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The impact of using Socrative based formative assessment to enhance student achievement in a nutrition course: A digital forward assessment

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Abstract

The purpose of this paper is to describe an experimental study that examined the impact of using Socrative as a tool for formative assessment "Feedforward" on EFL tertiary college students' conceptual understanding of a nutrition course in the United Arab Emirates. The impact is determined by student test achievements. The study used true experimental design on 47 nutrition students and randomly assigned 23 participants into an experimental group and 24 into a control group. Both groups took pre-post-test of three parts unit of macronutrients. After the teaching the units, a pretest was administered, then the experimental group got a Socrative formative based assessment and the control group received the usual traditional paper based review. The study evaluated students' understanding of the concepts and improvement of posttest after treatment of socrative based formative assessment. The results were analyzed in statistical software (SPSS 23) using independent t-test to determine if there was significant difference in the posttest scores between the two groups. The findings showed a significant improvement in the experimental group's posttest, which is an impact in the implementation of socrative as formative assessment in enhancing student achievement.

Keywords: formative assessment, student response system (SRS), socrative, feedforward, educational technology

1. Introduction

The learning needs of today's Instant Message Generation (Lenhart, et al., 2001) is changing and affecting the way teachers deliver a lesson (Prensky, 2001; 2005). The young generation of today spend the majority of their times in and outside the classroom engaged in some form of technology (Lim, 2017). These technological changes which are accelerating at a very fast pace are equally affecting teaching, learning and assessment (Fabienne, et al., 2015). Therefore, teachers and educational institutions are constantly competing with the rise of technology in new ways of engaging learner's attention and is driving research and experimentation of EFL paperless classrooms (Grigoryan, 2018). Accordingly, there is an evidence in research that the use of technology embedded lessons have increased in the last few decades and receive more interest and engagement by the students (Grigoryan, 2018).

One of the ways technology is being used in the classroom is to engage students in assessments for learning (Yoon, 2017). Formative assessment (FA), at times called assessment for learning (AFL), which occurs during and after instruction has become a paramount in today's teaching (Fabienne, et al., 2015). It is a way to measure learners' conceptual understanding and a way forward (Black & Wiliam, 2009). The goal of formative assessment is to practice the content for deeper learning and a way to give ownership of learning to the learner. Obviously, there is no grading involved during this stage and it is meant to engage the learner into a meaningful learning through feedback. This feedback should be based on gathering data on student progress and feeding it forward to instruction to enhance students' learning (Black, et al., 2003). The fundamental importance of productive formative assessment is a timely student progress data driven feedback to students (Wiliam, 2006). The traditional assessment and its

feedback takes time and does not engage and meet the needs of the instant message generation (IM) of today. One way to help with this problem is the use of technological tools like socrative, student response system (SRS).

2. Research - rationale, significance, purpose and hypotheses

This research focused on investigating the impact of student response systems (SRS) such as socrative based formative assessment on female student achievement in higher education in the United Arab Emirates. The majority of research in this area had fallen under the category of descriptive or theoretical and mainly had observed student engagement (Jones & Shao, 2011). There has not been sufficient studies done that provide information on the effectiveness of these technological systems on conceptual understanding and achievement of EFL students in nutrition. Finally, a limited number of studies here have been conducted on the benefits of student response system on examination results (Flosason, et al., 2015) and this research filled this gap because there is a need for this kind of true comparison between different instructional delivery methods and its impact on achievement. Grigoryan (2018) urged "the importance of reevaluating teaching and learning ways in light of the realities of the new digital worlds".

2.1 Rational for the study

This study compared the effects of socrative based formative assessment course delivery on academic achievement scores to traditional paper based scores. I gathered additional data, such as the students', grade levels, and students' ages. A quantitative approach, true experimental design, was appropriate because the analysis relied on numerical data and used control group (Creswell, 2003). It is important to engage today's learners in technology and assessment for learning. There is a need for more investigations on the effects of student response systems (SRS). The use of formative assessment through

socrative (SRS) should be driven by evidence of its efficacy. Research drives stakeholders in education to understand the impact of SRS formative assessment for learning. At this juncture, there is no clear indication of which types of learning tools are most effective for different populations of students. The purpose of this study was to examine the use of socrative (SRS) based formative assessment on the enhancement of EFL student achievement in the area of nutrition.

2.2 Significance of the study

As stated by many studies, the use of socrative or similar SRS tools could aid in improvement of conceptual understanding of a nutrition course (Hunsu, et al., 2016). Such tool allows the teacher to post questions, receive student responses and provide timely feedback. In this context, I would like to use "feedforward" as the data and responses received from the learners in socrative guides and directs the instruction (Carless,, et al., 2006) (Black & Wiliam, 2009). This experiment will fill the gap in the literature by investigating the effects of using socrative as a formative assessment to improve EFL student achievement in nutrition. Results of this study may provide implications for teaching EFL students in content.

2.3 Purpose of the Study

As technology based assessment for learning in higher education continues to increase and develop, relevant research must be conducted to determine what should be considered tenable approaches to these technologies for learners in general and for EFL in particular (Grigoryan, 2018). The purpose of the study is to investigate the effectiveness of socrative based formative assessment on learning and student achievement. This true experimental study compared the posttest scores of students who received socrative based formative assessment method with the achievement of those who received a traditional paper based revision for a nutrition course in fall of 2018. The independent variable for this study was socrative based formative assessment and data driven instruction for the

experimental group. The study's dependent variable is defined as academic achievement on the posttest of both groups measured by the Independent Samples T-Test (SPSS 23). This true experimental comparative research will fill the gap in investigating the efficacy of the two teaching methods of assessment for learning for a group of college students in a student response system technological tool. As a result, the intended outcome is to understand what impact different delivery methods have on student achievement and this guides the following hypothesis.

2.4 Hypotheses:

There is a significant difference between socrative based student achievement and traditional (paper-based) student academic achievement in college students when all other elements remain constant.

Null Hypothesis:

There will not be a statistically significant difference between the experimental group posttest scores of students who received socrative feedback through socrative and those who did not receive the treatment.

The p value for the intervention parameter is set to be less than or equal to 0.5 for the rejection of the null hypothesis.

Definition and operationalization of key concepts:

The definitions below are given to show clarity to the concepts used in this study.

- *Student Response System (SRS)*: an electronic response system used by teachers to pose questions and students to respond to them.
- *Socrative*: an internet application that teachers and students can access freely via a technological/smart device.
- *Formative assessment (FA)/(Assessment for learning (AFL)*: a formal or informal assessment that takes place

- *Feedforward*: a form of feedback that looks into the future to enhance learning

3. Literature Review

3.1 Formative assessment

Formative assessment also referred to as assessment for learning is a continuous feedback and feedforward with a specific goal of enhancing teaching as well as learning (Hargreaves, 2008). In today's classroom, formative assessment is seen as an important way in which teachers can help students in understanding and ways to engage the learner into the concepts at hand (Black & Wiliam, 2009). With this positive outlook of assessment and strong student interest, it would be reasonable to believe that formative assessment programs will enhance students' learning (Miller, 2009). It's often immediate and aimed to inform changes the teacher should make to the direction of instruction so that teaching is more effective. This is possible because teachers provide feedback to the pupils to identify progress and gaps in learning as they target individual student needs (Yin, et al., 2014). Assessment for Learning must be done during classroom as students are engaged in the learning process. In their study "Inside the Black Box", Black and Wiliam strongly urge that in order for an assessment to be valuable, it must be embedded into the learning and teaching process (Black & Wiliam, 2009). It must also provide the learners an active role in a feedforward assessment process.

3.2 Feed forward Assessment

According to Carless, Joughin and Liu's research (Carless,, et al., 2006) feed forward is "feedback that is forward looking, so that it can improve students' learning and enhance their future performance on assessed tasks". This kind of feedback is driven by the data collected from students while teachers teach and is used to modify instruction (Fabienne, et al., 2015).

3.3 Socrative: Instant Insight

Socrative, a student response system (SRS) is a tool (web 2.0) that allows teachers to post questions in a variety of different ways and quickly gather information on student's level of progress and at the same time give feedback to them (Mclaughlin & Yan, 2017) (Johnson & Mcleod, 2005). The data collected from the students shapes the instruction as it is based on visually represented student responses shown in figure 1. Socrative as a tool also involves students in a competitively collaborative engagement as they can race in groups (shown in figure 4).

One of the benefits of using SRS tools such as socrative is to improve student engagement and achievement (Moratelli & DeJamette, 2014). These student response systems may take different forms, but the majority of them allow for immediate student responses, as well as feedback from the teacher regarding their work. Students may submit answers, share responses, and demonstrate their learning through the use of multiple choice or true/false questions, surveys, and open-ended response questions (Johnson & Mcleod, 2005). Because of this, SRSs may be considered tools for conducting formative. William (2006) argues that formative assessment provides teachers with the opportunity to assess their students' knowledge at various points in their learning. Results from such assessments, in turn, inform future instruction. According to the data displayed in socrative and similar SRS tools about students' conceptual understanding, a teacher could use for clarification, discussion starters or simply reteach. Research has found that a SRS may serve as an effective tool for increasing student engagement and academic performance (Moratelli & DeJamette, 2014; Karaman, 2011).

Various researches have questioned and debated the efficacy of student response systems (SRS). Some have claimed that there isn't significant effect. However, they all recommend further investigation in the efficacy of student response system to enhance student achievement (Fabienne, et al., 2015) (Grigoryan, 2018) (Hunsu, et al., 2016)

(Johnson & Mcleod, 2005) (Karaman, 2011) (Lenhart, et al., 2001)

4. Theoretical underpinning

The theoretical underpinnings for this quantitative study is based on the positivist paradigm. The aim of this theory is to gather and assemble evidence in order to confirm or reject a hypothesis as it measures variables to determine causality (Scott & Morrison, 2007). This paradigm uses experimental methods involving experimental and control group, where the researcher is external and controller of the process. This theory though mostly used in large sizes, is suitable for this research because it examines the experiment's effect on learning with the use of web 2.0 tool integrated into teaching and learning (Bell, 2011). Generally its focus is on the objectivity of the research process (Creswell, 2015).

Formative assessment has struggled in designing a particular unique theory (Black, et al., 2003), but for the purpose of this study, the following assessment or learning conceptual framework (figure 1) has guided this process. It is important to connect research with a theory (Pryor & Crossouard, 2012). After carefully reviewing the literature, this framework shaped my methodological design. Bloomberg and Volpe (2008) state the significance of using a conceptual framework (Bloomberg & Volpe, 2008).

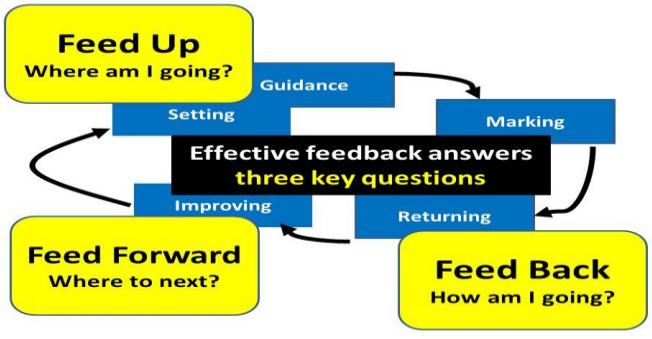


Figure 1: Conceptual Framework (The Power of Feedback by John Hattie and Helen Timperley) Review of Educational Research, v77 n1 p81-112 2007

5. **Methodology**

5.1 Study design

This study used a true experimental design and compared pretest-posttest scores of college students in a nutrition course. The experimental group received an intervention of a socrative formative assessment and the other received a traditional paper based assessment.

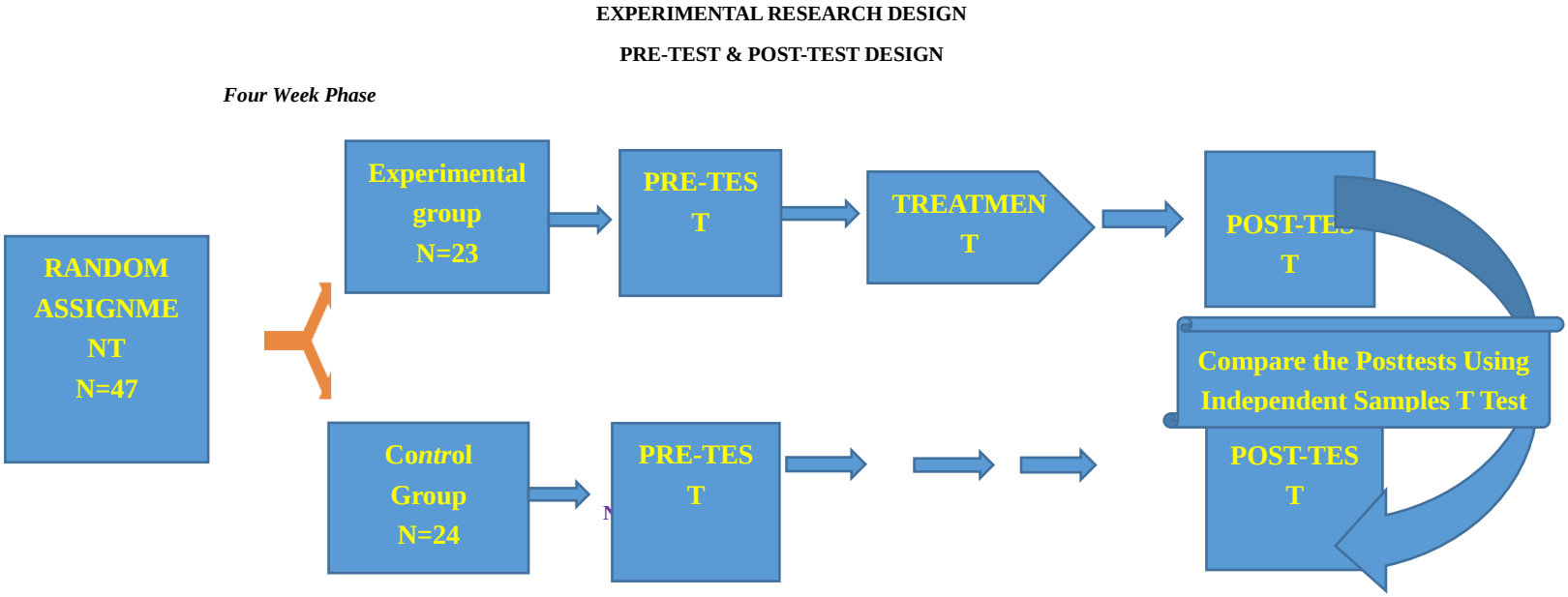
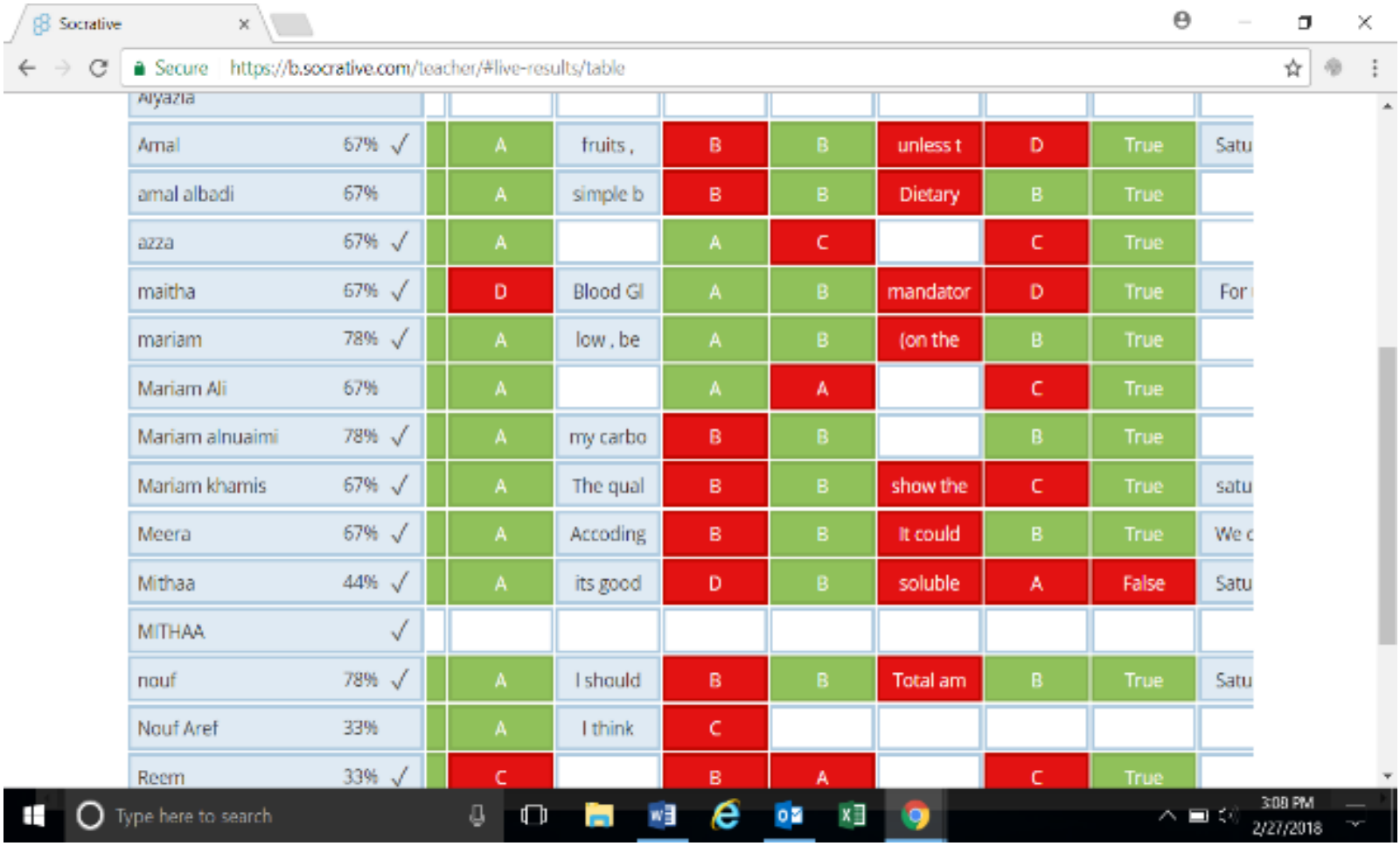


Figure 2: Study Plan

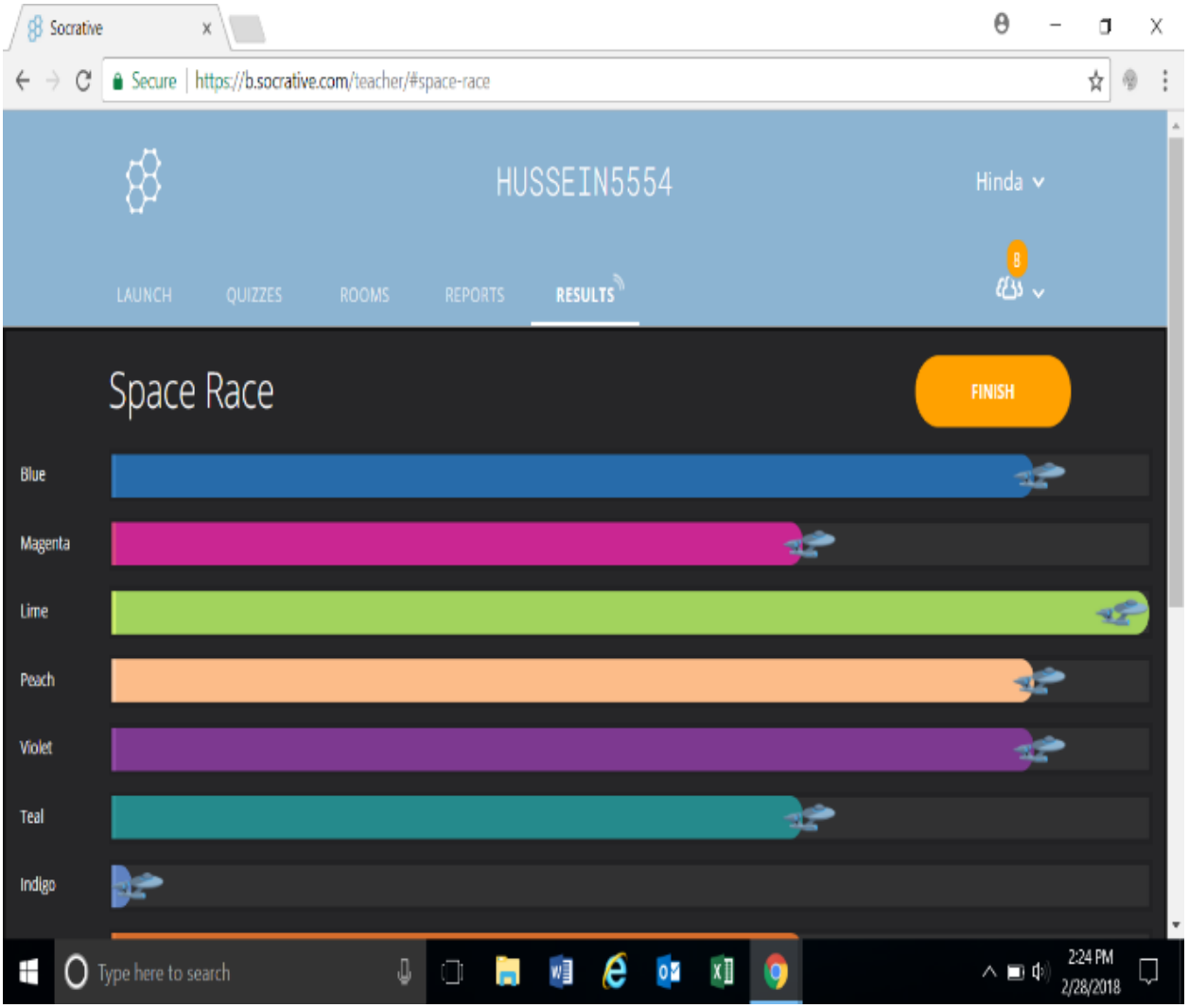
As shown in figure 2, this study was conducted in four weeks and in three phases: preparation, teaching and evaluation. The teaching and evaluation phase was guided by Bloomberg and Volpe's conceptual framework of "Feed Up, Feedback and Feed Forward". In the preparation phase, the researcher trained herself in socrative and created quizzes, questions and various assessment materials in socrative. Then explained and trained the students in how to use it and the purpose for it. In the teaching phase, the

experimental group first received instructions on three part units of a macro-nutrient: carbohydrates, lipids and protein. The instructions were based on teacher lectures, readings, videos and vocabulary activities. A pre-test with 20 varied questions: MCQ, true false, short answers of each unit was administered at the end of the instructions. For the purpose of the experiment, following the pretest, the experimental group (N=23) received a socrative based formative assessment to check students' understanding of the concepts (figures 3&4). Then, the experimental group had a socrative, a student response system (SRS) based formative assessment treatment, while the control group had traditional/paper based revision of the concepts with the teacher. Then, the two groups took the same exact post-test. Any difference between the scores of the two post-tests should show up as a difference between the mean levels of performance in the groups.

The benefits of socrative is that the teacher can see the students' answers to the questions and clarify the concepts in real time. An example of socrative quiz below (figures 3) shows students' understanding. The red areas in the screenshot of the quiz are questions students got wrong. The value of a formative assessment is what the teacher does with the information it generates. At this point, the teacher used this valuable data to reteach. The data present in figure 4 showed a representation of formative assessment in fun and collaborative way (McDonough & Foote, 2015). This guides the teacher in how to feedforward. It also shows students their own conceptual process so they take ownership for their own learning.



Example of a quiz (figure 3)



Example student race (figure 4)

5.2 Study setting

The participants, a total of 47 undergraduate college female students studying a nutrition course for their bachelor's liberal studies requirement in a tertiary public institution in the United Arab Emirates. The participants are EFL students studying bachelor programs in varied majors. This nutrition course is a liberal studies requirement. The participants (N=47) were randomly assigned through simple random sampling using the fish bowl process and chose students into an experimental (N=23) and control (N=24) groups (Kumar, 2014). The design was appropriate as the sample population was randomly

assigned, which increased internal validity and the independent variable, socrative (SRS) based feedforward formative assessment was manipulated. The dependent variable was the post-test scores.

5.3 Sampling

The participants of this study (N=47) were randomly chosen from three intact classes of EFL female students studying their bachelor's degree at a tertiary college in the United Arab Emirates. The institution has various bachelor programs in applied Communications, Business, Computer & Information Science, Engineering, Health Science and Education. The participants were EFL students whose native language is Arabic, but they are studying in an English medium. Their ages ranged from 18-23 and they were at different years in their programs studying "introduction to Nutrition" class. They were relatively homogeneous with respect to age, gender, record of academic achievement, and other variables potentially relevant to the performance of the tests. This course was part of the students' bachelor degree's liberal studies requirement. This course is one of two of health requirement for the bachelor's programs. The class met twice for four hours and ran for 16 weeks.

5.4 Data Collection

The data was collected spring of 2018 at a public college in the United Arab Emirates from scores of unit pre and posttest tests of a nutrition course. Data gathered and entered into SPSS was secured, dismantled after the study was completed and all the other ethical procedures were followed as urged by Creswell's (2007).

The pre and posttests were identical in every respect as it is important to test the reliability of the tests and measure the consistency of construct of the test (Newby, 2010). The pretest and posttest of this study consisted of system wide constructed test items from the college. Reliability measures of these items were tested and piloted at the start of the course. This is a course that is used in all campuses across the system and the same tests

are administered.

The tests were administered online via blackboard, which was the college's gradebook. During the tests, which was administered in class, each student used her own computer with lockdown browser. This system which is the usual way of conducting tests in this institution, secured the student into the test and did not allow the students to cheat. The grading was done automatically by the computer program, thus, increasing reliability. The aim of collecting the data was to get average numerical data for both groups, the data were collected directly from the blackboard and entered into SPSS. The researcher is the only teacher for the groups. All the students participated in the study because the researcher built the experiment into the course plan.

Creswell (2015) noted the importance of aligning research plan with suitable research. The purpose of collecting the data for this study was to drive and guide the feed forward instruction and ultimately check of the effect of the treatment on student achievement and outcome. Quantitative research was used as a measurement of values, study of numbers, and evaluation of trends. It allowed the researcher to look at cause and effect of more than one variable. Comparison studies evaluated the effectiveness of an intervention on outcomes, generally comparing one group using the intervention and another group not receiving the treatment (Creswell, 2015).

5.5 Data Analysis Plan

After completing the collection of the data, a two-tailed independent t-test was carried out to test the hypothesis of the study. SPSS, a statistical software was used to analyze the data. The null hypothesis was accepted or rejected based on alpha value of $P<0.05$. Additionally, an independent t-tests compared the pre-tests of the groups to confirm the

equivalence of the scores. Then, an independent t-tests was done to compare the posttests. A distribution graph showed the comparison and normality of the two groups was done for the null hypothesis, followed by the comparison of the posttests scores for the two groups. Comparison studies evaluated the effectiveness of an intervention on outcomes, compared one group using the intervention, from another group not using the intervention (Creswell, 2015).

6. Results:

This quantitative study examined the impact of socrative based formative assessment on learning as an effective method of teaching due to the achievement results of the students' scores. The data was based on a comparison of independent variable: socrative based formative assessment with a traditional paper based variable. However, the sample size was a limitation to the study, as well as the fact that the study was only conducted in one subject area and with one female students. This study contributes to the literature as the investigation was experimental included two different groups. The measurement tools were pre- and post-tests about their conceptual understanding of macronutrients. There was a significant increase in the experimental group's posttest scores, which concluded that socrative assessment for learning was an effective learning tool.

This study examined the effect of socrative based formative assessment on learning as an effective method of teaching due to the achievement results of the students' scores. The results are presented in two sections: a) reliability tests; and b) result for null hypothesis. A social science statistical package software (SPSS 23) was used for the statistical analysis. Table 1 represents the descriptive statistics, including the means, standard deviation, minimums and maximums of the scores of the pre and posttests units of the nutrition course.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Gender	47	1.00	1.00	1.0000	.00000	.	.
Age	47	1.00	4.00	2.4468	1.05930	.146	.347
Nationality	47	1.00	1.00	1.0000	.00000	.	.
Year of Education	47	1.00	4.00	2.2766	1.11710	.397	.347
Two groups	47	1.00	2.00	1.5106	.50529	-.044	.347
Scores of Pretests	47	28.00	79.00	59.5745	11.35541	-.903	.347
Scores of Postests	47	34.00	87.00	66.5532	11.61859	-.767	.347
Valid N (listwise)	47						

Table 1: Descriptive statistics

Reliability Test:

To make certain the test used as a measurement instruments is equivalent, it was important to conduct a reliability test. This showed as it is presented in table 2 that there was no difference between the pretest scores of the groups.

Group Statistics

	Two groups	N	Mean	Std. Deviation	Std. Error Mean
Scores of Pretests	Experimental	23	58.7826	11.60312	2.41942
	Control Group	24	60.3333	11.30858	2.30835

Table 2: Group statistics

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Scores of Pretests	Equal variances assumed	.023	.881	-.464	45	.645	-1.55072	3.34209	-8.28205	5.18060
	Equal variances not assumed			-.464	44.786	.645	-1.55072	3.34396	-8.28670	5.18525

Table 3: Independent sample test

Descriptive Statistics

	Mean	Std. Deviation	N
Scores of Pretests	59.5745	11.35541	47
Scores of Postests	66.5532	11.61859	47

Table 4: Descriptive statistics

Correlations

		Scores of Pretests	Scores of Postests
Scores of Pretests	Pearson Correlation	1	.761**
	Sig. (2-tailed)		.000
	N	47	47
Scores of Postests	Pearson Correlation	.761**	1
	Sig. (2-tailed)	.000	
	N	47	47

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

Table 5: Correlation

Results related in the null hypothesis is shown in Table 8, which provides the result of the two-tailed independent T-Test for the posttests.

Report

Scores of Postests

Two groups	Mean	N	Std. Deviation	Std. Error of Mean	Minimum	Maximum	Sum	Skewness	% of Total Sum	% of Total N
Experimental	72.6522	23	8.66345	1.80645	51.00	87.00	1671.00	-.635	53.4%	48.9%
Control Group	60.7083	24	11.19580	2.28533	34.00	77.00	1457.00	-.838	46.6%	51.1%
Total	66.5532	47	11.61859	1.69475	34.00	87.00	3128.00	-.767	100.0%	100.0%

Table 6

Group Statistics

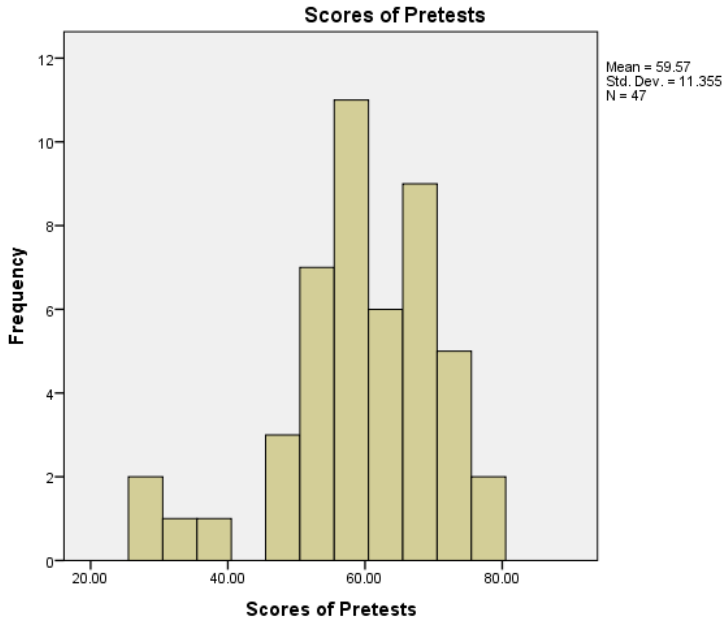
	Two groups	N	Mean	Std. Deviation	Std. Error Mean
Scores of Postests	Experimental	23	72.6522	8.66345	1.80645
	Control Group	24	60.7083	11.19580	2.28533

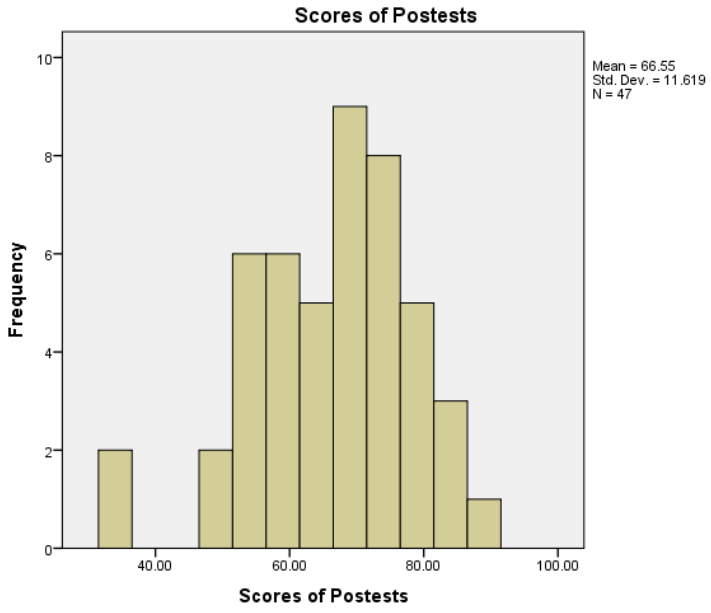
Table 7: group statistics

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Scores of Postests	Equal variances assumed	.956	.333	4.078	45	.000	11.94384	2.92902	6.04449	17.84319
	Equal variances not assumed			4.100	43.121	.000	11.94384	2.91308	6.06954	17.81815

Table 8: Independent sample test





An independent t-test was conducted to examine the difference between the pre- and post-unit test scores of students who used the student response systems when compared to those who did not. The Levene Test for Equality of Variances showed no violations

P=.333. Results indicated that the experimental group had (M =72.6522, SD=8.66345) higher scores than the control group who had (M=60.7083, SD=11.19580). *t*=4.078, *P <.001, Cohen's D=1.19.* Results of the t-test showed a statistically significant mean difference in the scores of those provided with formative assessment in comparison to those who were given traditional based assessment.

7. Limitations, Implications and Conclusion

7.1. Limitations:

The limitation of this study was that the sample was a small group of the student population, which was not representative of the entire college student studying in the bachelor program. In addition, the tests used in this research were restricted only to a particular course which could not represent the nutrition achievement for students in other classrooms. The study is limited to the data collected from students of one school only, possibly affecting the external of the hypotheses. All the participants were female students from the UAE, which makes the generalizability more difficult.

7.2. Implications:

This study was based on a course work in one college for a one semester period of time, so therefore the results may not be generalized to other contexts. Repeating similar studies that would cover a bigger number of students and a longer period of time would corroborate the findings of this research. In the meantime, and in spite of the limitations, this study contributes to educational technology in the classroom.

7.3. Conclusion:

With the increase of technology in classrooms, research needs to test and validate technologically based pedagogical practices. This study investigated the impact of using socrative based formative "feedforward" assessment on EFL learners' achievement in a nutrition course. Results showed a significant difference in achievement scores between

the experimental and control group. I observed that the students were engaged and a couple of them said that they found it helpful and suggested that they receive a similar formative assessment in the upcoming units. I am considering their suggestion and would like to conduct further units through a socrative based assessment and continue the research finding out what the students thought via questionnaire. Additional future interest might also be to try with other groups and include male students.

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