveness.

Koh, Gottipati, and Shankararaman (2018) examined the effectiveness of pedagogy-like bite-sized lectures used for students learning outcomes at the school of information technology. The findings of their study reveal that students learn better through bite-sized lecture, and teachers using these methods in the classroom to facilitate the comprehension of concepts among students proved that bite-sized lecture is suitable and offers many advantages over traditional lecture.

Summary

This chapter discussed the literature review based on three sections; the first section discussed the general introduction of the bite-sized teaching strategy and student engagement. The bite-sized teaching strategy is an instructional strategy in the classroom that incorporates bite-sized learning. Teachers have detailed learning material divided into three to four short, focused learning units on topics. Moreover, discussed student engagement means a level of confidence, interest, attention, and excitement that learner exhibits when they are involved in the educational process, which encourages the student's interaction and participation in learning activities. The literature reviewed the components, benefits, rules, and steps to promote bite-sized teaching strategies and types, characteristics, and student engagement strategies for a captivating student in the classroom. According to this chapter, the benefits of the bite-sized teaching strategy were huge due to which learners engage, motivate, and get involved. The benefits of bite-sized teaching or micro-learning for today's students produce a positive change.

The second section was based on theories and models of bite-sized teaching strategies and student engagement. Middleton (2021) presented the following six principles of micro-learning to bring innovation and change to traditional learning. The second model of student engagement was presented by Hayam-Jones (2016) with the Auckland student engagement (ASE) model, which explains the interaction across three domains of engagement. The following behavioral, cognitive, and further emotional researchers identified four main potential confounding factors of student engagement in the classroom. The third section was based on related research based on bite-sized teaching strategies and student engagement. This chapter defines the relationship between bite-sized teaching strategy and student engagement. This study highlighted the strong connection between new teaching strategies and student engagement for traditional students compared to non-traditional students, which shows the weak relationship between them. Therefore, there is a need to design new teaching strategies for greater inclusiveness.

Therefore, all the previous researchers examined the effect of inquiry, discussion, and teaching methods on different variables. Nevertheless, studies have yet to be examined in science subjects that have paid attention to the effect of bite-sized teaching strategies on student engagement at the secondary school level in Pakistan. Similarly, no scales or tools are available to provide information on essential teaching aspects.

A bite-sized teaching strategy offers an effective alternative to traditional lessons. This approach is rising in higher education but also needs to address science education at the secondary level in Pakistan. 'Bite-Sized Teaching strategy' means an instruction process teachers want to implement within the curriculum. These are just a few examples of research done in this field. The finding highlights different kinds of literature, using the

importance of student engagement in bite-sized teaching strategies. That is helpful in effective teaching and learning in science. However, only some people in Pakistan find out the effect of a Bite-sized teaching strategy on student engagement at the secondary level. Hence, there needs to be more literature regarding this area.

CHAPTER 3

METHODS AND PROCEDURES

The essential part of the research study was methodology which refers to the nature of the study, whether it is quantitative or qualitative. The researchers usually use the systematic investigation to accomplish things sequent and stepwise. The researcher analyzed many methods and techniques to select a particular methodology that may be relevant to the study. This chapter has integrated information about research procedures, research design, structure, target population, the process of tool validation and research instrumentation of the study, the procedure of pilot test reliability, sampling techniques, and the process of data collection used to carry out the research. The current study was conducted to investigate the bite-sized teaching strategy: effectiveness for student engagement at the secondary level. In this regard, the study focused on finding out the effect of bite-sized teaching strategy on student engagement among science students of ninth and tenth-class public sector school of Islamabad city Urban I and II.

3.1 Research Approach

The current study comprised a quantitative approach in nature involving the interpretation of the collected data using numbers. The researcher selected this approach because it enumerates the problem by creating numerical data which can be converted into useable statistics. Moreover, it facilitates more structured research patterns. That is why researchers have prioritized it. The researcher was interested in collecting data in a structured form, so

the researcher used this approach for the study because of the nature of the research objectives and hypotheses. There were three main objectives of this study set by the researcher, i.e., to explore the practices of bite-sized teaching strategy, to assess the level of students' engagement, and to find out the effect of 'bite-sized teaching strategy' on students' engagement at the Secondary level. Furthermore, the researcher used Statistical product and service solution (SPSS) to analyze collected data.

3.2 Research Design

The research design refers to a plan of action, design, and methods throughout the research to attain the objectives. Keeping in mind the analysis of objectives, the current study used a correlational type to determine the degree of association between variables. A correlational study aims to determine the interrelations among variables or to use these relations to make predictions (Gay, Mills, & Airasian, 2012). According to Baker (2017) the correlation is a statistical procedure to measure and describe the relationship or association between two variables. The researcher may not know whether the variables are related, or may suspect that one influences the other. In either case, no attempts were made to manipulate an independent variable in correctional design. According to Arbuckle (2013) a single-headed arrow denotes a cause to effect (regression model) between two variables. A double-headed arrow between two variables denotes a correlation between them. Therefore, the researcher was interested to observe the single-headed arrow to effect between the two variables.one-way association between bite-size teaching strategy and students’ engagement.

A survey method was used to find out the "Effect of bite-sized teaching strategy for students' engagement at the secondary level,” Correlation research is a significant in

surveys about educational research and refers to an effective investigation tool to collect data in relation to address educational problems (Gay, Mills & Airasian, 2006). Survey method was considered beneficial in social science studies are choose to employ. There are the different ways to collect the data through instrumentation. Further, in survey research studies, the process of information is to collect data from the participants by getting their responses through the numerically rated questionnaire in research projects. In survey researcher personally visited the field and collected respondents' responses.

3.3 Population

Population was based on Jazz smart schools of Federal Directorate of Education (FDE) which are facilitated the digital technology including (laptops, multimedia projectors, clickers, screens, UPS, and speakers) Therefore, the bite-sized teaching strategy can only be applicable to jazz smart schools. For the current study, the population was based on 2855 science students enrolled in (session 2021) at twenty-six secondary level schools of Islamabad City (Urban I & II) public sector. These include thirteen secondary level schools in Urban I and thirteen secondary level schools in Urban II of Islamabad City. Below table explains the population of the study.

Table No. 3.1

Total Number of Secondary School, and Science Students, Session (2021)

Sr. No.	Population/ (Secondary School)	N	Numbers of Students (Session 2021)
1.	Urban I	13	1392
2.	Urban II	13	1463
	Total	**26**	**2855**

The table No. 3.1 explained the number of secondary level schools in Islamabad City; Urban I, and II was 26 (Urban I secondary level school = 13 and Urban II secondary level school = 13). Numbers of Students enrolled in (Session 2021) was 2855 (Urban I Science students enrolled = 1392 and Urban II Science Students enrolled = 1463).

Source: - List of Jazz smart schools of Federal Directorate of Education (FDE) (See Appendix I).

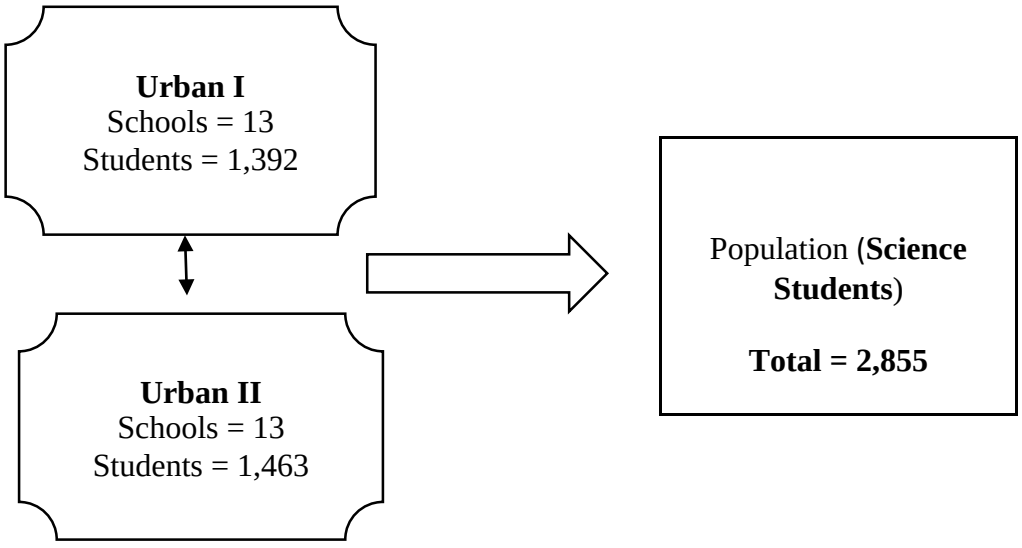

Figure No 3.1 Total Number of Secondary School and Science Students

3.4 Sampling Technique

Sampling is defined as selecting a group of persons from whom data will be collected for the analysis of study. In research if the figures of populations are huge then it would be crucial to manage and impossible for the researchers to make a sampling by visiting every one of the population. Fraenkel, Wallen and Hyun (2012) have defined sampling as the way of selecting people to put up in the research. A stratified sampling is a procedure or techniques of picking a group, classifying the determined class or category into smaller groups based on its existing group and then taking the same sample from the selected identified two sub-groups. Stratified technique has two kinds or type 1. Proportionate and 2. Disproportionate stratified technique. In proportionate stratified technique means the equal or alike sampling ratio is selected in each group, on the other hand disproportionate stratified sampling means not possible to maintain the same sampling ratio in each group.

There are several types of sampling which are being used for quantitative research in social sciences but considering the nature of the research, the researcher used only proportionate stratified random sampling techniques. For the application of proportionate stratified sampling technique equal numbers of respondent (secondary school students from Urban I and Urban II) was taken from both groups. It should be kept in mind that the data has been taken from two strata Secondary level School Urban I and Urban II of Islamabad. The researcher was taken equal ratio from both sides.

3.5 Sample Size

In the current study secondary level school of Islamabad city, 2855 Science students enrolled in the secondary school level. The researcher took the sample size by using

Krejcie and Morgan's (1970) table to determine sample size from a population (N=2855). According to above table, the sample size of the current study was n=386 of 2855; that is 13% of the population was extracted from each group which is 386 science students, 179 science students Urban I, and 207 science students Urban II. Hence, to start with 386 questionnaires were distributed among the sample participants. Out of 386 questionnaires, 363 questionnaires came back. So, 363 sets of questionnaires were selected for the final data analysis that involves a 94% rate of return. As the Secondary School level of Islamabad city (public) sector, 2855 Science students enrolled in the Secondary level school (See Appendix-L).

Table No. 3.2

Sample of the Study

Sr. No	**Science Students**	**No of Respondents**	**Rate of Return**	**Percentage**
1	Urban I	179	165	42%
2	Urban II	207	198	51%
	Total	**386**	**363**	**94%**

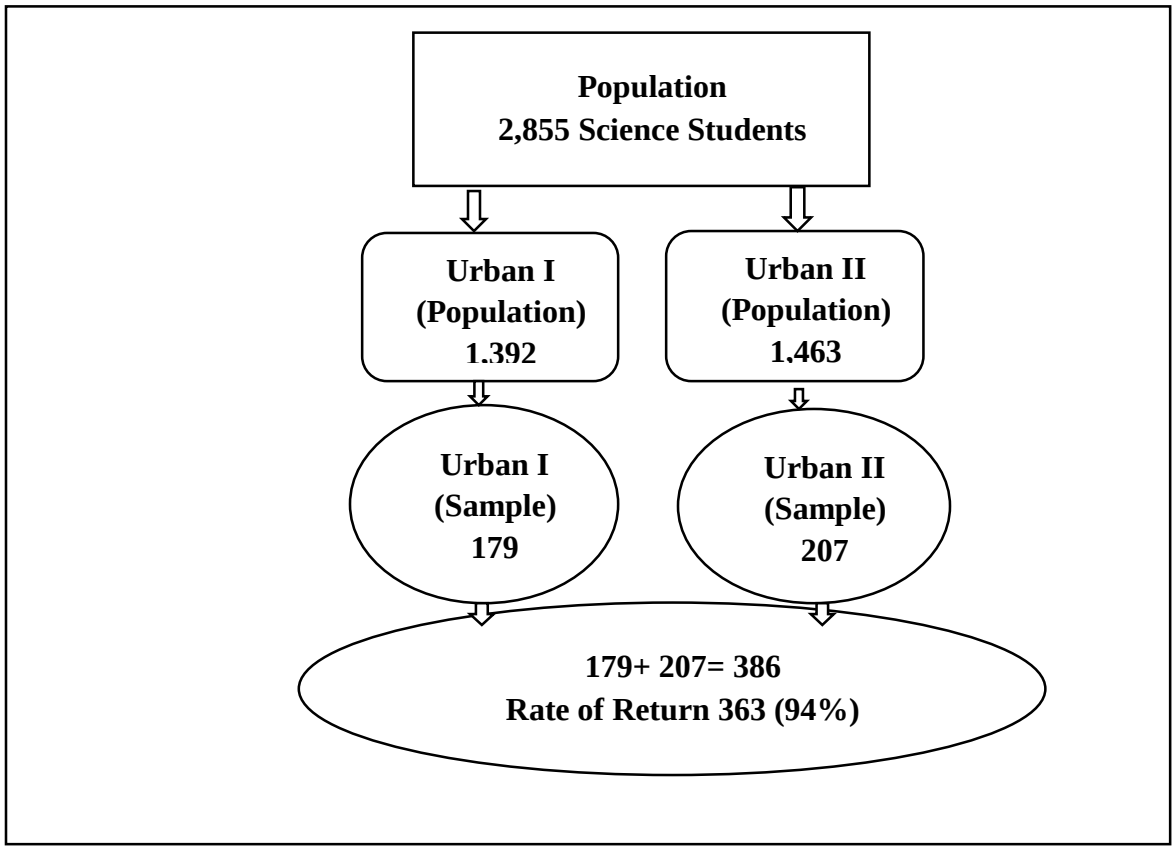

Figure No3.2 Sample size

3.6 Tool construction

In the current study the researcher kept in mind the objectives of study and used two sets of adapted close ended questionnaires that are relevant and comprehensive. Bite-Size Teaching Strategy Scale (BSTSS) and Students Engagement Scale (SES) were used. Research tool consisted of five sections: first section was based on demographic information, second and third was based on research variables, fourth section based on five-point Likert scale and last section based on scoring of research tool.

3.6.1 Demographic Detail Section

The research tool of demographic characteristic section which was related to the respondent's information. This section includes

a. Area of Schools,
b. Name of School / Sectors,
c. Class / Grade
d. Age.

The demographic characteristics are provided “Basic Information” about the respondent’s background.

3.6.2 Bite-Sized Teaching Strategy Scale (BSTSS)

The Bite-size teaching assessment scale was adapted from the work of Manning et al. (2021) to measure the “Effect of Bite-Sized Teaching (BST) on learner engagement”. The sections LU, RC, RD and PT sections were modified and the qualitative portion was excluded in order to adapt the tool in research study. The bite-sized teaching strategy scale was based on 36 items that comprises of four components, 1-10 items of learning unit, 11-19 items of relevant content, 20-26 items of refined delivery, and 27-36 items of peer teaching. The research instrument is appended as (Appendix L).

In survey pilot testing, is very helpful in avoiding misleading and inappropriate questions. The tool was used in different cultures and in different context. The tool needs validation process because the tool used in Pakistani education setup. Questionnaire was developed in English language, but in the process of validity of questionnaires it was recommended to translate questionnaires from English to Urdu. (See Appendix H). The reason to translate these tools was that the science students of ninth and tenth grade in secondary

level is not able to understand the questionnaires in English language. The researcher referred it to five experts and makes sensible changes by receiving feedback from the field of education to check tools validity. The tool was improved for final data collection in the light of the valuable suggestions provided by experts. Educational field experts further recommended that research tools were valid to measure bite-Sized teaching strategy at secondary level. After that, the worthy experts signed the validity certificate are attached (See Appendix G). The Cronbach alpha reliability of "Bite Sized Teaching Strategy Scale (BSTSS)" was found .972 f 4 sub variables of Bite sized Teaching strategy scale which shows that it is good and reliable research instruments for the study.it is important to address the reliability of research instrument for conducting research studies because collected data is dependent on it.

Table No.3.3

Description of Bite-sized Teaching Strategy Scale (Before Pilot Trial)

Scale	**Sub-variable**	**Item Coding**	**Items**
Bite-sized Teaching Strategy Scale (BSTSS)	Learning unit	LU1-LU10	10
	Relevant content	RC1-RC9	9
	Refined delivery	RD1-RD7	7
	Peer teaching.	PT1-PT10	10
Total Items			**36**

Table No. 3.3 presented the items pertaining to 'Bite-Size Teaching Strategy Scale' had four sub-variables. The total number of items in Bite-Size Teaching Strategy Scale (BSTSS) was 36.

3.6.3 Students Engagement Scale (SES)

For assessing students' engagement researcher has adapted a scale developed by Wang et al. (2016) to measure "The math and science engagement Scale". The sections Cognitive, emotional, social and behavioral sections were modified. Students Engagement Scale (SES) was based on 32 items that comprises on four components, 1-8 items of behavioral, 9-17 items of emotional, 18-24 items of cognitive and 25-32 items of social. The research instrument is appended as (Appendix L).

The tool was used in different cultures and in different context. The tool needs validation process because the tool used in Pakistani education setup. Questionnaire was developed in English language, but in the process of validity of questionnaires it was recommended to translate questionnaires from English to Urdu. (See Appendix H).

The reason to translate these tools was that the science students of ninth and tenth grade in secondary level is not able to understand the questionnaires in English language. The researcher referred it to five experts and makes sensible changes by receiving feedback from the field of education to check tools validity. The tool was improved for final data collection in the light of the valuable suggestions provided by experts. Educational field experts further recommended that research tool were valid to measure student engagement at secondary level. After that, the worthy experts signed the validity certificate are attached (See Appendix G).

The Cronbach alpha reliability of the "Student Engagement Scale (SES)" was found .959 of 4 sub variables of SES which shows that it is good and reliable research instruments for the study.it is important to address the reliability of research instrument for conducting research studies because collected data is dependent on it.

Table No. 3.4

Description of Students Engagement Scale (Before Pilot Trial)

Scale	Sub-variable	Item Coding	Items
Students Engagement Scale (SES)	Behavioral Engagement	BE1-BE8	8
	Emotional Engagement	EE1-EE9	9
	Cognitive Engagement	CE1-CE7	7
	Social Engagement	SE1-SE8	8
Total Items			**32**

Table No. 3.4 presented the items pertaining to 'Student Engagement Scale' had four sub variables. The total number of items in Student Engagement Scale (SES) was 32.

3.6.4 Description of Five Point Likert Scale

In Likert scale, scores can be rated on five points. It is used when the participants are asked to answer all statements on the Five-point Likert Scale. Below table mentions the description of five-point Likert scale.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

3.6.5 Scoring of the Research Tool

Student Engagements Scale (SES) was adapted by the researcher to measure the level of student's engagements and rated on 5 Point Likert scale. This scale has the following five points these are mentioned below:

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree).

Further, the responses were scored by calculating the scores obtained by the respondents. 22 items are in student engagement scale. So, the minimum possible score was 22 (1 x 22 = 22) and the highest possible score was 110 (5 x 22 = 110). This range (12-110) was divided into three sections as Below Average, Average and Above Average. The scoring of the responses to calculate the level of student engagement was based on the following division:

Score 22 – 51 = Below Average

Score 52 – 81 = Average

Score 82 – 110 = Above Average

Table No. 3.5

Scoring for the Level of Students Engagement

Variable	Level of Student Engagement	Score
Student Engagement	Below Average	22 – 51
	Average	52 – 81
	Above Average	82- 110

3.7 Validation of Instruments

The termed Validity means “a test is valid what it is supposed to be measured". The researcher referred it to five experts and makes sensible changes by receiving feedback from the field of education to check tools validity. The tool was improved for final data collection in the light of the valuable suggestions provided by experts. Educational field experts further recommended that research tools were valid to measure bite-Sized teaching strategy and student engagement at secondary level. After that, the worthy experts signed the validity certificate are attached (See Appendix F).

Table No. 3.6

Experts Suggestions in Tool Validation

Sr #	Expert Name	Designation	Suggestion
1.	Dr. Imran Yousuf	Chairperson, Department of Education	He had Suggested to add demographic information write area of school. The suggestion was followed by the researcher.

2.	Dr. Qaisara Parveen	Assistant Professor Department of Education	She had suggested logical sequence of items after that she validated questionnaires.
3.	Dr. Sheikh Tariq	Assistant Professor Department of Education	He had recommended tools for translation and after checking deeply he validated questionnaires.
4.	Dr. Humaira Akram	IRA Department of Education	She had suggested eliminating repetition of Items. Validate tools without declaring further amendments.
5.	Dr. Jameela Ashraf	Assistant Professor Department of Education	She had suggested improving grammatical and languages mistakes in a few items.

3.8 Translation of Tool

Questionnaires were developed in English language, but in the process of validity of questionnaires it was recommended to translate questionnaires from English to Urdu. The reason to translate these tools was that the science students of ninth and tenth grade in secondary level were not able to understand the questionnaires in English language. This effort to translate the tool in Urdu language made tools simple and easier and clearer for

their participants. For this purpose, it was consulted with the secondary school teacher. Certificate of tool translation is attached (See Appendix-H).

3.9 Pilot Testing

Pilot testing was administered to highlight the ambiguities in the tool. For pilot testing the researcher needs to check the validity and reliability of the questionnaire. For this purpose, the data was collected from two schools from Urban I IMSG (Islamabad Model School for Girls) VI-X, P.E G-5 and IMSG (Islamabad Model School for Girls) VI-X, G-8/2) two schools from Urban II IMSG (Islamabad Model School for Girls) I-X, G-9/1 and IMSG (Islamabad Model School for Girls) VI-X, F-11/1) category were selected for pilot trial. 40 questionnaires were given to secondary science students from Urban I and Urban II. 40 questionnaires were returned from the students for pilot trial, and was not included in the actual study sample. In this way 40 questionnaires with a 100% rate of return were analyzed. Researchers analyzed the data through Statistical product and service solution (SPSS) 22nd version.

3.10 Reliability of the Instruments

For concerned study the researcher was administered tools to forty science students at secondary level schools that were selected for pilot testing. After getting their responses on 40 questionnaires, data was collected through pilot trial and computed through Statistical product and service solution (SPSS) 22nd version. 68 items were formed in questionnaire, but 17 items were removed after reliability test, those were having Cronbach's Alpha reliability less than the required to enhance the overall reliability. Finally, the tools were comprised of fifty-one items in this questionnaire for the field

implementation. The data collected in pilot trial was used to check reliability, item-total and inter-section correlation of the questionnaires.

Table No.3.7

Cronbach Alpha Reliability of Bite-Sized Teaching Strategy Scale (BSTSS) pilot Testing (n=40)

Scale/Variable	Subscale/Variable	Reliability	Items
Bite-Sized Teaching Strategy Scale (BSTSS)		.975	36
	Learning unit	.881	10
	Relevant content	.925	9
	Refined delivery	.918	7
	Peer teaching	.930	10

Table 3.7 shows that the Cronbach alpha reliability of the "Bite-Sized Teaching Strategy Scale (BSTSS)" was found.972. Bite-sized teaching strategy scale had four sub-variables "Learning unit," "Relevant content," "Refined delivery" and "Peer teaching." The reliability scores for sub-variables were "Learning unit," "Relevant content," "Refined delivery" and "Peer teaching" were .851, .912, .918 and .930, respectively.

The item-total correlation was used to improve the research instruments. Therefore, the items having correlation less than (0.30) were excluded from the questionnaire. It was calculated to check the strength of each item. The item total correlation was as under.

Table No. 3.8

Item-total correlation of Bite-Sized Teaching Strategy Scale (BSTSS) pilot Testing (n=40)

Item Codes	**r**	**Item Codes**	**r**	**Item Codes**	**r**	**Item Codes**	**r**
LU1	.080	RC1	.873**	RD2	.820**	PT5	.768**
LU2	.798**	RC2	.832**	RD3	.819**	PT6	.813**
LU3	.294	RC3	.760**	RD4	.774**	PT7	.665**
LU4	.796**	RC4	.815**	RD5	.743**	PT8	.865**
LU5	.764**	RC5	.804**	RD6	.704**	**PT9**	**.010**
LU6	**.898****	RC6	.792**	RD7	.766**	PT10	.760**
LU7	.802**	RC7	.739**	PT1	.865**		
LU8	.171	RC8	.107	PT2	.762**		
LU9	.832**	RC9	.813**	PT3	.815**		
LU10	.107	RD1	.806**	PT4	763**		

"Correlation is significant at the 0.01 level."**

Item-total correlation of Bite-Sized Teaching Strategy Scale (BSTSS) is seen in table 3.8. Item Codes. LU6 (.898**) was the highest correlation and the lowest correlation was of the item Codes. PT9 (.010). In this way the items, (LU1, LU3, LU8, LU10, RC8 and PT9) were deleted from the scale.

Table No. 3.9

Intersection correlation of Bite-Sized Teaching Strategy Scale (BSTSS) pilot Testing (n=40)

	Learning Unit	**Relevant Content**	**Refined Delivery**	**Peer Teaching**	**Bite-Sized Teaching Strategy Scale (BSTS)**
Learning Unit	1				
Relevant Content	.909**	1			
Refined Delivery	.883**	.870**	1		
Peer Teaching	.863**	.875**	.870**	1	
Bite-Sized Teaching Strategy Scale (BSTS)	.957**	.960**	.945**	.950**	1

"Correlation is significant at the 0.01 level."**

Inter-section correlation of all sub variables of Bite-Sized Teaching Strategy Scale (BSTSS) is seen in table 3.9. The highest correlation was between learning unit and relevant content (.909**) whereas the learning unit and peer teaching (.863**) was found lowest correlation.

Table No. 3.10

Cronbach Alpha Reliability of Student Engagement Scale (SES) pilot Testing (n=40)

Scale/Variable	Sub-variable	Reliability	Items
Students Engagement Assessment Scale (SEAS)		.959	32
	Behavioral Engagement	.887	8
	Emotional Engagement	.872	9
	Cognitive Engagement	.859	7
	Social Engagement	.812	8

Table 3.10 shows that the Cronbach Alpha reliability of the "Student Engagement Scale (SES)" was found.959. Student engagement scale had four sub-variables "Behavioral engagement," "Emotional engagement," "Cognitive engagement" and "Social engagement". The score of reliability for sub-variables were "Behavioral engagement," "Emotional engagement," "Cognitive engagement" and "Social engagement" were .887, .872, .859 and .812, respectively.

Table No.3.11

Item-total correlation was used to enhance the research instruments. Therefore, the items having correlation less than 0.30 were excluded from the questionnaire. It was calculated to check the strength of each item. The item total correlation was as under.

Item-total correlation of Student Engagement Scale (SES) pilot Testing (n=40)

Item Codes	**r**	**Item Codes**	**r**	**Item Codes**	**r**	**Item Codes**	**r**
BE1	.763**	EE1	.844**	EE9	.765**	SE1	.717**
BE2	.153	EE2	.195	CE1	.823**	SE2	.725**
BE3	.773**	EE3	.867**	CE2	.834**	SE3	.818**
BE4	.807**	EE4	.839**	CE3	.796**	SE4	.027
BE5	.797**	EE5	.763**	CE4	.153	SE5	-.205
BE6	**.889****	EE6	.824**	CE5	.796**	SE6	.741**
BE7	.844**	EE7(R)	.275	**CE6(R)**	**.031**	SE7	.747**
BE8(R)	.280	EE8	.222	CE7	.732**	SE8(R)	.153

"Correlation is significant at the 0.01 level."**

Item-total correlation of Student Engagement Scale (SES) is shown in table 3.11.The Item Codes. BE6 (.889**) was the highest correlation and the item Codes. CE6 (R) (.031) was the lowest correlation. In this way the items, (BE2, BE8, EE2, EE7, EE8, CE4, CE6, SE4, SE5 and SE8) were deleted from the scale.

Table No. 3.12

Intersection correlation of Student Engagement Scale (SES) pilot Testing (n=40)

	Behavioral Engagement	**Emotional Engagement**	**Cognitive Engagement**	**Social Engagement**	**Student Engagement Scale (SES)**
Behavioral Engagement	1				
Emotional Engagement	.897**	1			
Cognitive Engagement	.824**	.859**	1		
Social Engagement	.801**	.795**	.814**	1	
Student Engagement Scale (SES)	.950**	.957**	.928**	.902**	1

The inter-section correlation of all sub variables of Student Engagement Scale (SES) is shown in table 3.12. The highest correlation was between behavioral engagement and emotional engagement **(**.897**) whereas the lowest correlation was found between emotional engagement and social engagement (.795**).

3.11 Final version of the Research Tool

The finalization of questionnaires was improved by eliminating the items with low correlation less than (0.30). The Item-total correlation table revealed that items codes no. LU1, LU3, LU8, LU10, RC8, PT9, BE2, BE8, EE2, EE7, EE8, CE4, CE6, SE4,SE5 and SE8 had low correlation which is less than (0.30) were deleted from the tools because of weak correlation.

Table No. 3.13

List of items Codes – Final version of tool "Bite-Sized Teaching Strategy Scale" (BSTSS)

Variable	**Learning Unit**	**Relevant Content**	**Refined Delivery**	**Peer Teaching**	**Total Items**
Bite-Sized Teaching Strategy Scale (BSTS)	LU1	RC1	RD1	PT1	
	LU2	RC2	RD2	PT2	
	LU3	RC3	RD3	PT3	
	LU4	RC4	RD4	PT4	
	LU5	RC5	RD5	PT5	
	LU6	RC6	RD6	PT6	
		RC7	RD7	PT7	
				PT8	
				PT9	
Total Items	**6**	**7**	**7**	**9**	**29**

Table No. 3.13 indicates the number of items finalized related to Bite-Sized Teaching Strategy Scale" (BSTSS) for finalization of data collection. In Bite-Sized Teaching Strategy Scale" (BSTSS) the items having correlation less than (0.30) were deleted.

Table No. 3.14

List of items Codes- Final version of tool "Student Engagement Scale" (SES)

Variable	Behavioral Engagement	Emotional Engagement	Cognitive Engagement	Social Engagement	Total Items
Students Engagement Scale (SES)					
	BE1	EE1	CE1	SE1	
	BE2	EE2	CE2	SE2	
	BE3	EE3	CE3	SE3	
	BE4	EE4	CE4	SE4	
	BE5	EE5	CE5	SE5	
	BE6	EE6			
Total Items	**6**	**6**	**5**	**5**	**22**

Table No. 3.14 indicates the number of items finalized for data collection which are related to Student Engagement Scale" (SES). In Student Engagement Scale" (SES) above table items having correlation less than (0.30) were deleted.

3.12 Data Collection

Data was collected through personal visit of the researcher collected data by distributing questionnaires among respondents that were science students studying in public sector secondary level schools of Islamabad both Urban I & Urban II. For this purpose, the

researcher took permission letter from the authorities' head of education of National University of Modern Language, Islamabad and taken it to the secondary level schools then research requested to the participants to fill the questionnaires. Moreover, the researcher discussed the questionnaire with the respondents before filling it and provided full guidance. Letter is attached at the end (See Appendix C)

3.13 Data Analysis

Researcher analyzed data through SPSS (Statistical product and service solution) 22nd version. The researcher used many statistical techniques such as reliability, item-total, inter-section correlation, mean (M), Individual Score, regression, along with the results acquired through regression have been observed, interpreted, and analyzed in the next chapter four. Below table explained the statistical tests along with research objectives which are applied for testing hypotheses.

Table No.3. 15

Description of Research objectives, Hypotheses and Statistical Analysis

Research Objectives	**Null Hypotheses**	**Statistical Tests**
1. To explore the practices of bite-sized teaching strategy at secondary level.		Mean
2. To measure the level of students' engagement at secondary level.		Individual Score

3. To find out the effect of **'Bite sized teaching strategy'** for **'students' engagement'** at Secondary level.	**H_o1**.There is no significant effect of 'bite-sized teaching strategy' for students' engagement at secondary level.	Linear Regression

Table No.3.15 indicates that statistical techniques were applied on these three hypotheses. Answer the first hypothesis, Mean was applied, for the second hypothesis, Individual Score was applied, to answer Hypothesis No. 3, 3a, 3b, 3c, and 3d linear regression was applied. Regression analysis was applied to check the one-way effect.

3.14 Ethical Consideration of Research

The researcher followed some basic research ethics considered in the field of research to make research more effective. Besides academic integrity, researchers strictly followed all ethical considerations while working with the public and their data. The researcher obtained a permission letter from the National University of Modern Language; Islamabad was also shown to their respondents. For reliable data collection, the researcher informed the study participants that all the data would be kept hidden and that it would only use for research purposes. Throughout the study procedure, participants were not forced by the researcher to fill out questionnaires, and it was an entirely voluntary decision.

CHAPTER 4

ANALYSIS AND INTERPRETATION OF THE DATA

The current chapter includes an analysis and interpretation of the data and a discussion researcher has used research tools to interpret the collected data. The research study was based on the effect of a bite-sized teaching strategy for student engagement at the secondary level in Islamabad, Pakistan. This research study was based on a quantitative approach. Furthermore, the researcher has used a correlational design. The survey method was adopted for data collection. The results were based on the opinion of secondary-level science students of Islamabad. To collect the data, the researcher used questionnaires to receive the responses from the Federal Directorate of Education Institutions (Islamabad City Urban I and II) students regarding their engagement in science class. The researcher used two data-collection scales regarding their behavioral, emotional, cognitive, and social engagements. The Bite-Size Teaching Strategy Scale (BSTSS) scale was used to assess the bite-sized teaching strategy, comprising four primary elements. The first element was related to the learning unit. The second element was based on relevant content. The third element was related to refined delivery. The fourth element was related to peer teaching. The bite-size teaching strategy tool had 29 Codes items in total. The scale related to students' engagement. The student Engagement Scale (SES) comprised four elements, named as behavioral, emotional, cognitive, and social. It had 22 items in the demographic

part, based on the nature of schools, names of sectors, class/ grade, and age of secondary-level science students.

For the data collection, the tools adapted by the researcher and analysis were given to the five experts, and made sensible changes by receiving feedback from the area of Education to check the tool's validity and for further improvement. The researcher improved scales at the suggestion of experts. Furthermore, the researcher needed to check the reliability of both scales through pilot testing. Forty questionnaires were distributed among secondary science school students from Urban I and Urban II. The researcher used Statistical Product for Service Solution 22nd Edition to analyze the results. The reliability of the overall questionnaire was calculated through Statistical tests like Cronbach's Alpha test, item-total, and inter-section correlation of the tool. Scales were improved in light of the results. Then questionnaires were distributed among sample participants. Final data were collected and analyzed using different statistical tests with the help of IBM SPSS 22nd Edition.

4.1 Summary of the Data Analysis

The chapter was divided into nine sections. The data was collected from the population with the help of questionnaires and analyzed through quantitative methods. The researcher used various statistical techniques to analyze and present the data in detail.

Section 1 Tool Construction

The first section is related to the reliability by obtaining Cronbach’s Alpha, item total Correlation and intersection correlation of both scales has been used in the form of tables.

Section 2 Demographic Information

In the second section the demographic information of the respondents of the study revealed. The tool was having following demographic to get detail of the respondents which includes the factors like;

a) School,
b) Name of schools,
c) Grade or class, and
d) Age

Section 3 Practices of Bite-sized Teaching Strategy

Section three was about the first objective that is to explore the practice of bite-sized teaching strategy at secondary level. The first objective was tested through Mean score.

Section 4 Level of Student Engagement

This section's second objective was about the level of student engagement. To attain the second objective the level was categorized into three states. These are below average, average, and above average. The second objective was categorized into four levels which were based on behavioral, emotional, cognitive and social.

Section 5 Effect of Bite-sized Teaching Strategy for Student Engagement at Secondary level

This section was about the effect of bite-sized teaching strategies for student engagement at secondary level. The aim of the third objective is to find out the effect of bite-sized teaching strategy for students' engagement through regression analysis. The third main objective was categorized into four sub-objectives which were based on learning unit, relevant content, refined delivery, and peer teaching.

Section 1

4.1 Tool Construction (n=363)

Table No. 4.1

Reliability of Bite-Sized Teaching Strategy Scale (BSTSS) (n=363)

Scale	Sub-Scale	Items	Cronbach Alpha Reliability
Bite-sized Teaching Strategy Scale (BSTSS)		**29**	**.962**
	Learning unit	6	.882
	Relevant content	7	.862
	Refined delivery	7	.809
	Peer teaching	9	.880

The reliability of the "Bite-Sized Teaching Strategy Scale (BSTSS)" was found.962. Bite-sized teaching strategy scale had four sub-scales "Learning unit," "Relevant content," "Refined delivery" and "Peer teaching." The reliability score for sub-scales were "Learning unit," "Relevant content," "Refined delivery" and "Peer teaching" were .882, .862, .809 and .880, respectively.

Table No.4.2

Item-total correlation of Bite-Sized Teaching Strategy Scale (BSTSS) (n=363)

Item No	**r**	**Item No**	**r**	**Item No**	**r**	**Item No**	**r**
LU1	.741**	RC3	.695**	RD4	.717**	PT5	.785**
LU2	.785**	RC4	.718**	RD5	.612**	PT6	.729**
LU3	.729**	**RC5**	**.534****	RD6	.715**	PT7	.830**
LU4	**.831****	RC6	.785**	RD7	.644**	PT8	.718**
LU5	.718**	RC7	.821**	PT1	.580**	PT9	.743**
LU6	.743**	RD1	.563**	PT2	.683**		
RC1	.696**	RD2	.558**	PT3	.610**		
RC2	.642**	RD3	.649**	PT4	.604**		

"Correlation is significant at the 0.01 level." **

Item-total Correlation of Bite-Sized Teaching Strategy Scale (BSTSS) is seen in table 4.2. The Item No. LU4 (.831**) was the highest correlation and the Item No. RC5 (.534**) was the lowest correlation.

Table No. 4.3

Intersection correlation of Bite-Sized Teaching Strategy Scale (BSTSS) (n=363).

	Learning Unit	**Relevant Content**	**Refined Delivery**	**Peer Teaching**	**Bite-Sized Teaching Strategy Scale (BSTS)**
Learning Unit	1				
Relevant Content	.789**	1			
Refined Delivery	.725**	.788**	1		
Peer Teaching	.834**	.743**	.730**	1	
Bite-Sized Teaching Strategy Scale (BSTS)	.926**	.918**	.886**	.904**	1

"Correlation is significant at the 0.01 level." **

Inter-section correlation of all sub variables of Bite-Sized Teaching Strategy Scale (BSTSS) is seen in table 4.3. The highest correlation was between learning unit and peer teaching (.834**) whereas the lowest correlation was found among learning unit and refined delivery (.725**).

Table No.4.4

Cronbach Alpha Reliability of Student Engagement Scale (SES) (n=363)

Scale	**Sub-scales**	**Items**	**Cronbach Alpha Reliability**
Students Engagement Assessment Scale (SEAS)		22	.952
	Behavioral Engagement	6	.875
	Emotional Engagement	6	.888
	Cognitive Engagement	5	.823
	Social Engagement	5	.802

Table 4.4 shows that the Cronbach alpha reliability of the "Student Engagement Scale (SES)" was found.952.Student engagement scale had four sub-scales "Behavioral engagement," "Emotional engagement," "Cognitive engagement" and "Social engagement". The reliability score for sub-scales were "Behavioral engagement," "Emotional engagement," "Cognitive engagement" and "Social engagement" were .875, .888, .823 and .802 respectively.

Table No.4.5

Item-total correlation of Student Engagement Scale (SES) (n=363)

Item No	**r**	**Item No**	**r**	**Item No**	**r**	**Item No**	**r**
BE1	.715**	EE1	.692**	CE1	.723**	SE1	.717**
BE2	.699**	EE2	.595**	CE2	.649**	SE2	.715**
BE3	.753**	EE3	.784**	CE3	.736**	SE3	.635**
BE4	.751**	EE4	.736**	CE4	.729**	**SE4**	**.539****
BE5	.679**	**EE5**	**.797****	CE5	.562**	SE5	.765**
BE6	.765**	EE6	.796**				

"Correlation is significant at the 0.01 level." **

Item-total Correlation of Student Engagement Scale (SES) is seen in table 4.5. The Item No. EE5 (.797**) was the highest correlation and the Item No. SE4 (.539**) had the lowest correlation.

Table No.4.6

Intersection correlation of Student Engagement Scale (SES) (n=363)

	Behavioral Engagement	**Emotional Engagement**	**Cognitive Engagement**	**Social Engagement**	**Student Engagement Scale (SES)**
Behavioral Engagement	1				
Emotional Engagement	.848**	1			
Cognitive Engagement	.841**	.846**	1		
Social Engagement	.935**	.890**	.860**	1	
Student Engagement Scale (SES)	.953**	.943**	.929**	.974**	1

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

Inter-section correlation of all sub variables of Student Engagement Scale (SES) is seen in table 4.6. The highest correlation was between behavioral engagement and social engagement **(**.935**) whereas the lowest correlation was found among emotional engagement and cognitive engagement (.709**).

Section 2

4.2 Demographic Characteristics of the Scale (n-=363)

Table No. 4.7

Demographic Characteristics of Respondents related to Nature of School (n=363)

Nature of School	Frequency	Percentage
Urban I	165	45.5%
Urban II	198	54.5%
Total	363	100%

Table No. 4.7 shows that in Urban I secondary level schools the total numbers of respondents were 165 and in Urban II secondary level schools the total numbers of respondents were 198. The total in Urban I was 45.5% and Urban II was 54.5%. Majority (54.5%) respondents were from Urban II secondary level schools.

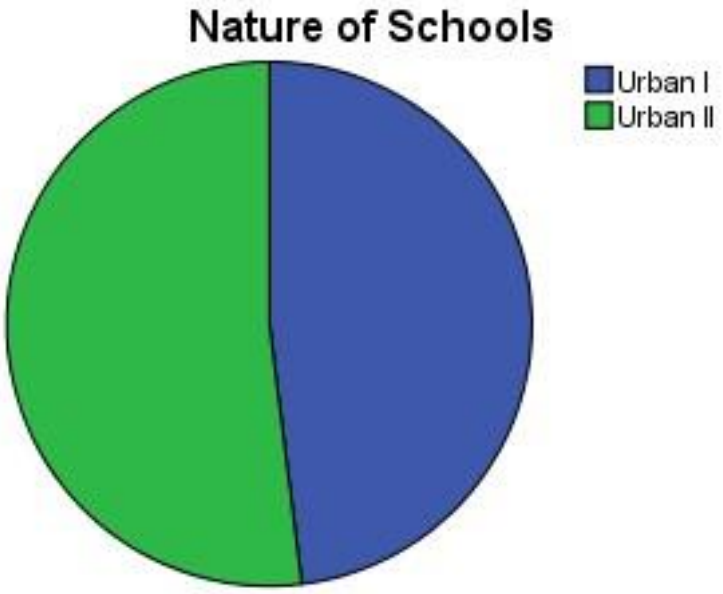

Figure No.4.1 Demographic Characteristic of Sample Related to Nature of School

Table No.4.8

Demographic Characteristic of Scale Related to Sector of Schools (n=363)

Sector of Schools	**Frequency**	**Percentage**
IMSG (VI-X), F-6/1	55	15.2%
IMSG (VI-X), F-7/2	71	19.6%
IMSG (VI-X), G-6/2	68	18.7%
IMSG (VI-X), G-7/1	49	13.5%
IMSG (VI-X), G-7/2	59	16.3%
IMSG (VI-X), G-9/3	61	16.8%
Total	**363**	**100%**

Table No. 4.8 indicates that there were 55 respondents of IMSG (VI-X) , F-6/1 secondary school and their percentage was 15.2%, 71 respondents of IMSG (VI-X) , F-7/2 secondary school and their percentage was 19.6%, 68 respondents of IMSG (VI-X) , G-6/2 secondary school and their percentage was 18.7%, 49 respondents of IMSG (VI-X) , G-7/1 secondary school and their percentage was 13.5%, 59 respondents of IMSG (VI-X) , G-7/2 secondary school and their percentage was 16.3% and 61 respondents of IMSG (VI-X) , G-9/3 secondary school and their percentage was 16.8%. Most students from IMSG (VI-X), F6/1 secondary schools the total numbers of respondents were 71 and their percentage was 19.6% of total population.

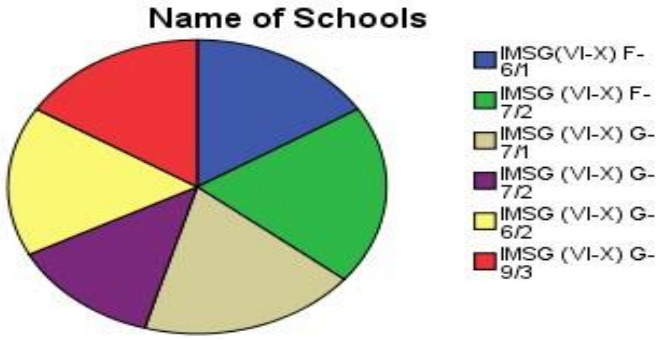

Figure No. 4.2 Demographic Characteristic of Sample Related to Name of Schools

Table No.4.9

Demographic Characteristic of Scale Related to Class (n=363)

Class	Frequency	Percentage
9th	173	47.7%
10th	190	52.3%
Total	**363**	**100%**

Table No. 4.9 indicates that 173 respondents were class 9th from secondary schools and their percentage was 47.7%. 190 respondents were class 10th from secondary schools and their percentage was 52.3%. Majority (52.3%) respondents were class 10th from secondary schools.

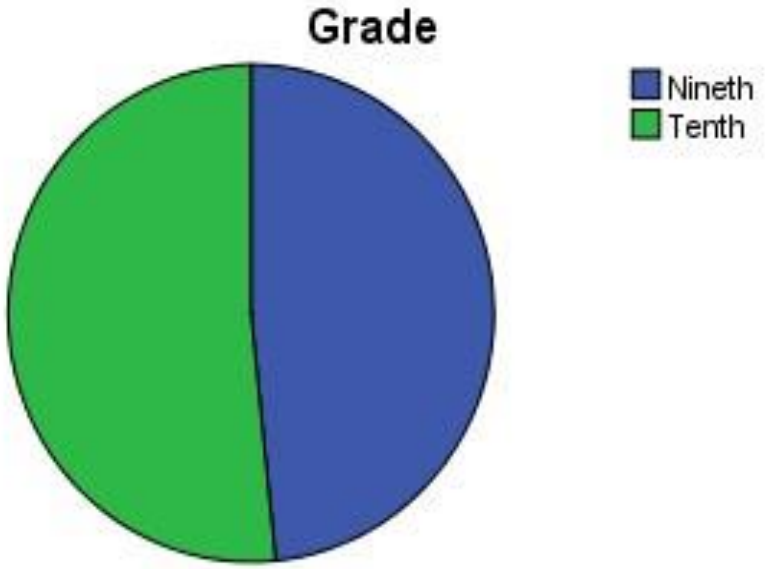

Figure No.4.3 Demographic Characteristic of Sample Related to Class

Table No.4.10
Demographic Characteristic of Scale Related to Age (n=363)

Age	Frequency	Percentage
11-12	5	1.4%
13-14	62	17.1%
15-16	127	35.0%
17-more	169	46.6%
Total	**363**	**100%**

The age of respondents was categorized in four sections which are shown in table no.4.10. The results indicate that 5 respondents age were 11-12 that consisted 1.4% of the whole sample, 62 respondents were fallen in age between 13-14 of 17.1% of the whole sample, 127 respondents were fallen in age between 15-16 of 35.0% of the whole sample and 169 respondents were fallen in age between 17-more of percentage 46.6% of total students. Majority (46.6%) respondents were fallen in age between 17-more.

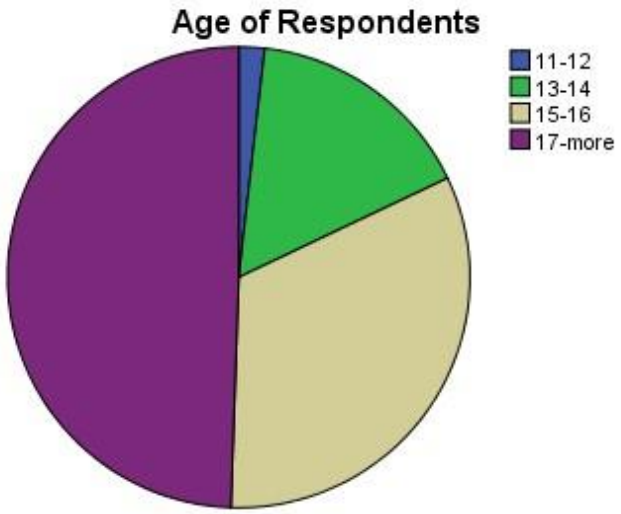

Figure No.4.4 Demographic Characteristics of Sample Related to Age

Section 3

4.3 Objectives 1 "To Explore the Practices of Bite-Sized Teaching Strategy at Secondary level". (n=363)

Table No.4.11

Practices of Bite-Sized Teaching Strategy (n=363)

Sr. No	Scale/Variable	n	Mean	Status
1	Learning Unit	363	3.0	Neutral
2	Relevant Content	363	3.1	Neutral
3	Refined Delivery	363	3.0	Neutral
4	Peer Teaching	363	3.0	Neutral

Table No. 4.11 indicated the practices of bite-sized teaching strategy at secondary level. The analysis of the result indicated mean value of variable. Total number of students were 363 while mean of the first variable learning unit was 3.0, Mean of Relevant content was 3.1, Mean of Refined delivery was 3.0 and Mean of Peer teaching was 3.0. Result showed that means values with the status of neutral about bite-sized teaching strategy at secondary level which mean that students were undecided about their practices at secondary level. All sub variables were dominating problems regarding practices.

The results showed that practices regarding learning unit was 3.0 with the status of neutral. The practices of learning unit were assessed by can they easily participate in

class discussion, quickly receive responses from teacher, understand concept in class discussion, express ideas in class, organize ideas, get feedback on time, work with other students in class activities and asked question regarding lecture and draw conclusion these types of practices, share their information in better way. Results indicated that Students were unsure about these practices at secondary level.

The results showed that practices regarding relevant content was 3.1 with the status of neutral. The practices of relevant content were analyzed by statements: can they easily find out the links between concepts, develop information about course content, cut down the concepts based on result, exercises are aligned with contents, and asked question regarding difficult concepts, critically examine the information, prepare exam through relevant information, and make conclusion from lecture. Finding revealed that the students were undecided about these practices at secondary level.

The results showed that practices regarding refined delivery was 3.0 with the status of neutral. The practices of refined delivery were indicated by statements: can they easily use of digital technology like multimedia projectors, used clickers to quickly response regarding questions, enhance learning through video lecture, pictures, and graphic description to express ideas, quickly aligned exercise with contents, try to take quizzes after watching video. Finding showed that the students were undecided about these practices.

The results showed that practices regarding peer teaching was 3.0 with the status of neutral. The practices of peer teaching were indicated by statements: can they easily comments on class fellow point of view in class discussion, defend their position in

class participation, feel free to ask questions about latest information, define things in straightforward way, use alternatives ways in doing task, improve communication skill through class discussion and achieve a goal in group work. Finding indicated that the respondents were undecided about these practices at secondary level.

Section 4

4.4 Objectives 2 "To Measure the level of Students' Engagement at Secondary level". (n=363)

Table No.4.12

Level of Student Engagement (n=363)

Scoring	Status	No. of Students	Percentage
22-51	Below average	48	13.2%
52-81	Average	215	59.2%
82-110	Above average	100	27.6%

Table No. 4.12 indicated that the student engagement level of secondary students. The student' engagement scoring is categorized into three categories such as Below Average (22-51), Average (52-81) and Above Average (82-110). The result show that 48 (13.2%) students had laid in first group 22-51 that status was below average, 215 (59.2%) students had fallen in second group 52-81that scored average level of student engagement and 100 (27.6%) students had fallen in third group 82-110 that status was above average. Majority (59.2%) those responded had average level of student engagement at secondary level.

Table No.4.12 (a)

Level of Behavioral Engagement (n=363)

Score	**Status**	**No. of Students**	**%**
6-14	Below Average	76	20.94%
15-23	Average	185	50.97%
24-32	Above Average	102	28.09%

Above table no.4.12 (a) has revealed level of Behavioral Engagement at secondary level. Classification of respondents according to behavioral engagement level of respondents in order to find out that exactly how many respondents standing on which score. Study results found from the above table shows that (20.94%) of the students were at “below average” level, while (50.97%) of the students were at “average level” and maximum (28.09%) of the students at “above average” level. Majority (50.97%) those responded had average level of behavioural engagement at secondary level.

Table No.4.12 (b)

Level of Emotional Engagement (n=363)

Score	**Status**	**No. of Students**	**%**
6-14	Below Average	64	17.64%
15-23	Average	178	49.03%
24-32	Above Average	121	33.33%

Above table no.4.12 (b) has revealed level of Emotional Engagement at secondary level. Classification of respondents according to emotional engagement level of respondents in order to find out that exactly how many respondents standing on which score. Study results found from the above table shows that (17.64%) of the students were at “below average” level, while (49.03%) of the students were at “average level” and maximum (33.33%) of the students at “above average” level. Majority (49.03%) those responded had average level of emotional engagement at secondary level.

Table No.4.12 (c)

Level of Cognitive Engagement (n=363)

Score	**Status**	**No. of Students**	**%**
5-11	Below Average	59	16.25%
12-18	Average	199	54.82%
19-25	Above Average	105	28.93%

Above table no.4.12 (c) has revealed level of Cognitive Engagement at secondary level. Classification of respondents according to cognitive engagement level of respondents in order to find out that exactly how many respondents standing on which score. Study results found from the above table shows that (16.25%) of the students were at “below average” level, while (54.82%) of the students were at “average level” and maximum (28.93%) of the students at “above average” level. Majority (54.82%) those responded had average level of cognitive engagement at secondary level.

Table No.4.12 (d)

Level of Social Engagement (n=363)

Score	**Status**	**No. of Students**	**%**
5-11	Below Average	66	18.18%
12-18	Average	207	57.02%
19-25	Above Average	90	24.80%

Above table no.4.12 (d) has revealed level of Social Engagement at secondary level. Classification of respondents according to social engagement level of respondents in order to find out that exactly how many respondents standing on which score. Study results found from the above table shows that (18.18%) of the students were at “below average” level, while (57.02%) of the students were at “average level” and maximum (24.80%) of the students at “above average” level. Majority (57.02%) those responded had average level of social engagement at secondary level.

Section 5

4.5 Effect of bite-sized teaching strategy for Students' Engagement at Secondary level (n=363)

Objectives No. 3: "To find out the Effect of bite-sized teaching strategy for Students' Engagement at Secondary level".

H_o1: "There is no significant effect of bite-sized teaching strategy for students' engagement at secondary level".

Table No.4.13

Effect of bite-sized teaching strategy for Students' Engagement (n=363)

Independent variable	Dependent variable	R^2	β (Coefficient)	t	Sig.
bite-sized teaching strategy	Students' Engagement	.84	.68	38.51	0.00

**P<0.01, *P<0.05

The table 4.13 indicates the effect of bite-sized teaching strategy for Students' Engagement. The R square value .85 which explains that bite-sized teaching strategy had 85% variation in Students' Engagement and the remaining is due to other elements. While the Beta value (β=.68) indicates that the level of significance is 0.01 which predict the positive effect. Therefore, hypothesis No. 1 There is no significant effect of bite-sized teaching strategy for students' engagement at secondary level was rejected.

Objectives No. 3 (a): "To find out the effect of learning unit for students' engagement at secondary level".

H_o1 (a): "There is no significant effect of learning unit for students' engagement at secondary level".

Table No.4.14

Effect of learning unit for Students' Engagement (n=363)

Independent variable	D**ependent variable**	**R^2**	***β*** **(Coefficient)**	**t**	**Sig.**
learning unit	Students' Engagement	.67	.82	24.02	0.00

**P<0.01, *P<0.05

Table 4.14 indicates that the effect of learning unit for Students' Engagement. The R^2.70 that explains learning unit had 70% variation in Students' Engagement and the remaining is due to other elements. While the Beta value (β=.83) indicates that the level of significance is 0.01 which predict the positive effect. Therefore, hypothesis No. 1 (a) there is no significant effect of learning unit for students' engagement at secondary level was rejected.

Objectives No. 3 (b): "To find out the effect of relevant content for students' engagement at secondary level".

H_o1 (b): "There is no significant effect of relevant content for students' engagement at secondary level".

Table No.4.15

Effect of Relevant Content for *Students' Engagement (n=363)*

Independent variable	D**ependent variable**	**R^2**	**β(Coefficient)**	**t**	**Sig.**
Relevant content	Students' Engagement	.85	.92	40.06	0.00

**P<0.01, *P<0.05

Table 4.15 indicates that the effect of relevant content for Students' Engagement. The R^2 .86 that explains relevant content had 86% variation in Students' Engagement and the remaining is due to other elements. Although the Beta value (β=.93) indicates that the level of significance is 0.01 which predict the positive effect. Therefore, hypothesis No. 1 (b) There is no significant effect of relevant content for students' engagement at secondary level was rejected.

Objectives No. 3 (c): "To find out the effect of refined delivery for students' engagement at secondary level".

H_o1(c): "There is no significant effect of refined delivery for students' engagement at secondary level".

Table No.4.16

Effect of Refined Delivery for *Students' Engagement (n=363)*

Independent variable	D**ependent variable**	**R^2**	***β*** **(Coefficient)**	**t**	**Sig.**
Refined delivery	Students' Engagement	.75	.87	29.50	0.00

**P<0.01, *P<0.05

Table 4.16 indicates that the effect of refined delivery for Students' Engagement. The value of R square .77 that explains there fined delivery had 77% variation in Students' Engagement and the remaining is due to other elements. Although the Beta value (β=.88) indicates that the level of significance is 0.01 which predict the positive effect. Therefore, hypothesis No. 1(c) there is no significant effect of refined delivery for students' engagement at secondary level was rejected.

Objectives No. 3 (d): "To find out the effect of peer teaching for students' engagement at secondary level".

H_o1 (d): "There is no significant effect of peer teaching for students' engagement at secondary level".

Table No.4.17

Effect of Peer Teaching for *Students' Engagement (n=363)*

Independent variable	D**ependent variable**	**R^2**	***β*** **(Coefficient)**	**t**	**Sig.**
Peer teaching	Students' Engagement	.74	.86	28.37	0.00

**P<0.01, *P<0.05

Table 4.17 shown that the effect of peer teaching for Students' Engagement. The value of R^2 was (.76) which explains that peer teaching had 76% variation in Students' Engagement and the remaining is due to other elements. Although the Beta value (β=.87) indicates that the level of significance is 0.01 which predict the positive effect. Therefore hypothesis No. 1(d) there is no significant effect of peer teaching for students' engagement at secondary level is was rejected.

CHAPTER 5

SUMMARY, FINDINGS, DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The current study was conducted to assess bite-sized teaching strategy: effectiveness for student engagement at the secondary school level. The research study was based on three key objectives; to explore Practices of Bite-Sized Teaching Strategy at the secondary school level. (ii) To measure the level of students' engagement at the secondary school level and (iii) To find out the effect of 'bite-sized teaching strategy' on students' engagement at the Secondary level. The researcher further included one central and four subs' hypotheses by the objectives. The study contained one null hypothesis, which had four sub-hypotheses. The conceptual framework of the study was based on two models. The Bite-Sized Teaching strategy model by Manning et al. (2021) has four components: learning unit, relevant content, refined delivery, and peer teaching, while the student engagement model by Wang et al. (2016)**.** In contrast, the student engagement model comprised four sub-sections, behavioral, emotional, cognitive, and social.

This research study was quantitative. Furthermore, the researcher has used a correlational design. The survey method was adopted for data collection. The study population was based on science students (2855) from twenty-six public sector secondary schools of Islamabad, both Urban I and Urban II session 2021 for this analysis, the researcher used a proportionate

stratified sampling technique. 13 % population was taken from each group which is 386 science students, 179 science students in Urban I, and 207 science students in Urban II. The researcher has taken equal ratios from both sides. Thus 386 tools were distributed among sample participants, and finally, 363 tools were received back. For data analysis, 363 sets of tools were selected that consisted of a 94% rate of return. The researcher used two tools for data collection. The bite-size teaching strategy scale (BSTSS) and students engagement scale (SES) are research tools for collecting the data. The bite-size teaching strategy scale (BSTSS) was based on 36 items and had four sub-Sections as; learning unit, relevant content, refined delivery, and peer teaching. The second questionnaire was on a student engagement scale (SES) based on 32 items divided into four sections as; behavioral, emotional, cognitive, and social. Educational experts validated the tools. After incorporating their important suggestions, the tool was improved. Two schools were taken from (Urban I), and two schools were taken from (Urban II) was 40 participants at the secondary school level were selected for the pilot trial.

The researcher personally visited for data collection and to test the reliability of the questionnaire data was analyzed through the Statistical product and service solution (SPSS) 22nd version. The reliability of the Bite-Sized Teaching strategy Scale (BSTSS) was (.975), and the reliability of the Student Engagement Scale (SES) was (.959). The tool was improved in light of the result, and 51 items were finalized for the scale. The data was collected personally by the researcher. For data analysis, the researcher used tests like Cronbach's Alpha Reliability test, Item-total correlation, intersection correlation, Individual score, Mean and linear regression.

5.2 Findings

Objective No. 1. "To explore the practices of bite-sized teaching strategy at secondary level."

1. Table No. 4.11 indicated the practices of bite-sized teaching strategy at secondary level. Table result indicated the value of Mean (M) variables. Number of total respondents was 363, Mean of learning unit variable was 3.0, Mean of Relevant content was 3.1, Mean of Refined delivery was 3.0 and Mean of Peer teaching was 3.0. Result indicated that means values were neutral about bite-sized teaching strategy at secondary level which mean that students were undecided about their practices at secondary level. All sub-variables were dominating problems towards practices.

   The study found the practice of bite-sized teaching strategy at secondary level. The practices of four sub-variables of bite-sized teaching strategy (learning unit, relevant content, refined delivery, and peer teaching) were explored among secondary level. The details of sub-variables are mentioned below:

   As per the analysis of the research data, the 1st sub-variable of bite-sized teaching strategy regarding learning unit showed that the status was neutral, which means that they were evaluated by: can they easily participate in class discussion, receive quickly responses from teacher, understand concept in class discussion, express ideas in class, organize ideas, get feedback on time, work with other students in class activities and asked question regarding lectures and draw inferences from

these types of practices, share their knowledge in more useful way. Results indicated that students were undecided about these practices at secondary level.

The 2nd sub-variable of bite-sized teaching strategy regarding relevant content showed that the status was neutral, which means that they were evaluated by statements: can they easily find out the links between concepts, develop information about course content, cut down the concepts based on result, exercises are aligned with contents, and asked question regarding difficult concepts, critically examine the information, prepare exam through relevant information, and make conclusion from lecture. Finding showed that the respondents were undecided about these practices at secondary level.

The 3rd sub-variable of bite-sized teaching strategy regarding refined delivery showed that the status was neutral, which means that they were indicated by statements: can they easily use digital technology like multimedia projectors, used clickers to quickly response regarding questions, enhance learning through video lecture, pictures, and graphic description to express ideas, quickly aligned exercise with contents, try to take quizzes after watching video. Finding showed that the respondents were undecided about these practices at secondary level.

As per the analysis of the research data, the 4th sub-variable of bite-sized teaching strategy regarding peer teaching showed that the status was neutral, which means that they were indicated by statements: can they easily comment on class fellow point of views in class discussion, defend their position in class participation, feel free to ask questions about new information, define things in simple way, use alternatives ways in doing task, improve communication skill through class

discussion and achieve a goal in group work. Finding showed that the respondents were undecided about these practices at secondary level.

Objective No. 2. "To measure the level of students' engagement at secondary level."

2. It was revealed Table No. 4.12 indicated that the student engagement level of secondary students. The student' engagement scoring is categorized into three levels such as Below Average (22-51), Average (52-81) and Above Average (82-110). The result show that 48 (13.2%) students had laid in first group 22-51 that status was below average, 215 (59.2%) students had fallen in second group 52-81that scored average level of student engagement and 100 (27.6%) students had fallen in third group 82-110 that status was above average. Majority (59.2%) those responded had average level of student engagement at secondary level.

   Above table no.4.12 (a) shows that (20.94%) of the students were at "below average" level, while (50.97%) of the students were at "average level" and (28.09%) of the students at "above average" level.

   Above table no.4.12 (b) shows that (17.64%) of the students were at "below average" level, while (49.03%) of the students were at "average level" and (33.33%) of the students at "above average" level.

   Above table no.4.12 (c) shows that (16.25%) of the students were at "below average" level, while (54.82%) of the students were at "average level" and (28.93%) of the students at "above average" level.

Above table no.4.12 (d) shows that (18.18%) of the students were at “below average” level, while (57.02%) of the students were at “average level” and (24.80%) of the students at “above average” level.

Objective No.3. **“To find out the effect of bite-sized teaching strategy for students’ engagement at secondary level.”**

3. Table 4.13 showed that there was significant effect of bite-sized teaching strategy for students’ engagement at secondary level. Bite-sized teaching strategy had 85% effect on students’ engagement. The results also indicated the effect of bite-sized teaching strategy for students’ engagement at secondary level. Because the 0.01 level of significance highlighting that there was a no significant effect of bite-sized teaching strategy for students’ engagement at secondary level was rejected.
4. It was mentioned in the interpretation of table 4.14 showed there was a significant effect of learning unit for students’ engagement at secondary level, learning unit had 70% effect on students’ engagement. The results also indicated the effect of learning unit for students’ engagement at secondary level. Because the significant at 0.01 level of significance highlighting that there was a no significant effect of learning unit for students’ engagement at secondary level was rejected.
5. The table 4.15 showed there was a significant effect of relevant content for students’ engagement, relevant content had 86% effect on students’ engagement. The results also indicated the effect of relevant content for students’ engagement. Because 0.01 level of significance highlighting that there was a no significant effect of relevant content for students’ engagement at secondary level was rejected.

6. It was showed in table 4.16 that there was a significant effect of refined delivery for students' engagement, refined delivery had 77% effect on students' engagement. The results also showed effect of refined delivery for students' engagement at secondary level. Because 0.01 level of significance highlighting that there was a no significant effect of refined delivery for students' engagement at secondary level was rejected.
7. It was mentioned in the interpretation of table 4.17 showed that there was a significant effect of peer teaching for students' engagement at secondary level, peer teaching had 76% effect on students' engagement. The results also showed effect of peer teaching for students' engagement at secondary level. Because 0.01 level of significance highlighting that there was a no significant effect of peer teaching for students' engagement at secondary level was rejected.

5.3 Discussions

This study aimed to determine the effect of a bit-sized teaching strategy on students' engagement with three objectives. So, the first objective was to explore the practices of bite-sized teaching strategies at the secondary level. It was found that the mean values related to learning unit, relevant content, refined delivery, and Peer teaching was 3.0, respectively. The study result showed that means values were Neutral, which means some students agreed. Some disagreed about the bite-sized teaching strategy at the secondary level, which means that students were still deciding about their practices at the secondary level. All sub-variables were dominating problems regarding practices.

A study by Fitzgerald and Tisdell (2019) found that the teaching micro-content "bite-sized instructional videos" results significantly impacted high student engagement, positive feedback in the classroom, improved confidence, and interest in learning. Additionally,

improve academic self-efficacy and performance. A recent study has noted that students' retention of knowledge declined after ten minutes in a traditional lecture (Bradbury, 2016). However, in every lecture at the beginning and the end, retention is the highest material. Short, focused material has been recognized as an effective target for improving student satisfaction and knowledge retention (Sawatsky et al., 2015). A recent study has noted that secondary school of Islamabad students regarding bite-sized teaching on student critical thinking skills. The sample of that research consisted of three hundred students and used experimental study to analyze the results that students response were agree on the statement about the dimension of bite-sized teaching and found that teaching of bite result significantly impact on student critical thinking skills, that they remember, understand and apply whatever they see in a short, easy and simple concepts (Shazad, 2020). Previous research supported that bite-sized teaching ensures focused, support, and feedback to the students on time (Manning et al., 2021).

The second objective was to measure the level of student engagement. A quantitative approach was used to address second objective. This objective was developed given the model given by Wang et al. (2016)**.** The data relating to secondary students' level of student engagement were collected through the student engagement scale (SES). To determine the level of student engagement. It was found that the majority, 60% of those who responded, had an average level of student engagement at the secondary level.

Likewise, Bergdahl (2019) conducted a study on upper secondary school students regarding "engagement and disengagement" in technology-enhanced learning. The sample of that research consisted of four hundred and ten students and used descriptive and inferential statistics to analyze the results showed that students are highly engaged in

learning activities towards short-term goals and less engaged toward long-term goals. This finding suggests that breaking down the long-term goals into sections may support students to engage at the class level.

The last main objective of the study was "To measure the effectiveness of bite-sized teaching strategy for students' engagement at the secondary level." A quantitative approach was used to address the third research objective. This objective addressed the bite-sized teaching strategy's four variables (learning unit, relevant content, refined delivery, and peer teaching). The model provides a guideline to develop the tool to measure the effectiveness of bite-sized teaching strategy for students at the secondary level, two sets of questionnaires (BSTSS & SES) were used. BSTSS was developed in the view of the model presented by Manning et al. (2021), and SES was developed in the view of the model presented by Wang et al. (2016)**.** The SES scale was comprised of 22 items, and the BSTSS scale was comprised of 29 items. All sections of the questionnaires were significantly correlated. The results also indicated that the bite-sized teaching strategy had an 84% effect on student engagement.

A study by Koh, Gottipati, and Shankararaman (2018) showed that bite-sized teaching is statistically significant. Bloom's taxonomy level, such as applying the concept and analyzing problems, increased (85%), and the level of remembering and understanding increased (75%) among respondents through bite-sized lectures. In contrast, it is also helpful for them compared to traditional course design. Most students' responses on bite-sized lectures agreed and strongly agreed, which helped them to learn better. Manning et al. (2021) conducted research on postgraduate students regarding "bite-sized teaching" and "learning engagement." The sample of that research consisted of one hundred and six

students. The result showed that bite-sized teaching had a significantly (79.8%) more significant impact bite-sized teaching on learning engagement.

As we know, micro-teaching skills improve teaching skills with the help of core skills of presentation and reinforcement (Remesh, 2013). Similarly, bite-sized teaching improved the necessary skills of teachers as well as students during lacking of presentation skills before involvement (Onwuagboke, Osuala, & Nzeako, 2017). The current study results supported the findings that bite-sized teaching enhances students' skills and allows teachers to manage the classroom (Umeh, Mogbo & Nsofor, 2015). One likely reason may be that a bite-sized teaching strategy enables the teachers to be more efficient, taking initial steps in a classroom situation and conducting many activities to engage the learner's attention. This helps to reduce distraction in the classroom and more all-inclusiveness of learners.

In the research, Schwartz et al. (2019) revealed that bite-sized teaching arouses the achievement of the appropriate skilled set showing bite-sized teaching as a centered approach to training the teacher in the lacking area of their performance. This could be explained by the fact that components of bite-sized teaching include learning units, relevant content, refined delivery, and peer teaching. Aside from that, the main objectives of the bite-sized teaching strategy contain a learning unit, which is essential for delivering the lecture through bite-sized teaching; therefore, it can enhance the practices of bite-sized teaching, leading to student engagement in a better way.

The findings were aligned with the previous research. Research showed that Bite-sized Information for Teaching with E-technologies initiatives (BITE) boosted the technologies in teaching and learning to support and promote the enhancement at the higher education level. Bite-sized Information for Teaching with E-technologies initiatives (BITE) was

conducted by approximately 1600 teaching staff in the initiatives six months. It could be explained by the fact that the implementation of BITE a success in promoting the quality of teaching through the use of technologies, and it also changes the practices of intervention of the teachers through self-confidence regarding the skills they obtained during the session (Kam & Csete, 2010). Furthermore, the results revealed that audio-visual aids successfully supported the teachers in managing their classrooms. Previous research studies were aligned with the results. A research study conducted in the past revealed that PowerPoint presentations of the teaching material along with Av aids increased student engagement skills in the classroom, leading to efficient development and positive classroom behavior (Remesh, 2013). Similarly, the finding showed that in a classroom setting, the colorful audio-visual aids enhance the ninety-two teaching performance (Umeh, Mogbo & Nsofo, 2015). The result may be explained that teaching aids in the refined delivery of bite-sized teaching strategies attract students' attention through creative designs and colors. Furthermore, the single, intelligent, focused lesson also leads to a virtual learning environment for the students.

While Fan, Salleh, and Laxman (2018) have used videos in the science classroom and showed that videos which are part of a refined delivery session of bite-sized teaching, have enhanced the concept of students related to science subjects. Most of the results agreed with the statement that the bite-sized teaching strategy helps them pay proper attention in science classes. A bite-sized teaching strategy is a new approach to teaching and learning for learners. Rather than learning through textbooks, when students watch videos through this approach, it creates an attractive atmosphere it grabs the attraction of students and pays attention to learning. Besides this, students paid attention and made considerable efforts to

understand the various concepts. It has been shown that students raised questions during teacher lectures. It might be because of the bite-sized teaching strategy with attention which made them able to answer the questions in peer teaching sessions. Later, the classroom environment demands a dynamic learning approach for learners. This requires teachers to actively engage students with constant feedback and encourage them to participate in classroom activities.

In addition, Bobek and Tversky's (2016) results showed that teachers could easily divide complex learning concepts into small, focused, and short pieces through videos in bite-sized teaching by taking advantage of eye-catching design and colors, which enhance cognitive engagement among students as well as helping students in getting the better understanding of the concepts in less time (Brame, 2016).

Bite-sized teaching strategies strengthen students' emotional engagement, like interest, satisfaction, and likeness towards biology concepts. Most of the participants replied that they were excited while watching videos in refined delivery sessions because in regular traditional lectures, they only listen to their teachers without their active involvement of them, which is boring for them but in straight delivery sessions, watching attractive videos with sounds, pictures and colors were more interesting for them. Similarly, the research study of akin showed that learners are passive in traditional lectures, face boredom, and lack excitement in the classroom; students' excitement may develop through refined delivery using videos (Devlin, Feldhaus & Bentrem, 2013). Moreover, another reason that bite-sized teaching arouses students' interest in science class is that students were bound to attempt the quiz at the end of each session, which is why they took an interest in it. Bite-sized teaching strategy enhanced their concepts by asking questions from their teacher,

which encouraged them to participate in classroom discussion and cleared ambiguity during classroom discussion. Lastly, it helped them understand concepts.

Contrary to this, when learners actively participate in classroom activities, they try to clear their concepts. Furthermore, it also showed from the participant's responses that they attentively responded to all questions at the end of the session. This finding is also a unique contribution of this study because, to my knowledge, no previous study has found the effect of bite-sized teaching strategies on students' engagement as an indicator of behavioral, cognitive, social, and emotional engagement.

5.4 Conclusion

Based on the findings, it was concluded by the researcher from the current study that explores the practices of bite-sized teaching strategy at the secondary level included four sub-variables: learning unit, relevant content, refined delivery, and peer teaching. It was concluded that means values were neutral about bite-sized teaching strategy at the secondary level, meaning that participants needed clarification about their practices at the secondary level. All sub-variables were dominating problems regarding practices.

To measure the level of student engagement at the secondary level. Four types were included in student engagement; Emotional, behavioral, social, and cognitive. This showed that the majority, 60% of those who responded, had an average level of student engagement at the secondary level. Teachers can support and guide in the classroom through innovative approaches and activities which differ from old ones and are efficient in the classroom in terms of strengthening student highest level of engagement.

In the end, it was concluded that bite-sized teaching strategy had a positive effect on students' engagement, and drawn from the finding that there was a significant effect

pertained to four sub-variables like "learning unit," "relevant content," "refined delivery," and "peer teaching."

5.5 Recommendations

For the current study following recommendations were derived based on finding.

1. Secondary students found less practices of bite-sized teaching (Learning unit, relevant content, and refined delivery and peer teaching). Therefore, it is recommended that Teachers need to enhance bite-sized teaching strategy in a better way by allowing students to use digital content, participate in activities and timely feedback (Objective No. 1, Finding No. 1).
2. It is recommended that to improve students' cognitive engagement teacher may provide healthy competitive environment like different type of quizzes competitions, discussions and project work (Objective No. 2, Finding No. 2).
3. For behavioural engagement, teacher may use brain breaks activity, encourage students to share their work and ask good questions, allow for think time and much more to attract the attention of students (Objective No. 2, Finding No. 2).
4. Teachers may use attractive colours, pictures, texts and animation in refined delivery session to improving students' emotional engagement (Objective No. 2, Finding No. 2).
5. Parent teacher, student teacher and parent child interaction may be encouraged to associate social engagement (Objective No. 2, Finding No. 2).
6. The effectiveness of bite-sized teaching is significant for enhancing student engagement, students' performance, increase attendance rate as well as decrease withdrawal and failure rate thus, teachers may break down detailed teaching material

in to a variety of micro related activities (including critical and creative thinking among students, problem solving and assessments) (Objective No. 3, Finding No. 3).

7. Teachers may split up detailed learning unit into smaller topics which help students in focusing and concentrating on single objective (Objective No. 3a, Finding No. 4).
8. It is recommended that, teachers may design diversified kind of contents like (info graphics, pictorial, bite-sized animated video) and dividing time in small intervals of 5-15 or 10-20 minutes which is helpful to consume even the smallest amount of time and easily digest the content (Objective No. 3b, Finding No. 5).
9. To avoid internet connectivity issues during refined delivery session teachers may save all video lectures in such tools like Compact Disk, USB and laptop and providing it to students while delivering lecture (Objective No. 3c, Finding No. 6).
10. It was also suggested that teachers may conduct classroom activities such as (study groups, pee-to-peer learning partnerships, and group work) to enhance student collaboration and communication skills, enhancement of student confidence and the ability to take control of their own learning (Objective No. 3d, Finding No. 7).

5.6 Recommendation for Future Research

1. It is suggested for future researchers that they may elaborate this study to find out the effect of bite-sized teaching strategy on other variables such as student motivation, students' performance, and students' satisfaction with course.
2. Future researchers may put forward this work in rural areas of secondary level schools of Islamabad. A comparison can be conducted between rural and urban secondary level school students located in Islamabad.

3. In the current study sample size were taken small, it is recommended to future researcher for their research to take study on large population and change sample size to observe the generalization of the current study results.
4. As this study was conducted on science students only so this research can also be administered on Arts students of secondary level.

5.7 Limitations of the Study

1. The limitations of the current study lies in its specific setting. The study focused only on science students enrolled in Urban I and II secondary level school of Islamabad while other science students enrolled in rural secondary level school of Islamabad were not covered by the researcher. Therefore, the result may not generalize to all secondary schools of Islamabad.
2. The current study was used correlational design instead of experimental design.
3. The data was collected by using close-ended questionnaires only.
4. In the current study the researcher focused on the use of Bite-sized teaching strategy only.

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Appendix-A

Conceptual Framework

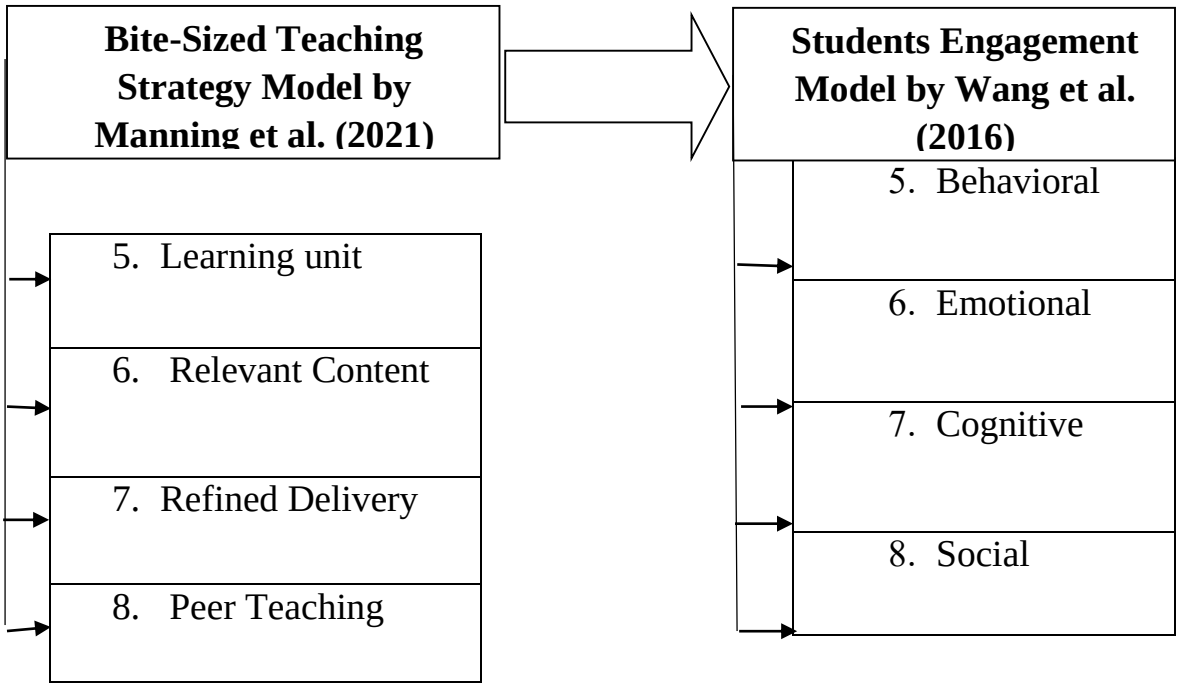

Figure No. 1 Conceptual Framework of the study

Appendix-B

Topic Approval letter

NATIONAL UNIVERSITY OF MODERN LANGUAGES
FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF EDUCATION

ML.1-4/2021/Edu

Dated: 10th December 2021

To: Kaainat Khan
10 MPhil/Edu/S20

Subject: **APPROVAL OF MPHIL THESIS TITLE AND SUPERVISOR**

1. Reference to Letter No, ML.1-4/2021-Edu, dated 11-12-2021, the Competent Authority has approved the title and supervisor in 12th BASR meeting dtd 18th November 2021 on the recommendations of Faculty Board of Studies vide its meeting held on 9th September 2021.

   a. **Supervisor's Name & Designation**
      Dr Qurat Ul Ain Hina (Supervisor)
      Assistant Professor
      Department of Education, NUML, Islamabad.
   b. **Thesis Title**

Bite-Sized Teaching Strategy: Effectiveness for Student Engagement at Secondary level

2. You may carry out research on the given topic under the guidance of your supervisor and submit the thesis for further evaluation within the stipulated time. It is to inform you that your thesis should be submit within described period **by 31st December 2022** positively for further necessary action please. ***(Time line attached)***

3. As per policy of NUML, all MPhil/PhD thesis are to be run on Turnitin by QEC, NUML before being sent for evaluation. The university shall not take any responsibility for high similarity resulting due to thesis run from own sources.

4. Thesis is to be prepared strictly on NUML's format that can be taken from (Dr Saira Nudrat, Coordinator MPhil/PhD)

Telephone No: 051-9265100-110 Ext: 2094
E-mail: snudrat@numl.edu.pk

Dr. Wajeeha Shahid
Head
Department of Education

Distribution:

Kaainat Khan (MPhil Scholar)

Dr Qurat Ul Ain Hina (Thesis Supervisor)

Appendix-C

Data Collection References Letter

DEPARTMENT OF EDUCATION
FACULTY OF SOCIAL SCIENCES
National University of Modern Languages
Sector H-9, Islamabad
Tel.No: 051-9265100 Ext: 2090

ML.1-3/2021-Edu

Dated: 08-12-2021

WHOM SO EVER IT MAY CONCERN

Ms. Kainaat Khan, Daughter of Muslim Khan student of Mphil (Edu) Department of Education National University of Modern Languages Islamabad is engaged in project of Research Work.

She may please be allowed to visit your Institutions to obtain the required information for her Research Work.

This information shall not be divulged to any unauthorized person or agency. It shall be kept confidential.

Dr Wajeeha Shahid
Head,
Department of Education.

Appendix-D

Cover Letter for Validity Certificate

Bite -Sized Teaching Strategy: Effectiveness on Students' Engagement at Secondary Level

Subject: **Request for validity certificate**

Respected Sir/Madam

I have attached my questionnaire adapted for the purpose of research titled as "Bite -sized teaching strategy: Effectiveness on students' engagement at secondary level". The BiteSized Teaching Strategy Scale (BSTSS) is based on the model bite-sized teaching presented by Manning et al. (2021). It is categorized into Learning unit, relevant content, refined delivery, and Peer teaching.

The Student Engagement scale (SES) is based on the model of Wang et al. (2016). It is categorized into Behavioral engagement, Emotional engagement, Cognitive engagement, and social engagement.

Kindly check my questionnaires and provide your valuable suggestion for its improvement. Also certify its validity by filling the certificate attached at the end of the document.

Kainaat Khan

M.Phil. Researcher, Department of Education,

National University of Modern Language,

Islamabad Pakistan

Appendix-E

CERTIFICATE FOR TOOL VALIDATION

Bite -Sized Teaching Strategy Scale (BSTSS) For

The Research Entitled As

BITE -SIZED TEACHING STRATEGY: EFFECTIVENESS ON STUDENTS' ENGAGEMENT AT SECONDARY LEVEL

By

Miss. Kainaat Khan

M.Phil. Scholar, Department of Education, Faculty of Social Sciences

National University of Modern Languages (NUML), H-9, Islamabad, Pakistan

This is to certify that the questionnaire adapted by the scholars towards her thesis has been assessed by me and find it that has been designed adequately to assess the bite -sized teaching strategy model presented by Manning et al. (2021). It comprises on four sections i.e. learning unit, relevant content, refined delivery and peer teaching.

It is considered that the research instrument, developed for research is according to the objectives of the research; assures adequate face and content validity according to the purpose of research. It can be used for data collection by the researcher with fair amount of confidence.

Name_____
Designation_____
Institute_____
Signature_____
Date_____

CERTIFICATE FOR TOOL VALIDATION

Students' Engagement Scale (SES)

For the Research Entitled As

BITE -SIZED TEACHING STRATEGY: EFFECTIVENESS ON STUDENTS' ENGAGEMENT AT SECONDARY LEVEL

By

Miss. Kainaat Khan

M.Phil. Scholar, Department of Education, Faculty of Social Sciences

National University of Modern Languages (NUML), H-9, Islamabad, Pakistan

This is to certify that the questionnaire adapted by the scholars towards her thesis has been assessed by me and find it that has been designed adequately to assess the student engagement model presented by Wang et al. (2016). It constitute on four sections i.e. behavioral engagement, emotional engagement, cognitive engagement and social engagement.

It is considered that the research instrument, developed for research is according to the objectives of the research; assures adequate face and content validity according to the purpose of research. It can be used for data collection by the researcher with fair amount of confidence.

Name_____

Designation_____

Institute_____

Signature_____

Date_____

Appendix-F

List of Experts Committee for Tool Validation

Sr.No	Expert's Name	Designation	University
1.	Dr. M. Imran Yousaf	Chairman	PMAS ARID RWP
2.	Dr. Qaisara Parveen	Assistant Professor	PMAS ARID RWP
3.	Dr. Sheikh Tariq Mehmood	Assistant Professor	IIU Islamabad
4.	Dr. Humaira Akram	IRA Education	IIU Islamabad
5.	Dr. Jameela Ashraf	Assistant Professor	NUML Islamabad

Appendix-G

Research Instruments Validity Certificates

CERTIFICATE FOR TOOL VALIDATION

Bite -Sized Teaching Strategy Scale (BSTSS)

For The Research Entitled As

BITE -SIZED TEACHING STRATEGY: EFFECTIVENESS ON STUDENTS' ENGAGEMENT AT SECONDARY LEVEL

By

Miss. Kainaat Khan

M.Phil Scholar, Department of Education, Faculty of Social Sciences

National University of Modern Languages (NUML), H-9, Islamabad, Pakistan

This is to certify that the questionnaire adapted by the scholars towards her research has been assessed by me and find it that has been designed adequately to assess the bite -sized teaching strategy model presented by Manning et al. (2021). It comprises on four sections i.e. learning unit, relevant content, refined delivery and peer teaching.

It is considered that the research instrument, developed for research is according to the objectives of the research; assures adequate face and content validity according to the purpose of research. It can be used for data collection by the researcher with fair amount of confidence.

Name Dr. M Imran Yousaf

Designation Chairman

Institute _____

Signature _____

Date _____

CERTIFICATE FOR TOOL VALIDATION

Students' Engagement Scale (SES)

For The Research Entitled As

BITE -SIZED TEACHING STRATEGY: EFFECTIVENESS ON STUDENTS' ENGAGEMENT AT SECONDARY LEVEL

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Name Dr M Imran Yousuf

Designation Chairman

Institute _____

Signature _____

Date 08-12-2021

Dr. M. Imran Yousuf
Associate Professor
PIR MEHR ALI SHAH
Arid Agriculture University
RAWALPINDI

CERTIFICATE FOR TOOL VALIDATION

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Name Qaisara Parveen

Designation A.P

Institute Arid

Signature

Date 15/12/2021

Dr. Qaisara Parveen
Assistant Professor
Department of Education
PMAS Arid Agriculture University
Rawalpindi

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Designation A.P

Institute Arid

Signature

Date 15/12/2021

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Assistant Professor
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Name Dr. Sheikh Tariq

Designation AP

Institute IIUI

Signature Dr Sheikh Tariq Mehmood

Assistant Professor
Department of Education
International Islamic University
Islamabad

Date

CERTIFICATE FOR TOOL VALIDATION

Bite -Sized Teaching Strategy Scale (BSTSS)

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Name Dr Sheikh Tariq

Designation A P

Institute IIUI

Signature

Date

Dr Sheikh Tariq Mehmood
Assistant Professor
Department of Education
International Islamic University
Islamabad

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Name Dr. Humaira Akram

Designation TRA Education

Institute IIUI

Signature

Date 22.12.2024

CERTIFICATE FOR TOOL VALIDATION

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For The Research Entitled As

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By

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National University of Modern Languages (NUML), H-9, Islamabad, Pakistan

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Name Dr. Humaira Akram

Designation TRA Education

Institute IIUI

Signature

Date 22. 12. 2021

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Name Dr. Jameela Ashraf

Designation Assistant Professor

Institute NUML, Islamabad

Signature

Date 21-01-22

CERTIFICATE FOR TOOL VALIDATION

Students' Engagement Scale (SES)

For The Research Entitled As

BITE -SIZED TEACHING STRATEGY: EFFECTIVENESS ON STUDENTS' ENGAGEMENT AT SECONDARY LEVEL

By

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M.Phil Scholar, Department of Education, Faculty of Social Sciences

National University of Modern Languages (NUML), H-9, Islamabad, Pakistan

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It is considered that the research instrument, adapted for research is according to the objectives of the research; assures adequate face and content validity according to the purpose of research. It can be used for data collection by the researcher with fair amount of confidence.

Name Dr. Jameela Ashraf

Designation Assistant Professor

Institute NUML, Islamabad

Signature

Date 21-01-22

Appendix-H

Certificate of Questionnaire Translation

Validation and Authentication Certificate of Questionnaire Translation

It is certified that Questionnairetranslation (Urdu) prepared by Miss. Kainaat Khan (Sys ID-NUML-S20-30146) M.Phil forher thesis title"*Bite-Sized Teaching Strategy: Effectiveness on Students Engagement at Secondary Level"* is appropriate and authentic to conduct the survey.

Name: Fauzia Ullah Khan

Designation: SST

Signature:

Date:

Govt. [illegible]
District Kohat

Appendix-I

List of FDE Recognized School in Islamabad

Government of Pakistan
Ministry of Federal Education & Professional Training
Federal Directorate of Education, Islamabad
(Research & Development)

LIST OF JAZZ SMART SCHOOL IN FDE

The following Educational Institution are included in Jazz Smart School Project:

S.#	Name of Institution
	Urban-I
1	IMSG (VI-X) F-7/2
2	IMCG G-8/4
3	IMSG (VI-X) G-7/1
4	IMSG (VI-X) G-6/1-3
5	IMSG (I-X) P.M G-5
6	IMSG (I-X) P.E G-5
7	IMSG (I-X) E-9
8	IMSG (VI-X) F-6/1
9	IMSG (VI-X) G-8/2
10	IMCG G-6/1-4
11	IMSG (VI-X) G-7/2
12	IMSG (VI-X) G-6/2
13	IMSG (VI-X) E-8
	Urban-II
14	IMSG (VI-X) G-9/3
15	IMCG G-9/2
16	IMCG, I-9/1
17	IMSG (VI-X) I-9/4
18	IMSG (VI-X) G-10/1
19	IMSG (VI-X) I-10/4
20	IMSG (I-X) G-9/1
21	IMSG (VI-X) G-11/1
22	IMSG (VI-X) I-8/1
23	IMSG (I-X) G-11/2
24	IMSG (VI-X) F-11/1
25	IMSG (I-X) G-10/3
26	IMSG (VI-X) G-9/4
	Bhara Kau
27	IMCG. NHC
28	IMCG, QAU Colony
29	IMCG Margalla Town
30	IMCG Maira Begwal
31	IMCG Kot Hathial
32	IMSG (I-X) Lakhwal
33	IMSG (I-X) Saidpur
34	IMSG (I-X) Gokina
35	IMSG (I-X) Shahdra Khurd
36	IMSG (I-X) Talhar
37	IMSG (I-X) Pulgran
38	IMCG Malpur

S.#	Name of Institution
39	IMCG, Pind Begwal
40	IMSG (I-X) Noor Pur Shah
41	IMSG (I-X) Kurri
42	IMCG (I-XII) Rawal Town
43	IMSG (I-X) New Shakrial
44	IMSG (I-X) Naugazi
45	IMSG (I-X) NHC
	Sihala
46	IMCG Pind Malkan
47	IMCG (I-X) Uppran Gohra
48	IMCG Herdogher
49	IMCG Rawat
50	IMCG Lohi Bheer
51	IMSG (I-X) Dhoke Gangal
52	IMCG Mohra Nagial
53	IMCG, Model Town Humak
54	IMCG Gagri
55	IMCG Nara Sydain
56	IMSG (VI-X) Sihala
57	IMSG (I-X) Humak
	Nilore
58	IMCG Thanda Pani
59	IMCG, Nilore
60	IMCG Kirpa
61	IMCG, Punjgran
62	IMSG (VI-X) Chirah
63	IMCG Jagiot
64	IMSG (I-X) Jaba Tali
65	IMCG Pehount
	Tarnaul
66	IMSG (I-X) Jhangi Syedan
67	IMSG (I-X) Maira Beri
68	IMCG, Tarnual
69	IMSG (I-X) Bhadana Kalan
70	IIMCG Shah Allah Ditta
71	IMCG Tarlai
72	IMCG (I-XII) Golra
73	IMSG (I-X) BQB
74	IMSG (I-X) Sangjani
75	IMSG (VI-X) I-14/3
	Total 75 Educational Institutions

(NADEEM AHMAD)
Assistant Director (R&D)
Cell # 03335109101

Appendix-J

List of School as population

Sr.No	Name of Schools	Sectors	Nature of Schools	Students Enrolment in Session (2021)
1	IMSG, (VI-X)	G-10/1	Urban I	108
2	IMCG	G-8/4	Urban I	129
3	IMSG, (VI-X)	G-7/1	Urban I	100
4	IMSG, (VI-X)	G6/1-3	Urban I	125
5	IMSG, (I-X)	G-5	Urban I	109
6	IMSG, (I-X)	G-5	Urban I	96
7	IMSG, (I-X)	E-9	Urban I	100
8	IMSG, (VI-X)	I-8/1	Urban I	102
9	IMSG, (VI-X)	G-8/2	Urban I	111
10	IMCG	G-6/1-4	Urban I	102
11	IMSG, (VI-X)	G-7/2	Urban I	108
12	IMSG, (VI-X)	G-6/2	Urban I	123
13	IMSG, (VI-X)	E-8	Urban I	103
14	IMSG, (VI-X)	G-9/3	Urban II	103
15	IMCG	G-9/2	Urban II	145
16	IMCG	I-9/1	Urban II	129
17	IMSG, (VI-X)	I-9/4	Urban II	109
18	IMSG, (VI-X)	F-7/2	Urban II	91
19	IMSG, (VI-X)	1-10/4	Urban II	102

20	IMSG, (I-X)	G-9/1	Urban II	121
21	IMSG, (VI-X)	G-11/1	Urban II	111
22	IMSG, (VI-X)	F-6/1	Urban II	95
23	IMSG, (I-X)	G-11/2	Urban II	108
24	IMSG, (VI-X)	F-11/1	Urban II	123
25	IMSG, (I-X)	G-10/3	Urban II	101
26	IMSG, (VI-X)	G-9/4	Urban II	103
Total				**2,855**

Appendix-K

Kerjcie & Morgan Sample Size

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

Appendix-L

Research Instrument

Serial No: _____

Bite -Sized Teaching Strategy: Effectiveness on Students' Engagement at Secondary Level

Dear Respondent,

I am M. Phil. Scholar (Education) working on my research work on the above-mentioned topic. You are requested to fill in the questionnaire attached. The first part of questionnaire consists of Demographic information. The remaining part of this questionnaire deals with two variables first part is about Bite-sized Teaching strategy and second is about Students' Engagement. It is assured that your response will be kept confidential and will not be disclosed to any person or authority. The questionnaire is developed to collect data for my research work only.

Kainaat Khan (M. Phil Researcher)
Department of Education
National University of Modern Language, Islamabad

Demographics Information

1.	**School**	Urban I 1			Urban 2 2		
2.	**Name of Schools/ Sectors**	IMSG (VI-X), F6/1 1	IMSG (VI-X), F7/2 2	IMSG (VI-X), G7/1 3	IMSG (VI-X), G7/2 4	IMSG (VI-X), G6/2 5	IMSG (VI-X), G9/3 6
3.	**Class/Grade**	9^{th} 1			10^{th} 2		
4.	**Age**	11-12 1	13-14 2		15-16 3	17-more 4	

Students Engagement Scale (SES)

INSTRUCTIONS

You are required to give your responses against the options ranging from 5 to1 indicating your preferences of responses (5= Strongly Agree, 4=Agree, 3= Neutral, 2= Disagree, 1=-Strongly Disagree).

Sr #	Code	I. Behavioral Engagement It is defined as the levels to which students actively participate in learning activities, follow instructions, responding to questions, regularity in their class attendance, and no distractions.	SD	D	N	A	SA
1.	BE1	I put effort into learning to understand the lecture	1	2	3	4	5
2.	BE2	I keep try to understand difficult concept	1	2	3	4	5
3.	BE3	I participate in class activities actively	1	2	3	4	5
4.	BE4	I complete my homework on time	1	2	3	4	5
5.	BE5	I pay attention on task during class	1	2	3	4	5
6.	BE6	I analyze a piece of information which is truthful	1	2	3	4	5
7.	BE7	I get confused to participate in class (R)	1	2	3	4	5
8.	BE8	I do other things when I am supposed to be paying attention (R)	1	2	3	4	5
		II. Emotional Engagement	**SD**	**D**	**N**	**A**	**SA**

		It refers to the degree to which students put efforts to improve affective reactions like interested, inspired, and enthusiastic about bite-sized teaching topics, methods, and learning activities.					
9.	EE1	I take interest in science class	1	2	3	4	5
10.	EE2	I enjoy to learn new things in class	1	2	3	4	5
11.	EE3	I want to understand what is learned in science class	1	2	3	4	5
12.	EE4	I feel good when I am in class	1	2	3	4	5
13	EE5	I feel motivated in science class	1	2	3	4	5
14.	EE6	I feel good to listen class lecture	1	2	3	4	5
15.	EE7	I often avoid to attend class (R)	1	2	3	4	5
16.	EE9	I feel less motivated when I am in class (R)	1	2	3	4	5
17.	EE10	I get bored when teacher discuss new things in class (R)	1	2	3	4	5
		III. Cognitive Engagement It defined as the levels to which learners put efforts in their learning tasks and improve their intellectual power to acquire knowledge.	**SD**	**D**	**N**	**A**	**SA**
18.	CE1.	I try to solve problems through different ways in class	1	2	3	4	5
19.	CE2.	I take class and make sure that it is appropriate	1	2	3	4	5

20.	CE3.	I try to connect new knowledge with previous one	1	2	3	4	5
21.	CE4.	I try to understand my mistakes when I do something wrong in class	1	2	3	4	5
22.	CE5.	I only focus on easy parts of my work in class	1	2	3	4	5
23.	CE6.	I like to give answers rather than doing work(R)	1	2	3	4	5
24.	CE7.	I often consider it easy when I work in class (R)	1	2	3	4	5
		IV. Social Engagement It refers to the degree to which students put efforts in their learning and improve quality of social interaction with teachers and peers.	**SD**	**D**	**N**	**A**	**SA**
25.	SE1	I am active and responsive to others in class	1	2	3	4	5
26.	SE2	I consider the ideas of friends when I make study decision.	1	2	3	4	5
27.	SE3	I try to work with others who can help me in learning	1	2	3	4	5
28.	SE4	I try to help others who are struggling in study	1	2	3	4	5
29.	SE5	I compare different opinions to see which is better	1	2	3	4	5
30.	SE6	I concentrate less peers' ideas in class(R)	1	2	3	4	5
31.	SE7	I get confused in sharing with fellows in class (R)	1	2	3	4	5
32.	SE8	I usually less cooperate with classmate in group activity (R)	1	2	3	4	5

Bite-Size Teaching Strategy Scale (BSTSS)

INSTRUCTIONS

You are required to give your responses against the options ranging from 5to1 indicating your preferences of responses (5= Strongly Agree, 4=Agree, 3= Neutral, 2= Disagree, 1=-Strongly Disagree).

Sr #	Code	**I. Learning Unit** It is a way to represent 4 to 5 brief, short focused and multiple, few minutes learning talks on single topic.	**SD**	**D**	**N**	**A**	**SA**
1.	LU1	I try to remember the concept in class	1	2	3	4	5
2.	LU2	I try to understand concept in class	1	2	3	4	5
3.	LU3	I try to participate in class discussion	1	2	3	4	5
4.	LU4	I get sufficient time for learning	1	2	3	4	5
5.	LU5	I receive quickly response from teacher in class	1	2	3	4	5
6.	LU6	I try my best to ask questions in class	1	2	3	4	5
7.	LU7	I get feedback on time in class discussion	1	2	3	4	5
8.	LU8	I enjoy to work with other students in class activities	1	2	3	4	5
9.	LU9	I try to explain information when someone does not understand it	1	2	3	4	5
10.	LU10	I try to organize my thought before arguing in class discussion	1	2	3	4	5

		III. Relevant Content It is a way by providing refined and relevant content to the students to achieve learning objectives.	**SD**	**D**	**N**	**A**	**SA**
11	RC1	I try to understand information in short time during class	1	2	3	4	5
12	RC2	I try to give clarification on difficult concepts	1	2	3	4	5
13	RC3	I try to think critical on information in class	1	2	3	4	5
14	RC4	I try to increases my understanding through classroom activities	1	2	3	4	5
15	RC5	I try to prepare exam through relevant information	1	2	3	4	5
16	RC6	I try to develop information about the course content	1	2	3	4	5
17	RC7	I try to learn material with bite-sized teaching better than with traditional lecture-based instruction	1	2	3	4	5
18	RC8	I feel difficult to information about the course content(R)	1	2	3	4	5
19	RC9	I think class exercises are aligned with contents	1	2	3	4	5
		III. Refined Delivery It refers to the use of digital technology like laptops, multimedia projectors, clickers, screens, UPS, and speakers. As 7-8 minutes' videos and presentation slides was produced by instructor / teacher for the sake of students' attention to deliver their ideas in classrooms.	**SD**	**D**	**N**	**A**	**SA**
20	RD1	I am aware of the use of Multi-media Projector during class	1	2	3	4	5
21	RD2	I try to use of Clickers during class	1	2	3	4	5

22	RD3	I try to use of Screen during class	1	2	3	4	5
23	RD4	I try to use of UPS during class	1	2	3	4	5
24	RD5	I try to use of Speaker during class	1	2	3	4	5
25	RD6	I try to enhance my learning through video lecture	1	2	3	4	5
26	RD7	I try to take test and quizzes after watching video	1	2	3	4	5

		IV. Peer Teaching It refers to a group activity that helps the peer to learn from the other group member, to promote positive relations with other peers and teachers.	**SD**	**D**	**N**	**A**	**SA**
27	PT1	I try to participate in class discussion	1	2	3	4	5
28	PT2	I feel happy when my friends appreciate my ideas	1	2	3	4	5
29	PT3	I try to improve my communication skill through class discussion	1	2	3	4	5
30	PT4	I feel motivated when i receive feedback from friends	1	2	3	4	5
31	PT5	I feel free to ask my peers for new information	1	2	3	4	5
32	PT6	I try to clear my arguments easily in group discussion	1	2	3	4	5
33	PT7	I can communicate freely with my peer in class discussion	1	2	3	4	5
34	PT8	I try my best to achieve a goal in group work.	1	2	3	4	5
35	PT9	I feel that my fellows usually agree with my ideas	1	2	3	4	5
36	PT10	I try to define things in simple way to others in group discussion	1	2	3	4	5

سیریل نمبر: _____

Bite -Sized Teaching Strategy: Effectiveness on Students' Engagement at Secondary Level

محترم جواب دہندہ،

میں ایم فل (ایجوکیشن) اسکالر ہوں۔ میں مذکورہ بالا موضوع پر تحقیقی کام کر رہی ہوں ۔آپ سے درخواست ہے کہ منسلک سوالنامے کے جوابات دیں۔سوالنامے کا پہلا حصہ ذاتی معلومات پر مشتمل ہے۔ اس سوالنامے کا بقیہ حصہ دو متغیرات سے متعلق ہے پہلا حصہ بائٹ سائز کی تدریسی حکمت عملی اور دوسرا طلباء کی مصروفیت کے بارے میں ہے۔ یہ یقین دہانی کرائی جاتی ہے کہ آپ کے جواب کو صیغہ راز میں رکھا جائے گا اور کسی شخص یا اتھارٹی کو ظاہر نہیں کیا جائے گا۔ سوالنامہ صرف تحقیقی کام کے لیے ڈیٹا اکٹھا کرنے کے لیے تیار کیا گیا ہے

تحقیق کنندہ:
کائنات خان (ایم فل اسکالر)
ڈپارٹمنٹ آف ایجوکیشن
نیشنل یونیورسٹی آف ماڈرن لینگویج،
اسلام آباد

ذاتی معلومات:

1	اسکول	شہری (I)			شہری (II)	
2	اسکول	آئی ایم ایس جی (VI-X)،جی ۔ 7/1 1	آئی ایم ایس جی (VI-X)،ایف ۔ 7/2 2	آئی ایم ایس جی (VI-X)،جی ۔ 7/1 3	آئی ایم ایس جی (VI-X)،ایف ۔ 6/2 4	آئی ایم ایس جی (VI-X)،جی ۔ 7/2 5	**آئی ایم ایس جی (VI-X)،جی ۔ 7/2** 6
3	کلاس	نوھم 1			دھم 2		
4	عمر	11 سے 12 سال 1	13 سے 14 سال 2	15 سے 16 سال 3	**17 سال سے** زیادہ 4		

سوالنامہ

بائٹ سائز ٹیچنگ اسٹریٹجی اسکیل (Bite-Size Teaching Strategy Scale)

ہدایات:

براہ کرم درج ذیل جوابات میں سے اس جواب پر نشان (✓) لگائیں جو آپ کے جوابات کی ترجیحات کی نشاندہی کرتے ہیں۔ **(1. مکمل غیر متفق، 2. غیر متفق، 3. غیر جانبدار، 4. متفق، 5. مکمل متفق)**

نمبر شمار	I. لرننگ یونٹ	مکمل غیر متفق	غیر متفق	غیر جانبدار	متفق	مکمل متفق
1	میرا استاد کلاس میں تصورات کو یاد رکھنے میں میری مدد کرتا/کرتی ہے۔	1	2	3	4	5
2	میرا استاد کلاس میں سوالات کرنے کا موقع فراہم کرتا/کرتی ہے۔	1	2	3	4	5
3	میرا استادکلاس ڈسکشن میں معلومات شئیر کرنے میں میری مدد کرتا/کرتی ہے۔	1	2	3	4	5
4	میرا استاد کلاس ڈسکشن میں حصہ لینے کے مواقع فراہم کرتا/کرتی ہے۔	1	2	3	4	5
5	میرا استاد کلاس میں مشکل موضوعات کو سمجھنے میں میرا مددکرتے/کرتی ہیں۔	1	2	3	4	5
	II. متعلقہ مواد	مکمل غیر متفق	غیر متفق	غیر جانبدار	متفق	مکمل متفق
6	میرا استاد کلاس میں سوالات کے فوری جوابات دیتا/دیتی ہے۔	1	2	3	4	5
7	میرے خیال میں کلاس کی مشقیں مقاصد اور مواد کے ساتھ منسلک ہیں۔	1	2	3	4	5
8	میں مشکل تصورات پر وضاحت دینے کی کوشش کرتا/کرتی ہوں۔	1	2	3	4	5
9	میں کلاس میں معلومات کے بارے میں تنقیدی سوچ کی کوشش کرتا/کرتی ہوں۔	1	2	3	4	5
10	میں کلاس روم کی سرگرمیوں کے ذریعے اپنی سمجھ کوبڑھانے کی کوشش کرتا/کرتی ہوں۔	1	2	3	4	5
11	میں متعلقہ معلومات کے ذریعے امتحانات کی تیاری کرنے کی کوشش کرتا/کرتی ہوں۔	1	2	3	4	5
12	میں کورس کے مواد کے بارے میں معلومات تیار کرنے کی کوشش کرتا/کرتی ہوں۔	1	2	3	4	5
13	میں روایتی لیکچر پر مبنی ہدایات کے مقابلےمیں تدریس کے ساتھ مواد کو بہتر طریقے سے سیکھنے Bite-Sized کی کوشش کرتا/کرتی ہوں۔	1	2	3	4	5

	III. بہتر ترسیل	مکمل غیر متفق	غیر متفق	غیر جانبدار	متفق	مکمل متفق
14	میں کلاس کے دوران کلکرز استعمال کرنے کی کوشش کرتا / کرتی ہوں۔	1	2	3	4	5
15	میں کلاس کے دوران اسکرین کو استعمال کرنے کی کوشش کرتا / کرتی ہوں۔	1	2	3	4	5
16	میں کلاس کے دوران اسکرین کو استعمال کرنے کی کوشش کرتا/کرتی ہوں۔	1	2	3	4	5
17	میں کلاس کے دوران یو پی ایس استعمال کرنے کی کوشش کرتا / کرتی ہوں۔	1	2	3	4	5
18	میں کلاس کے دوران سپیکر استعمال کرنے کی کوشش کرتا/کرتی ہوں۔	1	2	3	4	5
19	میں ویڈیو لیکچرز کے ذریعے اپنے علم کو بڑھانے کی کوشش کرتا/کرتی ہوں۔	1	2	3	4	5
20	میں ویڈیو لیکچر دیکھنے کے بعد ٹیسٹ اور کوئز لینے کی کوشش کرتا/کرتی ہوں۔	1	2	3	4	5
	IV. پیئر ٹیچنگ	مکمل غیر متفق	غیر متفق	غیر جانبدار	متفق	مکمل متفق
21	میں گروپ ورک میں مقاصد حاصل کرنے کی پوری کوشش کرتا/کرتی ہوں۔	1	2	3	4	5
22	جب میرے دوست میرے خیالات کی تعریف کرتے ہیں تو مجھے خوشی محسوس ہوتی ہے۔	1	2	3	4	5
23	میں کلاس ڈسکشن کے ذریعے اپنی بات چیت اور اظہار خیال سے متعلقہ مہارتوں کو بہتر بنانے کی کوشش کرتا/کرتی ہوں۔	1	2	3	4	5
24	جب مجھے دوستوں سے رائے ملتی ہے تو میں حوصلہ افزائی محسوس کرتا/کرتی ہوں۔	1	2	3	4	5
25	میں اپنے ساتھیوں سے نئی معلومات کے لیے بلا جھجک سوالات پوچھتا/پوچھتی ہوں۔	1	2	3	4	5
26	میں گروپ ڈسکشن میں اپنے دلائل کو واضح اور سادہ انداز میں بیان کرنے کی کوشش کرتا/کرتی ہوں۔	1	2	3	4	5
27	میں اپنے ساتھیوں سے نئی معلومات کے لیے بلا جھجک سوالات پوچھتا/پوچھتی ہوں۔	1	2	3	4	5
28	میں گروپ ڈسکشن میں اپنے دلائل کو واضح اور سادہ انداز میں بیان کرنے کی کوشش کرتا /کرتی ہوں۔	1	2	3	4	5
29	میں کلاس ڈسکشن میں اپنے ساتھی کے ساتھ آزادانہ بات چیت کرنے کی کوشش کرتا /کرتی ہوں۔	1	2	3	4	5

سوالنامہ

طلباء کی مصروفیت کا پیمانہ (Students Engagement Scale)

ہدایات:

براہ کرم درج ذیل جوابات میں سے اس جواب پر نشان (✓) لگائیں جو آپ کے جوابات کی ترجیحات کی نشاندہی کرتے ہیں۔ **(1. مکمل غیر متفق، 2. غیر متفق، 3. غیر جانبدار، 4. متفق، 5. مکمل متفق)**

نمبر شمار	I. طرز عمل کی مصروفیت	مکمل غیر متفق	غیر متفق	غیر جانبدار	متفق	مکمل متفق
1	میں لیکچرز سے سیکھنے اور سمجھنے کی کوش کرتا / کرتی ہوں۔	1	2	3	4	5
2	میں مشکل تصورات کو سمجھنے کی کوشش کرتا / کرتی ہوں۔	1	2	3	4	5
3	میں کلاس کی سرگرمیوں میں بڑھ چڑھ کر حصہ لیتا/ لیتی ہوں۔	1	2	3	4	5
4	میں وقت پر اپنا ہوم ورک مکمل کرتا/ کرتی ہوں۔	1	2	3	4	5
5	میں کلاس کے دوران اپنے کاموں پر توجہ دیتا/ دیتی ہوں۔	1	2	3	4	5
6	میں صرف سچائی اور حقیقت پر مبنی معلومات کا تجزیہ کرتا / کرتی ہوں	1	2	3	4	5
	II. جذباتی مصروفیت	مکمل غیر متفق	غیر متفق	غیر جانبدار	متفق	مکمل متفق
7	میں سائنس کی کلاس میں دلچسپی لیتا / لیتی ہوں۔	1	2	3	4	5
8	مجھے کلاس میں نئی چیزیں سیکھنے میں لطف آتا ہے۔	1	2	3	4	5
9	میں سمجھنا چاہتا / چاہتی ہوں کہ میں سائنس کی کلاس میں کیا سیکھتا/ سیکھتی ہوں۔	1	2	3	4	5
10	جب میں کلاس میں ہوں تو مجھے اچھا لگتا / لگتی ہے۔	1	2	3	4	5
11	میں سائنس کی کلاس میں حوصلہ افزائی محسوس کرتا / کرتی ہوں۔	1	2	3	4	5
12	مجھے کلاس لیکچر سن کر اچھا لگتا / لگتی ہے۔	1	2	3	4	5

	III. علمی وآگاہی مصروفیت	مکمل غیر متفق	غیر متفق	غیر جانبدار	متفق	مکمل متفق
13	میں کلاس میں مختلف طریقوں سے مسائل حل کرنے کی کوشش کرتا/ کرتی ہوں۔	1	2	3	4	5
14	میں کلاس لیتے ہوئے اس بات کو یقینی بناتا/ بناتی ہوں کہ یہ مناسب ہے۔	1	2	3	4	5
15	میں نئے حاصل کردہ معلومات کو پچھلے معلومات سے جوڑنے کی کوشش کرتا / کرتی ہوں۔	1	2	3	4	5
16	جب میں کلاس میں کچھ غلط کرتا/ کرتی ہوں تو میں اپنی غلطیوں کو سمجھنے کی کوشش کرتا/ کرتی ہوں۔	1	2	3	4	5
17	میں کلاس میں صرف اپنے کام کے آسان حصوں پر توجہ مرکوز کرتا/ کرتی ہوں۔	1	2	3	4	5
	IV. سماجی مصروفیت	مکمل غیر متفق	غیر متفق	غیر جانبدار	متفق	مکمل متفق
18	میں کلاس میں دوسروں کے لیے سرگرم عمل ، ذمہ دار اور جوابدہ ہوں۔	1	2	3	4	5
19	جب میں پڑھنے کا فیصلہ کرتا/ کرتی ہوں تو میں دوستوں کے خیالات پر غور و خواص کرتا/ کرتی ہوں۔	1	2	3	4	5
20	میں دوسروں کے ساتھ کام کرنے کی کوشش کرتا/ کرتی ہوں جو سیکھنے میں میری مدد کر سکتے ہیں۔	1	2	3	4	5
21	میں دوسروں کی مدد کرنے کی کوشش کرتا/ کرتی ہوں جو پڑھنے، سیکھنے اور سمجھنے کی کوشش کر رہے ہیں۔	1	2	3	4	5
22	میں یہ دیکھنے کے لیے مختلف آراء کا موازنہ کرتا / کرتی ہوں کہ کون سا آراء بہتر ہے۔	1	2	3	4	5

Appendix-M

Proof Reading Certificate

PROOFREADING CERTIFICATE

THIS IS TO ACKNOWLEDGE THAT THE THESIS ENTITLED BITE-SIZED TEACHING STRATEGY: EFFECTIVENESS FOR STUDENTS ENGAGEMENT AT SECONDARY LEVEL.

WRITTEN BY

Kainaat Khan

MPHIL SCHLOR, DEPARTMENT OF EDUCATION, FACULTY OF SOCIAL SCIENCES, NATIONAL ENIVERSITY OF MODERN LANGUAGES,

H-9, ISLAMABAD PAKISTAN

HAS BEEN PROOFREAD AND RETURNED TO THE STUDENT ON

30-May- 2022.

Name: Kanwal Nareen

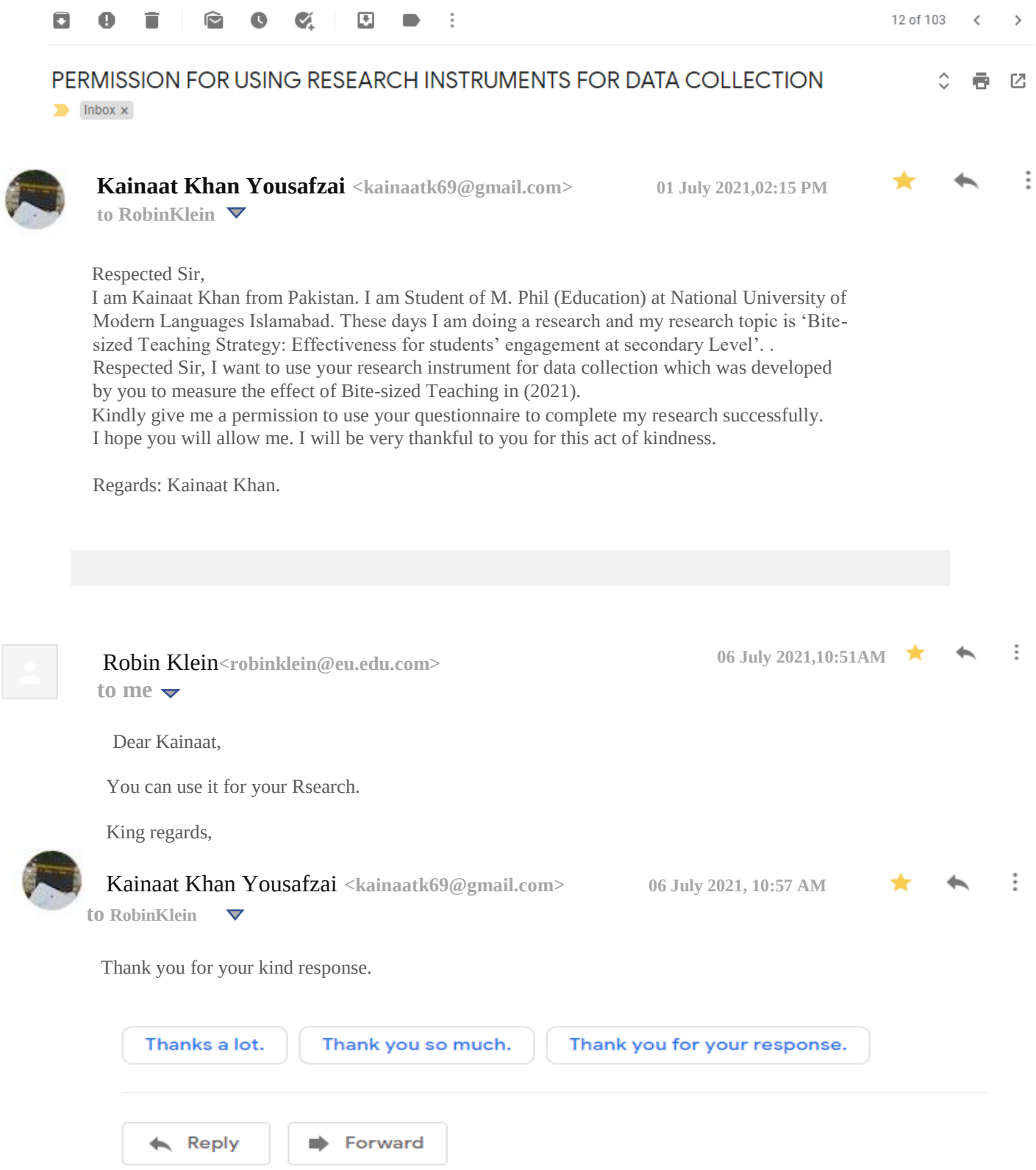
Designation: Lecturer

Institute: NUML

Signature:

Appendix-N

Permission for using Research Instruments



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PERMISSION FOR USING RESEARCH INSTRUMENTS FOR DATA COLLECTION

Inbox ×

Kainaat Khan Yousafzai <kainaatk69@gmail.com> 01 July 2021,02:15 PM

to RobinKlein

Respected Sir,
I am Kainaat Khan from Pakistan. I am Student of M. Phil (Education) at National University of Modern Languages Islamabad. These days I am doing a research and my research topic is 'Bite-sized Teaching Strategy: Effectiveness for students' engagement at secondary Level'. .
Respected Sir, I want to use your research instrument for data collection which was developed by you to measure the effect of Bite-sized Teaching in (2021).
Kindly give me a permission to use your questionnaire to complete my research successfully.
I hope you will allow me. I will be very thankful to you for this act of kindness.

Regards: Kainaat Khan.

Robin Klein<robinklein@eu.edu.com> 06 July 2021,10:51AM

to me

Dear Kainaat,

You can use it for your Rsearch.

King regards,

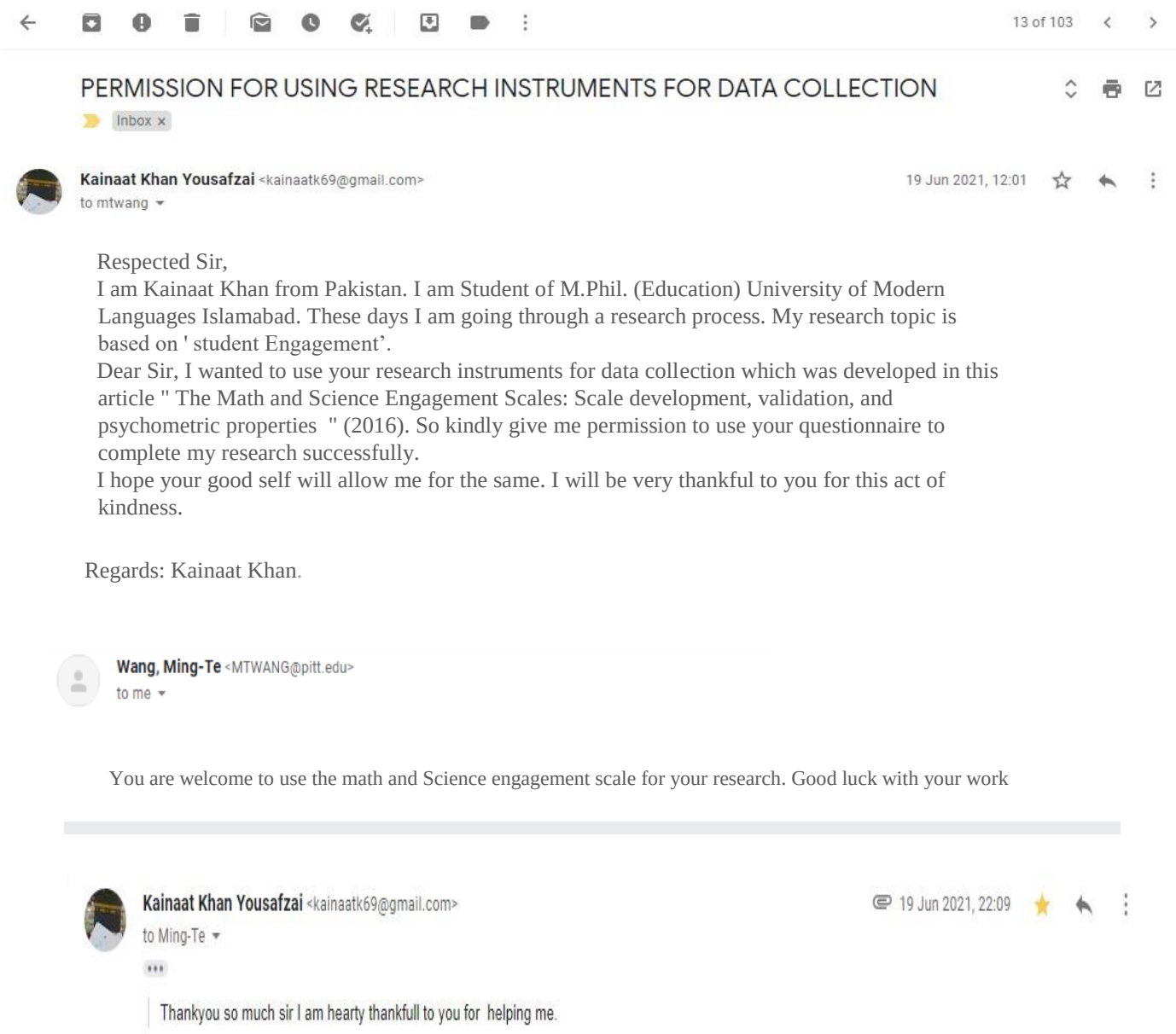
Kainaat Khan Yousafzai <kainaatk69@gmail.com> 06 July 2021, 10:57 AM

to RobinKlein

Thank you for your kind response.

Thanks a lot. | Thank you so much. | Thank you for your response.

Reply | Forward



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PERMISSION FOR USING RESEARCH INSTRUMENTS FOR DATA COLLECTION

Inbox ×

Kainaat Khan Yousafzai <kainaatk69@gmail.com>
to mtwang

19 Jun 2021, 12:01

Respected Sir,
I am Kainaat Khan from Pakistan. I am Student of M.Phil. (Education) University of Modern Languages Islamabad. These days I am going through a research process. My research topic is based on ' student Engagement'.
Dear Sir, I wanted to use your research instruments for data collection which was developed in this article " The Math and Science Engagement Scales: Scale development, validation, and psychometric properties " (2016). So kindly give me permission to use your questionnaire to complete my research successfully.
I hope your good self will allow me for the same. I will be very thankful to you for this act of kindness.

Regards: Kainaat Khan.

Wang, Ming-Te <MTWANG@pitt.edu>
to me

You are welcome to use the math and Science engagement scale for your research. Good luck with your work

Kainaat Khan Yousafzai <kainaatk69@gmail.com>
to Ming-Te

19 Jun 2021, 22:09

Thankyou so much sir I am hearty thankfull to you for helping me.

Appendix-O

List of videos about Technology which are used In Jazz Smart School in FDE

- https://youtu.be/aLFK_W-Zj7Q
- https://youtu.be/G2kEazXPbcQ
- https://youtu.be/OpGRLHj08Qc
- https://youtu.be/_NevF-6LHtE
- https://youtu.be/tSO7BetMuC0
- https://youtu.be/KXcNsNk766c

Appendix-P

Turnitin Letter Issued By QEC

National University of Modern Languages
Quality Enhancement Cell
Sector H-9, P.O. Shaigan, Islamabad, Pakistan
Tel: +92-51-9265100 Ext 2246/2247
Web: www.numl.edu.pk

Dated: June 23, 2022

Faculty of Social Sciences

Subject: Turnitin Report of MPhil Thesis of Ms Kainaat Khan (Education) 1st - Attempt

This is to state that **MPhil** thesis of **Ms Kainaat Khan** has been run through **Turnitin on June 23, 2022**. Paper ID is 1861778592 and similarity index is 06%. This is within the limit prescribed by the Higher Education Commission.

The subject similarity index report is attached for further processing, please.

(Dr. Khushbakht Hina)
Director
Quality Enhancement Cell

Dean FSS

HOD Edu: