The 15th International Scientific Conference
eLearning and Software for Education
Bucharest, April 11-12, 2019
10.12753/2066-026X-19-088

An Interdisciplinary Research: USTEAM Approach & BWG Assessment in Online Courses

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***Abstract**:Real life jobs need interdisciplinary skills and educations should be adjusted in a way that students obtain these skills in their education lives. Designing interdisciplinary online courses seems to be unavoidable in educational institutions to have the technological and innovational catch-up in the 21st century. This paper includes a discussion about the importance of the assessment methods and presents BWG assessment method as an option. It is measuring students' success in three factors with BWG Assessment: Behavioral Success, Work Success and Group Success. A teaching method, as an alternative to STEM and STEAM approaches, combining the expertise of Science, Technology, Engineering, Arts and Math with specialized, student-centered Unique projects called USTEAM was delivered to lycée students' for 9 months. To find students' attitude towards this new method USTEAM Attitude test is used. Descriptive Statistics, Compare Means and General Linear Models were used in IBM SPSS Statistics 25 for analyzing the data obtained from BWG pretest and BWG posttest marks of the Standard Online Courses and the USTEAM Online Courses. Results was awarding parts of the study and success was more than what was expected. Although some students were aggressive at the beginning toward being a member of USTEAM groups, they were more motivated by assuring that they didn't have any competitors and they were expected to produce their Unique projects regardless of what others do! For motivation theorists, the results from this study provide evidence that interdisciplinary cultural influences in courses can be expressed in diverse educational settings. For educators, this study underlines the importance of cooperative and creative USTEAM activities in online courses.*

***Keywords:** USTEAM, BWG, Assessment, Pretest, Post Test, Online Course.*

I. INTRODUCTION

1.1 What is STEM or STEAM?

Students perceptions and attitudes plays an important role on the effectiveness of the teaching methods. However the first version of the combined disciplines method STEM was often associated with negative perceptions and learning difficulties [1, 2,5], which was the main reason of the curriculum designers increased efforts for modifying STEM integrating arts and encouraging creative solutions with a newer approach STEAM [3]. This new approach claimed to help students to transfer enthusiasm from artistic work to science to support individual self-efficacy and thus, to close the 'creativity gap' and may provide additional channels to learn abstract mathematical problem-solving tasks [6,7]. However all of these exclude the personal differences and needs of students. Students in schools are coming from all folks of life bringing their own expertise of life each. Some of this background experiences are very good examples for students developments, however some were very bad and specially the students with bad experiences needed more attention. Today, in governmental schools students coming from rich families and poor families are classmates. So, how can a poor student buy the necessary research equipment's necessary for the STEAM? It would not be fair to expect same experiences, performance and facilities from every student. Each student should be

evaluated his own Unique capacities and should be counselled to work on his capabilities. On the other hand there are lots of students coming from a divorced family, from an unhappy family or even from a family in which parents are both dead. There are also students with lots of personal differences such as dyslexic or hyperactivity in classrooms. In addition to all these, day by day classes get more multicultural. These days in most of lycée classes we have students from Turkey, Cyprus, Russia, England, Australia and Azerbaijan. None of the mentioned methods until today are considering these differences among students, hence for all these reasons another newer approach considering these differences, considering Uniqueness of students is needed!

1.2 Why USTEAM?

USTEAM (Unique Science, Technology, Engineering, the Arts and Mathematics) is an educational approach that uses different disciplines as access points for guiding student questions, dialogues, problem solving strategies, imagination, critical thinking and producing unique solutions all valid in different cases. In this method more responsibility is on students and they are forced to think more, take their own risks and engage in experiential learning collaboration and become more aware of the culture and the community they live. Instead of blank-minded computer youth who are sitting in front of computers and playing more than 10 hours computer games, we need innovators, educators, leaders, and learners of the 21st century. That is why we have to change our educational methods and make sure that we help them to be the one that they dream!

1.3 Assessment in Online Courses

Assessment and evaluation is a topic which is mostly omitted for years by educators, researchers and curriculum designers. However, it is one of the most important part of the education process that helps us teachers to deliver more effective courses. Today there are not many researches on how we can better asses and evaluate students process in online courses. Mostly the assessment methods of the students are the multiple choice tests like the current assessment method of the most universities. Does crossing a's, b's or c's need a special talent? Or is it really the wanted outcome of our courses? Does crossing or clicking letters mean that we have reached our aims of the course? Although it was known that the assessing and the integration of technology into the classrooms is one of the biggest challenges of educational decision makers and school administrators face [4], not much is done in most of the offline or online educations to overcome this challenge.

1.4 BWG Assessment Method

How we understand when our students acquired the knowledge? It doesn't seem completely true to assess students from one-type multiple choice questions. In 21st century more than that is needed. For example when we really learn something it may be observed from our behaviours to the topic as a result of the influence and impact of the new knowledge has had on us. Of course, the extend of the change of behaviour is directly proportional with the ingrained negative behaviour and the habits of the person. So, the behavioural change can be assessed in time and is one of the good outcomes of a well designed courses. When observing the change in the behaviour, one should not omit the factor or importance of the gained knowledge and skills. Most history courses in schools are memorized by the students and after a few years they are forgotten. So, why we are keeping our students mind busy with the things that they will forget in time? Why we are not trying to help students to keep their own history in their minds for a lifetime and help them to represent our culture as a grown up businessman? Students start a race once they start in their school life and continue until they graduate from the school. They learn how to attain in a race in school life and they always try to be more successful from their friends in the real life. However, in real life we need more than racers! We need people who are knowledgeable, who can think, who can produce and who can share their knowledge with others for the sake of the community. We have to teach students how to collaborate, how to work together in schools so that we can expect these when they grow up and become our workers. That is why assessment and evaluation of their collaborative work is also necessary. This study offers BWG Assessment method where Students' knowledge and skills are measured in 3 different ways: "Their change in Behavior (B)", "Their Work Marks (W)", "and Average Group Marks (G)".

1.5 Purpose

Primary aim of this research study is to find if there is a meaningful difference between the students pretest BWG and posttest BWG marks in the Standard online courses and in the USTEAM Online courses. Secondary aim of the study is to find the students' attitude towards USTEAM courses.

II. METHOD

2.1 Population

240 students, ages between 15-17 in Cyprus have attained to the research study. 120 students were registered to the USTEAM Online Courses and 120 students attained to the Standard Online Courses.

2.2 Instruments and Process of Data Collection

Both groups actively participated to the online courses for 9 months, in total 72 hours. Course materials were uploaded and shared students via Bloggers and Social Media Group, face-to-face chats were Students directed by teachers to choose their own unique projects and prepared their own videos and uploaded to the bloggers. Figure1 shows some of the students videos that they had prepared and uploaded online. They all had different projects according to their interests and had to report each week on the course blog their studies during the week by uploading a writing document or a video. Standard Online courses were following the standard teaching and learning methods such as teachers explaining a subject asking questions and students answering those. However, USTEAM online courses students were free to do their unique project in the guidance of the USTEAM council in the school (which contained 18 different branch teachers; Chemistry, Physics, Biology, Technology, Computer Engineer, Electronics, Turkish, English, French, German, Geography, History, Arts, Psychology, Philosophy, Economics, Music, Councilor). Students had to choose 4 different teachers each week, show their work and take their advice. Every Friday, students were presenting their work to their Technology teacher in the online class chats and sharing their activity videos with their friends. Although some students were shy at the beginning and were not very eager to attain to the class meetings and present their weekly report, they get used to it in time. Students getting used to presenting their own work are encouraged them to continue and do their best.

Figure no.1. Students' Online Videos

Teachers from different diciplines Science,Technology, Engineering, Arts and Mathematics collaboratively worked on the course curriculumn and prepared the USTEAM course materials for students. Descriptive statistics were used to analyze and to report the data gained from the questionnaire. For data analysis, SPSS 25.0 was used. Students' knowledge was measured in different ways: "Their change in Behavior (B)", "Their Work Marks (W)", "and Average Group Marks (G)". If the change was observed they got 1 and if the change was not observed they get 0. Every student Got a "behavioral success" mark each week, and the average of these (in 10 weeks) is accepted as ***B success mark*** for this study. This mark was given as 1 (if B is higher than or equal to 50) and 0 (if B is lower than 50). Similarly, each week, students was marked for their "work success". W Marks were given between 0 until 100, according to the rubrics prepared for each course. At the end of 10 weeks average of these marks were taken and this formed the ***W success mark.*** This mark was given as 1 (if W is higher than or equal to 50) and 0 (if W is lower than 50). G Marks were also given between 0 until 100 (if G is higher than or equal to 50) and 0 (if G is lower than 50). Average score of the marks are given according to the rubrics prepared for each course. At the end of 10 weeks average of these marks were taken and this formed the ***G success mark*** for this study.

Attitude test was applied to the students at the end of 10 weeks. Any relation between students BWG successes and their attitude or perception was investigated. After having taken the experts suggestions; the questionnaire was divided into 3 factors: ***Behavioral Success Attitude (B success attitude)***, ***Work Success Attitude (W success attitude)*** and ***Group Success Attitude (W success attitude).*** In these questionnaire students, attitudes towards USTEAMs resulting in their ***Behavioral Work Success and Group Success*** are measured. The scales of the attitude questionnaire have values changing from 1 (strongly disagree) to 5 (agree). Interviews were carried with the course teachers to get their opinion about their students behavioral changes.

III. RESULTS AND DISCUSSION

As a result of 9 months USTEAM Online activities, Pre-BWG Marks and Post BWG Marks provided us interesting results. In 3.1 results of students attitude tests was presented

3.1 Students Attitudes toward USTEAM

Students attitudes towards USTEAM can be seen in the Table no.1. This table shows that students have positive attitude towards USTEAM.

	Sex	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree		Strongly Agree
Adaptable/Flexible	Female	0	0	7	32		15
	Male	3	3	15	33		12
USTEAM Allows Collaboration and Cooperation	Female	0	0	2	30		22
	Male	3	3	8	36		16
USTEAM Should be in school curriculum	Female	0	4	17	14		19
	Male	3	6	11	27		19
USTEAM Projects are Enjoyable	Female	0	0	4	29		21
	Male	3	3	6	39		15
We do Feasible Studies with USTEAM	Female	0	0	7	32		15
	Male	3	3	18	28		14
I feel Aggressive in USTEAM Projects	Female	23	24	3	2		2
	Male	39	17	4	6		0
USTEAM is Quite Frustrating	Female	29	15	6	2		2
	Male	43	15	8	0		0

I feel Happy doing USTEAM projects	Female	2	6	1	19		26
	Male	2	11	12	19		22
Helps me to improve my skills.	Female	11	11	10	11		11
	Male	19	9	19	9		10
Improves my knowledge.	Female	5	11	17	9		12
	Male	9	13	23	11		10
USTEAM helps me improve my social skills.	Female	0	0	7	30		17
	Male	3	5	12	33		`13
USTEAM is just not for me	Female	24	23	2	1		4
	Male	27	32	6	1		0
I am more eager to learn with USTEAM	Female	1	7	6	39		1
	Male	1	13	16	33		3
Provides opportunity to use ubiquitous learning tools	Female	2	12	12	17		11
	Male	2	15	14	25		10
USTEAM makes me creative	Female	0	6	13	19		16
	Male	2	8	17	28		11
I can easily voice out options in USTEAM Groups	Female	6	16	12	10		10
	Male	11	14	19	11		11
I want to use USTEAM in all my courses	Female	0	6	13	19		16
	Male	2	8	17	28		11

Table no.1. USTEAM Attitudes

According to this results and the descriptive statistical analysis the following interpretations are made: % 57, 96 of them agreed "*USTEAM" will be useful for them for developing social communication skills."* (*M* = 3, 53, *SD* = 1, 12). Students have positive attitudes for USTEAMs being used to improve communication skills. %70, *42 feel happy* doing "USTEAM" works (*M* = 3, 93, *SD* = 1, 07). %74, 58 believe that *the more often that teachers use "USTEAM", the more they will enjoy the school* (*M* = 3, 44, *SD* = 1, 34). % 87, 5 of them *did not agree* with the item about "USTEAM" being frustrating (*M* = 1, 59), *SD* = 0, 86); and %90, 41 of them *did not agree* with the item "USTEAM" doing any good (*M* = 1, 69, *SD* = 0, 80). These are important; since if they do not think that it is frustrating, then they do not have a negative attitude to it. If they do not have a negative attitude, then they have no objections to the USTEAM's rules such as; respecting others; behaving as a unique person to each member in their groups.

% 40 of the students said that they know "USTEAM" will be useful for them for improving their organization skills (*M* =2, 97, *SD* = 1, 41). *%42, 08 of the students said that they learn more when they are attaining a "USTEAM" course than other courses* (*M* = 3, 27, *SD* = 1, 25). What is more, *%64,58 of them study more for "USTEAM" courses than the other courses* (*M* = 3, 52, *SD* = 0, 90) and *%56,25 of them wants to use "Unique" game in their courses when they become a teacher* (*M* = 3, 45, *SD* = 1, 29). *%56, 67 of "Unique" should be used in schools curriculum,* (*M* = 3, 54, *SD* = 1, 31) and *%61, 25 of them believe that more and more people will be using "USTEAM"* (*M* = 3, 44, *SD* = 1, 34). Only a low percentage of students (%15) think that *is a "waste of time". We do not need games to learn things* (*M* = 1, 72, *SD* = 1, 07). As well as all these, *%60,83 of the students think "USTEAM" helps them to develop "Feasible Studies"* (*M* = 3, 46, *SD* = 1, 28). Work success attitude of students were positive (M > 2, 5).

%43, 33 of the students think that in "Unique" groups, it is easier to voice out my opinions than speak them face to their instructor (*M* = 3, 13, *SD* = 1, 38). *%68, 33 of them claims that they have the opportunity to use ubiquitous learning tools* (*M* = 3, 58, *SD* = 0, 85) and a high percentage of them (*%63, 75)* think that they help them to be Adoptable (*M* = 3, 60, *SD* = 1, 23). *%74, 17 of them think*

that it is easier to collaborate and cooperate in "USTEAM" classes than the traditional classes (*M* = 3, 75, *SD* = 1, 28). *%87, 5 of them feel aggressive toward being a member of "USTEAM" groups* (*M* = 1, 65, *SD* = 0, 93).

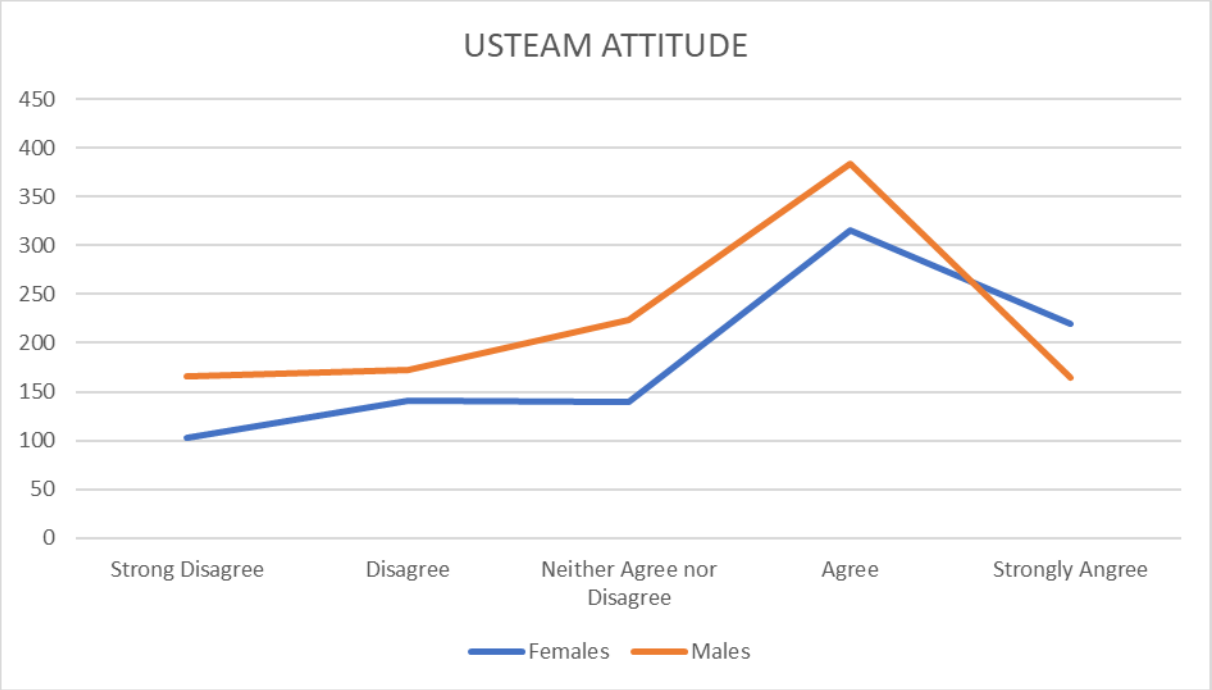

Figure no.2. USTEAM Attitude of Male and Female Students

It can be seen in the figure no.2 above that especially male students have a more positive attitude than female students and they think that the USTEAM courses are more enjoyable than the traditional ones.

3.2 BWG Marks of Standard Online Courses and USTEAM Online Courses

A paired-samples t-test was conducted to compare Pre-BWG Marks which were obtained from the tests delivered to students before courses and the Post-BWG Marks which were given at the end of the courses. There was a significant difference in the Pre-BWG Marks (M=1.09, SD=0.988) and Post-BWG Marks (M=1.80, SD=1.14); t(239)=-23.18, p=0.00. However, these tests were not enough to compare the USTEAM Online courses and the Standard Online courses. To find if there is significant difference between USTEAM Online group and Standard Online group controlling PreBWG Univariate test was delivered (see Table no.2).

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Post-BWG Pre-BWG	-.708	.473	.031	-.769	-.648	-23.175	239	.000

Table no.2. Pre-BWG & Post-BWG Test

Means of USTEAM and Standard Online courses was calculated. Levene's Test of Equality of Error Variances, Type III Sum of Squares was analysed and it was found that there is a significant difference between the Post-BWG Marks of USTEAM Online groups and Post-BWG Marks of Standard Online groups controlling the effect of the Pre-BWG achievements, F (1,237)=69.87, p=0.00 (see Table no.3)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	198.846	2	99.423	686.649	.000	.853
Intercept	.854	1	.854	5.895	.016	.024
Pre-BWG	16.842	1	16.842	116.316	.000	.329
Group	10.116	1	10.116	69.866	.000	.228
Error	34.316	237	.145			
Total	517.000	240				
Corrected Total	233.163	239				

Table no.3. Univariance Analysis of Groups

IV. CONCLUSIONS AND RECOMMENDATION

There is a huge research gap in the education area about the correct assessment and evaluation methods. Since our students come with different facilities and personal differences we have to adjust our educational system according to the changing community. USTEAM offers more than STEAM and STEM and this study shows that it has positive effects on students BWG Marks. Univariate results show that there is a significant difference between Post BWG Test Marks of Online USTEAM Classes and Standard Online Classes, taking Pre-BWT Test Marks as covariate. Attitude test results show that students with USTEAM method define themselves to be more creative and more attentive and more happy. What are more male students has more positive attitude than female students towards USTEAM. As a result of the current research study, it is recommended to educational administrators to include USTEAM in their curriculums and to encourage more interdisciplinary studies.

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