SYNCHRONOUS E-LEARNING PERFORMANCE IN RELATIONS TOTHINKING SKILLS, EXECUTIVE FUNCTIONS AND ATTENTION BENEFITS OF STUDENTS

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Abstract: Synchronous e-learning between the students and teachers could possible via WhatsApp, Web-conferencing, Blackboard Collaborate, Adobe Connect, WebEx, IMO, or Skype. The main objectives of the study are to assess the effects of Synchronous e-learning performance in relations to Thinking skills and Executive functions and Attention benefits of elementary students. Sixty students (n=60) age range 13.2 year-13.8 years, mean age 13.4 and SD 2.1of class VIII in a school was participated in the synchronous e-learning. Non-Equivalent Pre-test-Post-test Quasi-experimental Design was used in this study by following non-randomization and selective manipulation principle. The effectiveness of independent variables (i.e. synchronous e-learning, thinking skills, executive functions, and attention benefits) on the dependent variables (i.e. learning performance) was assessed through pre-test post-test score, where pretest used as the covariate. To minimize the effects of confounding variables, ANCOVA, multiple hierarchical regression analysis and non-randomize sampling techniques were used. The findings of the present study claimed that students perceived benefits to Synchronous e-learning environment.

Keywords: Attention Benefits, Executive Functions, Synchronous e-learning and Thinking Skills.

INTRODUCTION

E-learning is a powerful tool which plays a crucial role to achieve, improve and update the skills of learning about the new advancements and technological perspectives in the field of education. Moreover, E-learning is becoming an important prospect of an educational system as it is working as a boon in the modern times in improving or evaluating the quality of education. Synchronous e-learning mainly refers to a learning event in which groups of students are engaging in learning at the same time. Synchronous learning can be facilitated by having students and instructors participate in a class via a web conferencing tool, Blackboard Collaborate, Adobe Connect, WebEx, imo, or Skype (Johnson, 2006) these synchronous learning tools are designed to develop and strengthen instructor-student and student-student relationships. Now, we are living in the knowledge based global world where there is a rapid advancement of science and technology. In fact, communication and technology plays a dominating role in almost all the sectors of human life like: business, industry, bank and education etc. Information and Communication Technology (ICT) refers to all the technologies through which people can communicate with others across the world. A synchronous learning event would involve students watching a live web stream of a class, while simultaneously taking part in a discussion. Synchronous e-learning is an online mode of education providing media such as video-conferencing chats and emails which have the potential to support e-learners in the development of teaching-learning process (*Hrastinski, 2008).* In the present study, synchronous e-learning intervention was provided through WhatsApp.

SYNCHRONOUS E-LEARNING

A total of 15 studies were reviewed in support to synchronous e-learning performance. Out of these 10 studies were experimental, 1 survey study, 1 case study, 1 descriptive, 1 study qualitative and a single study is conceptual. No study was found relating to synchronous e-learning and learner's performance conducted in India. Out of 11 experimental studies, most of were conducted in European countries and few were conducted in American continent. Most of the participants are university level and few were college and school level. The

sample size was ranged from 4 to 1,748 those were exposed to questionnaire, interview and with online intervention on campus and off campus tutorial, and other modern inventions were controlled was not treated with any modern method. In Sweden, a quasi-experimental design was framed on 24 subject case 1 and 74 subjects case 2 at university level result shows that synchronous use of chat as compared to asynchronous used of discussion board induced more support to social exchange was supported by (Hrastinski, 2008). One study were conducted in Tehran with 26 college students in New York found Synchronous communication tools play in developing a sense of community in online-learning environment among the leraners (Wang, 2008). A study was conducted in Spain with 240 university clients found supported network design in synchronous e-learning (Granda, Garcia, Nuno and Suarez, 2010). Another two studies were conducted in USA participant ranged from 4-67 on university and college students by (Stewart, Harlow & Bacco, 2011: Olaniran, 2006) found a significant effect of synchronous course provided through CMC. Asterhan and Tammy, 2011 conducted a study in Jerusalem on online discussion over face-to-face discussion found significant effect. Two studies were conducted in Australia with sample size range from 26-1748 on university students found web conferencing enhances teaching- learning synchronous environment (Bower, 2011) but contrast to the study conducted by (Bower , Dalgarno, Kennedy, Kenny & Kepner, 2015) found a learning outcomes before, during and after blended synchronous lesson was not significant. One more study is conducted by (Ten, Chen, Kinshuk and Leo, 2012) were 16 week seminar was organized and found that CMC has a significant effect on teaching and learning across geographical boundaries. Two studies were conducted in Taiwan on university students ranged from 160-212 by (Chang and Wu, 2015: Wu, Tennyson & Hsia, 2013) found relationship between innovative and creative learning environment including web based synchronous learning significantly affect learning. Another study was conducted in Netherland with 110 students found synchronous communication in e-learning gas a significant on the learner's performance (Giesbers, Rienties, Tempelaar & Gijselaers, 2013). Another descriptive study was conducted in China by (Wang, Jaeger, Liu, Guo & Xio, 2013) including 45 participants found a significant effect of synchronous technologies for students' achievement. One qualitative study was conducted by (Szeto, 2014) in Hongkong, China including 28 participants were 14 online group students and 14 face to face group students found a significant effect of blended synchronous on teaching and learning for quality education. An experimental study conducted by (Mullen, Byun, Gadepally, Samsi, Reuther & Kepner, 2017) on 100 participant of Institute of learning was found not significant effect of HPC learning path. To know the effect of this online learning the present study was undertaken by the researcher.

SYNCHRONOUS E-LEARNING IN RELATIONS TO THINKING SKILLS
A total of 12 studies were reviewed in support to synchronous e-learning performance in relations to thinking skills; out of these 11 were experimental studies and one is survey study. The first study was conducted in London by (Blakemore & Choudhury, 2006) undertaking 145 participant from medical institute found a significant effect of changes in brain structured in both adolescence and early adulthood stage of development among the learners. A study was conducted in Ankara by (Akyuz, 2009) undertaking 44 participants of university students found no significant difference between pre-test and post-test result among the student's academic achievement. A study was conducted by (Cavus, 2009) in North Cyprus undertaking total no. of 41 participants were 20 male and 21 female university undergraduate students found a significant effect of mobile learning in changing students attitude towards learning environment. One study was conducted by (Lee, 2013) in Australia undertaking 1st group 672, and 2nd group 23 college students' found no significant difference between thinking skills and cognitive social presence among the students. One survey study was conducted in Auckland by (Samarraie, Teo & Abbas, 2013) undertaking 210 university students as a participant found a significant effect of structured representatives in influencing students metacognitive activities. In the above discussion, it was noted that most of the studies in relations to thinking skills has a significant effect over traditional learning but few studies were not significant and disagreed with the findings that is why the present study was undertaken. Two studies were conducted in Thailand were 1st study included 30 school students found a significant difference between pre-test and post-test among the learners (Petchtone & Sumalee, 2014) whereas 2nd study included 30 university students' found e-learning has a significant effect in developing creative thinking among learners in pursuing higher education (Songkram, 2015). One study was conducted by (Vainikainen, Hautamaki, Hotulainen & Kupiainen, 2015) in Finland undertaking 1543 school students' found formal thinking of an individual has a significant effect on verbal and quantitative reasoning. Another study was corroborated in Melbourne by (Broadbent & Poon, 2015) taking 140 online group students and 466 blended group students found a significant effect of using time management and elaborative strategies for academic achievements between both the groups of student's. Another study was supported by (Thaiposri &Wannapiroon, 2015)findings show that information and communication technologies play an important role in student developments in 21st century learning. In this study, students used social network to communicate and collaborate with each other during learning activities. Enhancing students' critical thinking skills through teaching, and learning by inquiry-based learning activities using social network and cloud computing is appropriate for application to real practice and helps student to develop the knowledge and skills that they will

require to achieve success in the information age. A study was conducted in New Zealand and Korea participants of 25 university students by (Lee, Parsons, Kwon, Petrova, Jeong & Ryu, 2016) found significant effect of mobile learning tools' in providing information within and between the learning situation for academic achievement. Cheng & Wang, 2017 conducted in Hongkong including 3,869 college student participants found there is no significant difference between students' thinking skills and learning dispositions.

SYNCHRONOUS E-LEARNING IN RELATIONS TO EXECUTIVE FUNCTIONS

The researcher reviewed a total of 11 experimental studies were undertaken in support to synchronous e-learning performance in relations to executive functions. The first study was conducted by (Welsh, Pennington & Groisser, 1991) undertaking 110 university students in Denver found no significant early prefrontal skills in relations to attentional stage of order. In the above discussion, it was noted that executive function has a significant effect over the traditional learning style but few studies were not significant and effective so the present study was undertaken. A study was conducted in London including 50 participants were 25 were male and 25 were female school students found a significant links between Executive Functions (EFs) and Theory of Mind (TOM) in students' performance (Hughes, 1998). One study was conducted in USA by (Carlsona, Mosesb & Bretona, 2002) undertaking 47 university students found there is a no significant relations between Executive Function (EF) and false belief understanding among the learner's. A study was conducted by (Kane & Engle, 2002) undertaking 104 university students in North Carolina and Georgia found a significant bonding between working memory, intelligence and prefrontal cortex functions simultaneously among learners performance. One study was conducted by (Carlson, Stephanie, Mandell, Dorothy, Williams & Luke, 2004) found a relation was non-significant with the controls included as individual differences in EF were relatively stable. Another study was conducted by (Willcutt, Doyle, Nigg, Feroane & Pennington, 2005) participants ranged from 2969 without ADHD and 3734 with ADHD group of medical institute found a significant difference between both the groups of children's. A study was conducted by (Thomson & Gathercole, 2006) including 51 participants were 27 were boys and 24 were girl's school students in England found that working memory and inhibitory control hassignificant effect over the traditional learning approach. A study was conducted in UK by (Bull, Espy & Wiebe, 2008) undertaking 124 pre-school children found a significant effect in between the variance of cognitive skills and math and reading. Another study was supported by (Anderson, 2010) on ecological validity of EF tests and neuropsychological assessment procedures are examined, and adjunct methods of measurement are presented to enable a more comprehensive and valid assessment of EF. One study was conducted in Spain by (Rueda, Posner & Rothbart, 2010) undertaking participant ranging from 2 to 3 yearskindergarten school children's found a significant effect between cognitive and behavioral training in relations to attentional control. One study was conducted by (Becker, Miao, Duncan & McClelland, 2014) undertaking 127 pre-school and kindergarten school children's in United States found a significant relations between stimulus Response (SR) and Executive Functions (EFs) with Visuo Motor Stimulus (VMS) among the children's. A study was conducted by (Cragg, Keeble, Richardson, Roome & Gilmore, 2017) undertaking total of 293 participants were 84 primary students , 67 secondary students , 67 university students and 75 adult young ; U.K found there is no significant effect between executive function and mathematics achievement among the learners performance. One last study was supported by (Vandenbroucke, Verschueren & Baeyens, 2017) results indicate moderate to large growth and stability in working memory and cognitive flexibility and small improvements and stability in inhibition.

SYNCHRONOUS E-LEARNING IN RELATIONS TO ATTENTION BENEFITS

A total of 8 studies were undertaken in support to synchronous e-learning performance in relation to attention benefit of the student's achievements. A first study was conducted by (Posner & Peterson, 1990) in Missouri undertaking 25 university students found a significant effect of attention to the targeted group as it was impaired in nature. Another study was conducted by (Cowan, Nugent, Elliot, Ponomarev & Saults, 1994) in Missouri, Columbia & Portland undertaking total number of 24 school, college and university students found a significant effect of spatial cueing modulation over spatial Stroop object based attention. Another experimental study is conducted by (Pomplun, Reingold and Shen, 2001) in Toronto, Canada undertaking 24 university students including 8 students in each group found a significant effect of both comparative task and attentional manipulation on visual span size. A study was conducted by (Puez & Solis, 2007) undertaking 521 college students found a significant effect of attention, working memory, and executive functions are separated but itsustained a fast improvement in performance of the students. Another study was conducted by (Chen & Wu, 2015) in Taiwan undertaking 37 university students found that videos lecture has a significant effect on student's performance. A study was supported by (Gaston, Moore & Butler, 2016) in Canada undertaking two group of students i.e., 23 and 18 found in attention, hyperactivity, oppositional behaviour has a significant effect on the nature of the learners. The last study was conducted in Finland by undertaking a total of 15 medical students were 8 female and 7 male by (Salo, Salmela, Salmi, Numminen & Alho, 2017) found a significant

effect of attention as same while using or applying other objects too. Another study was conducted by (Bosse & Valdois, 2009) in France found visual attention span gas a significant effect on reading skills of the learners.

OBJECTIVES OF THE STUDY
1. To study the effects of synchronous e-learning performance in relations to thinking skills of elementary students.
2. To study the effects of synchronous e-learning performance in relations to executive functions of elementary students.
3. To study the effects of synchronous e-learning performance in relations to attention benefits of elementary students.
4.

HYPOTHESIS OF THE STUDY
H1: There is no hierarchical significant relationship among the synchronous e-learning performance and thinking skills of elementary students.

H2: There is no hierarchical significant relationship among the synchronous e-learning performance and executive functions of elementary students.

H3: There is no hierarchical significant relationship among the synchronous e-learning performance and attention benefits of elementary students.

METHODOLOGY
Participants
The study aimed to assess the effects of synchronous e-learning performance in relations to thinking skills, executive functions, and attention benefits of elementary school students. Sixty students (N=60) age range 13.2 year-13.8 years, mean age 13.4 and SD 2.1of class VIII in a school was assigned for synchronous e-learning. For synchronous e-learning WhatsApp intervention was given to the students.

Design of the study
Non-Equivalent Pre-test-Post-test Quasi-experimental Design was used in this study by following non-randomization and selective manipulation principle. The effectiveness of independent variables (i.e. synchronous e-learning, thinking skills, executive functions, and attention benefits) on the dependent variables (i.e. learning performance) was assessed through pre-test post-test score, where pretest used as the covariate. To minimize the effects of confounding variables, ANCOVA, multiple hierarchical regression analysis and non-randomize sampling techniques were used. The finding of the study was generalized upon the whole population. The schematic representation of the design of the study is given below in the table no. 1.

Table no. 1 Design of the study

Groups	Nature	Pretest	Intervention	Post test
Experimental Group (60)	Synchronous e-learning	Achievement Test Thinking skill Test Executive function Scale Attention benefit scale	WhatsApp	Achievement Test

Tools

There are four tools such as Achievement Test, Thinking Skill Test, Executive Function Scale and Attention Benefit Scale used in this study. The details of the tools regarding construction and standardization procedures were given below.

INSTRUMENTATION
Achievement Test in Geography
Barman & Jena (2017) developed an achievement test on Geography based on the syllabus for Class VIII students affiliated to NCERT, New Delhi. The test contains 40 items having 10 short type items, 18 multiple-choice items having 4 options with three good distracters, and 12 very short type items developed with equal weightage. A maximum mark of the achievement test was 100. In addition to that, Content validity ratio (CVR=.86), test-retest reliability and split half reliability coefficient was .90 and .89 respectively and the time duration to response the items was 10-15 minutes has established.

Table no. 2 Tool specification of Achievement Test

Material	Achievement test on geography has short, long, multiple choice types items. Each multiple choice type itemshave four options and out of this one correct response and other three are good distracter.
Scoring	1 point for each correct response
Administration	Flexible
Norms	Percentile norms available
Reliability	
Test retest	r=.90
Cronbach alpha co- efficient	r=.89
Validity	
Content	Lawshe(1975) developed a formula termed the content validity ratio:$CVR = (n_e - N/2)/(N/2)$ where CVR = content validity ratio n_e =number of SME panelists indicating "essential" N= total number of SME panelists. This formula yields values, which range from +1 to -1; positive values indicate that at least half the SMEs rated the item as essential. The mean CVR across items may be used as an indicator of overall test content validity. Here, the CVR=.83
Usability	
Availability	Sample available to administer the tool
Ease of use for tester	No
Range of use	No
Time limit	No time limit is given for the test. However, most of the students finish it within 10 minutes.

Thinking Skill Questionnaires

Thinking Skill Test(Barman & Jena, 2017) has 3 sub-areas (convergent thinking, divergent thinking and creative thinking) assessed through MCQ, assertion and picture identification type of items constructed in corroboration with 4 chapters of 8th class Geography. The standardized criteria were followed during the construction of the items. The Construct Validity Ratio was .83, split half .89 and Cronbach α .88 and time duration (10-15 minutes) to response the whole items was established.

Table no.3 Tools of specification of Thinking Skills Test

Standardization	
Material	Thinking Skill Test (Barman & Jena, 2017) has three dimensions (i.e. convergent thinking, divergent thinking, and creative thinking) like Kirton's model of Thinking Skills Test.
Scoring	01 point for each correct response of the item
Administration	Flexible
Norms	Percentile norms available
Reliability	
Cronbach α	α =.88
Guttmann's Split-half	r=.89
The inter-item correlation ranged from	.66-1
Factor analysis	Factor analysis was calculated for convergent thinking found .91, divergent thinking .94, and creative thinking .91.
Principal component analysis	Principal component analysis used in the extraction method where the initial Eigen values ranged from 1.152 to 52.53
Validity	The validity coefficients, with English version of this instrument was estimated on a sample of 200 students of secondary classes
Construct : convergent	The construct validity of the tool (Cronbach, 1990; Cronbach &Meehl, 1955) has been tested in several studies, showing moderate correlations (0.40-0.65)
Usability	

Availability	Sample available to administer the tool
Ease of use for tester	No
Range of use	No
Time limit	No time limit is given for the test. However, most of the students finish it within 10 minutes.

Executive functions Scale

Executive Function Scale (Barman & Jena, 2017) has three sub-areas (working memory, self-monitoring and task initiation). All the items were statement form, matching types, picture identification, passage, and analogy types. During the construction of the test items of executive functions scale all the standardized steps were followed. Construct validity ratio.86, test- retest reliability .87 and maximum 10-15 minutes to response the whole items was established. The details of Tool specification of Executive functions Scale is given below.

Table no. 4 Tools of specification of Executive functions Scale

Standardization	
Material	Executive Function Scale (Barman & Jena, 2017) has three sub-areas (working memory, self-monitoring and task initiation).
Scoring	01 point for each correct response of the item
Administration	Flexible
Norms	Percentile norms available
Reliability	
Test- retest reliability	.87
Factor analysis	Factor analysis was calculated for working memory .86, self-monitoring .87 and task initiation .88
Principal component analysis	Principal component analysis used in the extraction method where the initial Eigen values ranged from 1.152 to 52.53
Validity	The validity coefficients, with English version of this instrument was estimated on a sample of 200 students of secondary classes
Construct validity ratio	.86
Usability	
Availability	Sample available to administer the tool
Ease of use for tester	No
Range of use	No
Time limit	No time limit is given for the test. However, most of the students finish it within 10 minutes.

Attention Benefit Scale

Attention Benefit Scale (Barman & Jena, 2017) has three basic areas: Attention Time Span (picture identification, tick the odd out & naming the image), Attention Representing (sentence completion & short notes) and Attention Analyzing (naming the pictures, fill in the blanks & group activity). Construct Validity Ratio .89, test- retest reliability .88 and the maximum time 10-15 minutes time to response the whole items was established.The details of the tool specification of attention benefit scale are given below.

Table no. 5 Tools of specification of Attention Benefits Scale

Standardization	
Material	Barman & Jena, 2017 Attention Benefit Scale has three basic areas: attention time span, attention representing, and attention analyzing.
Scoring	01 point for each correct response of the item
Administration	Flexible
Norms	Percentile norms available
Reliability	
Test- retest reliability	.88
Factor analysis	Factor analysis was calculated for attention time span .78, attention representing, 87, and attention analyzing .88.
Principal component analysis	Principal component analysis used in the extraction method where the initial Eigen values ranged from 1.152 to 52.53
Validity	The validity coefficients, with English version of this instrument was estimated on a sample of 200 students of secondary classes
Construct Validity Ratio	.89
Usability	
Availability	Sample available to administer the tool
Ease of use for tester	No
Range of use	No
Time limit	No time limit is given for the test. However, most of the students finish it within 10 minutes.

Procedure of experiment for Synchronous e-learning

The study aimed to examine the effects of synchronous e-learning on the academic performance, thinking skills, executive functions and attention benefitsof students. Before conducting the Synchronous e-learning, a day pre-intervention training was organized for the experimental group. In this training program, learners were advised on how to operate the WhatsApp and on how to chat or how to send or communicate and share the informations to a researcher. As per the training, participants interact with the researcher through WhatsApp, and the researcher advised to collect the related learning materials through WhatsApp group to read and understand the concepts by themselves up to their possibility level. In regard, to understand or to clarify the doubts, participants were advised to contact or send message in the WhatsApp group to the researcher for their difficulties, misunderstanding, misconceptions, and better clarifications. As per syllabus, the learning materials were provided to the participants for better clarification of the concepts. This process continued up to three months to cover up all the entire 4 chapters respectively. Before instructions, a pre-test on geography was administered and after instructions, the same achievement test on geography counted as the post-test was administered. The phases of instructions of Synchronous e-learning are given below.

Phases1. Sending learning materials on Geography

The whole geography book of Class VIII classified into chapter1 (Resources), chapter2 (Land, Water & Soil), chapter3 (Minerals & Power Energy) and chapter4 (Agriculture) respectively. The lesson plans were developed and learning materials were downloaded. Few pdf files, videos, images, few Wikipedia materials, screened and uploaded to the WhatsApp group and advised the participants to read the materials at their own pace and if they find difficulties in understanding, the concepts they could text with the researcher about their queries at any time. The materials were uploaded frequently according to the needs of the participants and this process was continued up to the end of the instruction.

Phase2. Building concrete idea with synchronous e-learning

Participants used the learning materials in addition to their previous knowledge, applied their pace of learning, and constructed their ideas through Synchronous e-learning (WhatsApp).

Fig 1: Synchronous e-learning WhatsApp lesson plan

Synchronous e-learning(WhatsApp)
Subject-Geography
Concept- Resources and its types
Class- 8th Standard
Period- 2nd period**Time-** 11 to 12
Objectives
  ➢ Understand meaning of resources
  ➢ Differentiate between natural and man-made resources
  ➢ Define biotic and abiotic resources
Materials
    Printed Materials (MCQ)
  ➢ Geography Text-Book
  ➢ PDF notes
Methodology
  ➢ Classroom demonstration
  ➢ Assigning the MCQ
  ➢ Using emails forums
Evaluation
  ➢ Go through the materials

Analysis and Results
Testing of Hypothesis 1: There is no hierarchical significant relationship among the synchronous e-learning performance and thinking skills of elementary students

Table 1.1 Mean and SD synchronous e-learning performance, convergent thinking skills, divergent thinking skills, and creative thinking skills of elementary school students

	N	Mean	SD
Synchronous e-learning	60	60.08	6.606
Thinking skills			
Convergent thinking skills	60	9.17	4.251
Divergent thinking skills	60	8.77	4.027
Creative thinking skills	60	8.63	2.934

a. Predictors: (Constant), Convergent thinking skills
b. Predictors: (Constant), Convergent thinking skills, Divergent thinking skills
c. Predictors: (Constant), Convergent thinking skills, Divergent thinking skills, Creative thinking skills
d. Dependent Variable: Synchronous e-learning

Table 1.1 reveals the Mean, Standard Deviation (SD) of post-test score of synchronous group of participants. The post-test mean and SD of synchronous e-learning group participants was post-test was (mean= 60.08 & SD = 6.606) convergent thinking skills mean and SD was (9.17 & 4.251) and divergent thinking skills mean and SD was (8.77& 4.027) and creative thinking skills was (8.63 & 2.934). However, the mean and standard deviation of convergent thinking skill was better over both the divergent and creative thinking skill.

Table 1.2 R, R^2, adjusted R^2 and Durbin-Watson Synchronous e-learning performance, convergent thinking skills, divergent thinking skills, and creative thinking skills of elementary school students

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.945a	.893	.892	2.175	.893	486.406	1	58	.000	
2	.949b	.900	.897	2.120	.007	4.028	1	57	.050	
3	.964c	.929	.925	1.812	.028	21.993	1	56	.000	.469

a. Predictors: (Constant), Convergent thinking skills
b. Predictors: (Constant), Convergent thinking skills, Divergent thinking skills
c. Predictors: (Constant), Convergent thinking skills, Divergent thinking skills, Creative thinking skills
d. Dependent Variable: Synchronous e-learning

In table 1.2, the column labelled R is the values of the multiple correlation coefficients between the predictors and the outcome. When convergent thinking skills, divergent thinking skills, creative thinking skills were used as the predictors, this is the simple correlation between synchronous e-learning and, convergent thinking skills (0.945), convergent thinking skills, divergent thinking skills (.949) and convergent thinking skills, divergent thinking skills, creative thinking skills (.964).

The next column gives us a value of R^2, which is a measure of how much of the variability in the outcome is accounted for by the predictors. For the first model, its value is 0.893, which means that convergent thinking skills accounts for 89.3% of the variation in synchronous e- learning. However, for the final model (model 3), this value increases to 0.925 or 92.5% of the variance in synchronous e-learning. Therefore, whatever variables enter the model in block 2 account for an extra (92.9-89.3) 3.6% of the variance in synchronous e-learning scores (this is also the value in the column labelled R−square change but expressed as apercentage).

The adjusted R^2 gives idea of how well the model generalizes and ideally, it would like its value to be the same, or very close to, the value of R^2. In this table, the difference for the final model is a fair bit (0.929 – 0.925= 0.004 or 0.4%). This shrinkage means that if the model were derived from the population rather than a sample it would account for approximately 0.4% less variance in the outcome.

The Durbin-Watson tests statistics identified the correlations between errors. Specifically, it tests whether adjusted residual are correlated. In short it assessed the assumption of independent errors. The tests statistics can verify between 0 and 4 with a value of two meaning that the residuals are correlated. A value greater than 2 indicates a negative correlation between adjusted and residuals whereas a value below 2 indicated a positive correlations. The closer to 2 that the value is better and for this data the value is .469 which is closer to 2 that the assumption has almost certainly been met.

Table 1.3 ANOVA of Synchronous e-learning performance, convergent thinking skills, divergent thinking skills, and creative thinking skills of elementary school students

Model		Sum of Squares	Df	Mean Square	F	Sig.
	Regression	2300.292	1	2300.292	486.406	.000[b]
1	Residual	274.291	58	4.729		
	Total	2574.583	59			
	Regression	2318.395	2	1159.197	257.913	.000[c]
2	Residual	256.188	57	4.495		
	Total	2574.583	59			
	Regression	2390.636	3	796.879	242.598	.000[d]
3	Residual	183.947	56	3.285		
	Total	2574.583	59			

a. Dependent Variable: Synchronous e-learning
b. Predictors: (Constant), Convergent thinking skills
c. Predictors: (Constant), Convergent thinking skills, Divergent thinking skills
d. Predictors: (Constant), Convergent thinking skills, Divergent thinking skills, Creative thinking skills

Table 1.3 reveals the output contains an analysis of variance (ANOVA) that tests whether the model is significantly better at predicting the outcome than using the mean as a 'best guess'. Specifically, the *F*−ratio represents the ratio of the improvement in prediction that results from fitting the model (labelled 'Regression' in the table), relative to the inaccuracy that still exists in the model (labelled 'Residual' in the table). If the improvement due to fitting the regression model is much greater than the inaccuracy within the model then the value of *F* will be greater than 1 and SPSS calculates the exact probability of obtaining the value of *F* by chance. For the initial model the *F*−ratio $(1, 58) = 486.406$ p< .05, which is very unlikely to have happened by chance ($p < .001$). For the second model the value of *F* $(2, 57) = 257.913$, which is also highly significant ($p < .05$), and in the final model the F $(3, 56) = 242.598$, which is also highly significant ($p < .05$). We can interpret these results as meaning that the final model significantly improves our ability to predict the outcome variable.

Table 1.4 Coefficients for Synchronous e-learning performance, convergent thinking skills, divergent thinking skills, and creative thinking skills of elementary school students

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	46.620	.672		69.383	.000		
	Convergent thinking skills	1.469	.067	.945	22.055	.000	1.000	1.000
2	(Constant)	46.812	.662		70.713	.000		
	Convergent thinking skills	2.003	.274	1.289	7.306	.000	.056	17.841
	Divergent thinking skills	-.581	.290	-.354	-2.007	.050	.056	17.841
3	(Constant)	41.515	1.263		32.862	.000		
	Convergent thinking skills	.782	.350	.503	2.232	.030	.025	39.856
	Divergent thinking skills	-.915	.258	-.558	-3.553	.001	.052	19.320
	Creative thinking skills	2.250	.480	.999	4.690	.000	.028	35.580

a. Dependent Variable: Synchronous e-learning

In table 1.4 the multiple regressions model interpreted in the form of an equation that contains a coefficient (*b*) for each predictor. The first part of the table gives us estimates for these *b* values and these values indicate the individual contribution of each predictor to the model.

The *b* values tell us about the relationship between synchronous e-learning performance and each predictor. If the value is positive, we can tell that there is a positive relationship between the predictor and the outcome whereas a negative coefficient represents a negative relationship. For these data, both predictors have positive *b* values indicating positive relationships but a predictor like divergent thinking indicated negative. So, as convergent thinking skills increases, synchronous e-learning performance increases and as creative thinking, increase so does synchronous e learning performance. The *b* values also tell us to what degree each predictor affects the outcome if the effects of all other predictors are held constant.

Each of these beta values has an associated standard error indicating to what extent these values would vary across different samples, and these standard errors are used to determine whether or not the *b* value differs significantly from zero (using the *t*-statistic that you came across last year). Therefore, if the *t*-test associated with a *b* value is significant (if the value in the column labelled Sig. is less than 0.05) then that predictor is making a significant contribution to the model. The smaller the value of Sig. (and the larger the value of *t*) the greater the contribution of that predictor. For this model, convergent thinking, $t(158)$ $(69.383+22.055)$ = 91.438, $p <.05$, and creative thinking, $t(156)$ = 4.690, $p < .05$) are significant predictors ofsynchronous e-learning performance. From the magnitude of the *t*-statistics we can see that the Synchronous e-learning performance had slightly more impact than divergent thinking$t(157)$ = -2.007, $p = .05$).

The *b* values and their significance are important statistics to look at; however, the standardized versions of the *b* values are easier to interpret because they are not dependent on the units of measurement of the variables. The standardized beta values are provided by SPSS and they tell us the number of standard deviations that the outcome will change because of one standard deviation change in the predictor. The standardized beta values) are all measured in standard deviation units and so are directly comparable: therefore, they provide a better insight into the 'importance' of a predictor in the model. The standardized beta (β) values for convergent thinking skills is 0.503 p <.05, divergent thinking skills is -0.558 p<.05 and for creative thinking 0.999 p<.05. This tells us that convergent thinking skills, divergent thinking skills, creative thinking skills have statistically significant impact in the model.

Table 1.5 Excluded variables^a of Synchronous e-learning performance, convergent thinking skills, divergent thinking skills, and creative thinking skills of elementary school students

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	Divergent thinking skills	-.354[b]	-2.007	.050	-.257	.056	17.841	.056
	Creative thinking skills	.790[b]	3.515	.001	.422	.030	32.857	.030
2	Creative thinking skills	.999[c]	4.690	.000	.531	.028	35.580	.025

a.   Dependent Variable: Synchronous e-learning

b.   Predictors in the Model: (Constant), Convergent thinking skills

c.   Predictors in the Model: (Constant), Convergent thinking skills, Divergent thinking skills.

Table 1.6 Collinearity diagnostics[a] Synchronous e-learning performance, convergent thinking skills, divergent thinking skills, and creative thinking skills of elementary school students

Model	Dimension	Eigen value	Condition Index	Variance Proportions			
				(Constant)	Convergent thinking skills	Divergent Thinking skills	Creative Thinking skills
1	1	1.909	1.000	.05	.05		
	2	.091	4.568	.95	.95		
2	1	2.876	1.000	.02	.00	.00	
	2	.119	4.922	.98	.01	.01	
	3	.005	24.171	.00	.99	.99	
3	1	3.873	1.000	.00	.00	.00	.00
	2	.119	5.693	.21	.01	.01	.00
	3	.006	26.529	.04	.21	.99	.06
	4	.002	45.238	.75	.78	.00	.94

a. Dependent Variable: Synchronous e-learning

Table 1.6 depicts the Collinearity is a phenomenon in which one predictor variable in a multiple regression model can be linearly predicted from the others with a substantial degree of accuracy. Here, there are two statistics one is tolerance and other is VIF. In tolerance statistic $1-R^2$ (R^2 is the amount of variance in dependent variable in a multiple regression explained by a combination of all of the independent variables). If the tolerance is below .20 it means at least 80 % of the variance of this independent variable is share with some other independent variables. It means that the multiple correlation of the other independent variable with this independent variable is at least .90 (because .9×.9=.81). In the recent data the tolerance of convergent thinking skill .100 is just above .2 similarly in the final model 3 convergent thinking skill, divergent thinking skills and creative thinking skill tolerance statistics .025(25%), .056(56%) and .028(28%) respectively has the variance of these independent variables were share with other independent variables. Another statistics used for multi Collinearity is the variance inflation factor, which is just the reciprocal tolerance of statistics. VIF provides an index that measures how much the variance (the square of the estimates SD) of an estimated regression coefficient is increased because of the Collinearity. A VIF of greater than 5 is generally considered evidence of multi Collinearity. If we divide $1 / R^2$, we will get (1.1198) which is exactly same as the VIF statics shown above (*see* table 1.6).Hence, the null hypothesis is rejected and there exists hierarchical significant relationship among the synchronous e learning performance and thinking skills of elementary students. The earlier researchers (Blakemore & Choudhury, 2006; Broadbent & Poon, 2015; Petchtone & Sumalee, 2015) supported this result and found synchronous e-learning has significant effect on learning performance over traditional group participants. The details of the regression model is interpreted in figure 4.2.1 a, b & c for asynchronous e learning performance, convergent thinking, divergent thinking, and creative thinking of elementary school students.

The regression line is obtained using the method of least squares. Any line y = a + bx that we draw through the points gives a predicted or fitted value of y for each value of x in the data set. For a particular value of x the vertical difference between the observed and fitted value of y is known as the deviation, or residual. The method of least squares finds the values of a and b that minimize the sum of the squares of all the deviations. The equation of a straight line is given by y= a + bx, where the coefficients a and b are the intercept of the line on the y axis and the gradient, respectively. The equation of the regression line for the synchronous e-learning performance & convergent thinking skills, synchronous e-learning performance &divergent thinking skills, synchronous e-learning performance &creative thinking skills data is as follows: In synchronous e-learning performance = 46.62 + (1.47 × convergent thinking skills) and synchronous e-learning performance = 47.16 + (1.47 × divergent thinking skills) (calculated using the method of least squares, which is described below). The gradient of this line is 1.47, which indicates that for an increase of convergent thinking skills the expected increase in synchronous e-learning performance. Similarly, the synchronous e-learning performance = 41.53 + (2.15 × creative thinking skills). Here, the gradient of this line is 2.15, which indicates that for an increase of creative thinking skills the expected increase in synchronous e-learning performance.

Figure 1. a, b & c for asynchronous e learning performance, convergent thinking, divergent thinking, and creative thinking of elementary school students

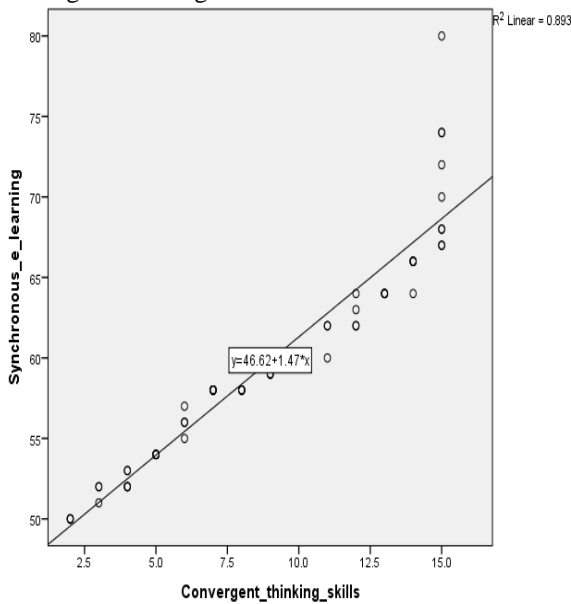Fig 4.2.1 a Synchronous e learning performance, convergent thinking

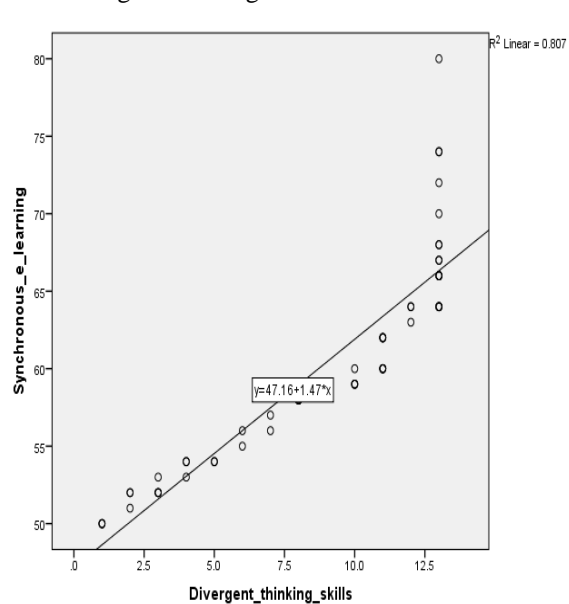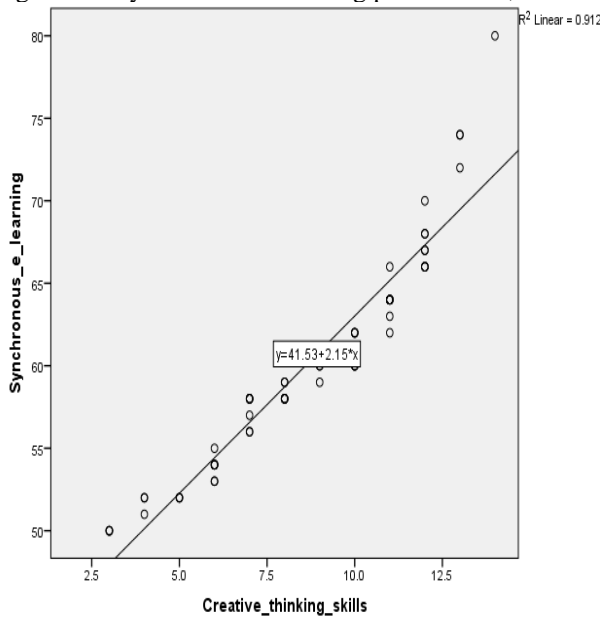Fig 4.2.1 b Synchronous e learning performance, divergent thinking

Fig 4.2.1 c Synchronous e learning performance, creative thinking

Testing of Hypothesis 2: There is no hierarchical significant relationship among the synchronous e-learning performance and executive functions of elementary students

Table 2.1 Mean and SD of Synchronous e-learning performance, working memory, self-monitoring &task initiation

	N	Mean	SD
Synchronous e-learning	60	60.08	6.606
Executive Functions			
Working Memory	60	13.08	2.309
Self-monitoring	60	9.07	1.645
Task Initiation	60	10.10	2.549

Table 2.1 reveals the Mean, Standard Deviation (SD) of post-test score of synchronous group of participants. The post-test mean and SD of synchronous e-learning group participants was post-test was (mean= 60.08 & SD = 6.606), working memory mean and SD was (mean= 13.08 & SD= 2.309) and self-monitoring mean and SD

was (mean= 9.07 & SD= 1.645) and task initiation was (mean= 10.10 & SD= 2.549). However, the mean and SD of working memory was better over both the self-monitoring and task initiation.

Table 2.2 R, R², adjusted R² and Durbin-Watson of Synchronous e-learning working memory, self-monitoring, task initiation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df 1	df 2	Sig. F Change	
1	.810ᵃ	.655	.649	3.911	.655	110.318	1	58	.000	
2	.946ᵇ	.895	.891	2.178	.240	130.052	1	57	.000	
3	.963ᶜ	.928	.924	1.816	.033	25.937	1	56	.000	.479

a. Predictors: (Constant), Working Memory

b. Predictors: (Constant), Working Memory, Self-monitoring

c. Predictors: (Constant), Working Memory, Self-monitoring, Task Initiation

d. Dependent Variable: Synchronous e-learning

In table 2.2 the column labelled R are the values of the multiple correlation coefficients between the predictors and the outcome. When convergent thinking skills, divergent thinking skills, creative thinking skills were used as the predictors, this is the simple correlation between synchronous e-learning and, working memory (0.810), working memory, self-monitoring (.946) and working memory, self- monitoring and task initiation (.963). The next column gives us a value of R^2, which is a measure of how much of the variability in the outcome is accounted for by the predictors. For the first model, its value is 0.893, which means that working memory accounts for 65.5% of the variation in synchronous e- learning. However, for the final model (model 3), this value increases to 0.924 or 92.4% of the variance in synchronous e learning. Therefore, whatever variables enter the model in block 2 account for an extra (92.8−65.5) 27.3% of the variance in synchronous e-learning scores (this is also the value in the column labelled R−square change but expressed as apercentage). The adjusted R^2 gives idea of how well the model generalizes and ideally, it would like its value to be the same, or very close to, the value of R^2. In this table, the difference for the final model is a fair bit (0.928 – 0.924= 0.004or 0.04%). This shrinkage means that if the model were derived from the population rather than a sample it would account for approximately 0.04% less variance in the outcome. The Durbin-Watson tests statistics identified the correlations between errors. Specifically, it tests whether adjusted residual are correlated. In short, it assessed the assumption of independent errors. The tests statistics can verify between 0 and 4 with a value of two meaning that the residuals are correlated. A value greater than 2 indicates a negative correlation between adjusted and residuals whereas a value below 2 indicated a positive correlations. The closer to 2 that the value is better and for this data the value is .479 which is closer to 2 that the assumption has almost certainly been met.

Table 2.3 ANOVA of Synchronous e-learning performance, convergent thinking, divergent thinking, and creative thinking of elementary school students

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1687.418	1	1687.418	110.318	.000ᵇ
	Residual	887.165	58	15.296		
	Total	2574.583	59			
2	Regression	2304.240	2	1152.120	242.916	.000ᶜ
	Residual	270.344	57	4.743		
	Total	2574.583	59			
3	Regression	2389.816	3	796.605	241.438	.000ᵈ
	Residual	184.768	56	3.299		
	Total	2574.583	59			

a. Dependent Variable: Synchronous e-learning

Table 2.3 reveals the output contains an analysis of variance (ANOVA) that tests whether the model is significantly better at predicting the outcome than using the mean as a 'best guess'. Specifically, the *F*−ratio represents the ratio of the improvement in prediction that results from fitting the model (labelled 'Regression' in the table), relative to the inaccuracy that still exists in the model (labelled 'Residual' in the table).

If the improvement due to fitting the regression model is much greater than the inaccuracy within the model then the value of *F* will be greater than 1 and SPSS calculates the exact probability of obtaining the value of *F* by chance. For the initial model the *F*−ratio (1, 58) = 110.318 p< .05. For the second model the value of *F* (2, 57) =242.916, which is also highly significant (*p* < .05), and in the final model the F *(3, 56)* =241.438, which is also highly significant (*p* < .05). We can interpret these results as meaning that the final model significantly improves our ability to predict the outcome variable.

Table 2.4 Coefficient[a] Synchronous e-learning performance, working memory, self-monitoring & task initiation

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	29.782	2.929		10.169	.000		
	Working Memory	2.316	.221	.810	10.503	.000	1.000	1.000
2	(Constant)	25.731	1.669		15.416	.000		
	Working Memory	-.038	.240	-.013	-.160	.873	.261	3.827
	Self-monitoring	3.844	.337	.958	11.404	.000	.261	3.827
3	(Constant)	33.486	2.063		16.230	.000		
	Working Memory	-.897	.262	-.314	-3.427	.001	.153	6.540
	Self-monitoring	2.144	.436	.534	4.913	.000	.108	9.222
	Task Initiation	1.871	.367	.722	5.093	.000	.064	15.682

Dependent Variable: Synchronous e-learning

In table 2.4 the multiple regressions model takes form of an equation that contains a coefficient (*b*) for each predictor. The first part of the table gives us estimates for these *b* values and these values indicate the individual contribution of each predictor to themodel.

The *b* values tell us about the relationship between synchronous e-learning performance and each predictor. If the value is positive, we can tell that there is a positive relationship between the predictor and the outcome whereas a negative coefficient represents a negative relationship. For the data both predictors have, positive *b* values indicating positive relationships but a predictor like self-monitoring indicated negative. Therefore, as working memory increases, synchronous e-learning performance increased and as task initiation, increase so does synchronous e learning performance. The *b* values also tell us to what degree each predictor affects the outcome if the effects of all other predictors are heldconstant.

Each of these beta values has an associated standard error indicating to what extent these values would vary across different samples, and these standard errors are used to determine whether the *b* value differs significantly from zero (using the *t*-statistic that you came across last year). Therefore, if the *t*-test associated with a *b* value is significant (if the value in the column labelled Sig. is less than 0.05) then that predictor is making a significant contribution to the model. The smaller the value of significant (and the larger the value of *t*) greater the contribution of that predictor. For this model, working memory, *t*(158) (10.169+10.503) = 10.672, *p* <.05, and self-monitoring, *t*(157) =11.404, *p* < .05) are significant predictors of synchronous e-learning performance. From the magnitude of the *t*-statistics we can see that the Synchronous e-learning performance had slightly more impact than task initiation *t*(156) = 5.093, *p* = .05).

The *b* values and their significance are important statistics to look at; however, the standardized versions of the *b* values are easier to interpret because they are not dependent on the units of measurement of the variables. The standardized beta values are provided by SPSS and they tell us the number of standard deviations that the outcome will change because of one standard deviation change in the predictor. The standardized beta values) are all measured in standard deviation units and so are directly comparable: therefore, they provide a better insight into the 'importance' of a predictor in the model. The standardizedbeta (β) values for convergent thinking skills is 0.503 p <.05, divergent thinking skills is -0.558 p<.05 and for creative thinking 0.999 p<.05. This tells us that Comparable: therefore, they provide a better insight into the 'importance' of a predictor in the model. The standardized beta (β) values for working memory is -0.314 p <.05, self-monitoring is 0.534 p<.05 and for task initiation 0.722 p<.05. This tells us that working memory, self-monitoring, and task initiation has statistically significant impact in the model.

Table 2.5 Excluded variables^a for Synchronous e-learning performance, working memory, self-monitoring, task initiation

Model		Beta In	T	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	Self-monitoring	.958[b]	11.404	.000	.834	.261	3.827	.261
	Task Initiation	1.255[b]	11.586	.000	.838	.154	6.509	.154
2	Task Initiation	.722[c]	5.093	.000	.563	.064	15.682	.064

a. Dependent Variable: Synchronous e-learning
b. Predictors in the Model: (Constant), Working Memory
c. Predictors in the Model: (Constant), Working Memory, Self-monitoring

Table 2.6 Collinearity Diagnostics^a Synchronous e-learning performance, working memory, self-monitoring, and task initiation

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	Working Memory	Self-monitoring	Task Initiation
1	1	1.985	1.000	.01	.01		
	2	.015	11.514	.99	.99		
2	1	2.977	1.000	.00	.00	.00	
	2	.019	12.486	.99	.06	.08	
	3	.004	26.354	.00	.94	.92	
3	1	3.962	1.000	.00	.00	.00	.00
	2	.032	11.173	.27	.00	.00	.04
	3	.004	30.248	.02	.63	.30	.01
	4	.002	48.546	.72	.36	.70	.96

a. Dependent Variable: Synchronous e-learning

Collinearity is a phenomenon in which one predictor variable in a multiple regression model can be linearly predicted from the others with a substantial degree of accuracy. Here, there are two statistics one is tolerance and other is VIF (*see* table 4.3.5 & 4.3.6). In tolerance statistic $1-R^2$ (R^2 is the amount of variance in dependent variable in a multiple regression explained by a combination of all of the independent variables). If the tolerance is below .20 it means at least 80 % of the variance of this independent variable is share with some other independent variables. It means that the multiple correlation of the other independent variable with this independent variable is at least .90 (because .9×.9=.81). In the recent data the tolerance of convergent thinking skill .100 is just above .2 similarly in the final model 3 convergent thinking skill, divergent thinking skills and creative thinking skill tolerance statistics .064(64%), .261(26%) and .064(64%) respectively has the variance of these independent variables were share with other independent variables.

Another statistics used for multi Collinearity is the variance inflation factor, which is just the reciprocal tolerance of statistics. VIF provides an index that measures how much the variance (the square of the estimates SD) of an estimated regression coefficient is increased because of the Collinearity. A VIF of greater than 5 is generally considered evidence of multi Collinearity. If we divide $1/R^2$ we will get (1.52671756) which is exactly same as the VIF statics shown above.

Hence, the null hypothesis is rejected and there exists hierarchical significant relationship among the synchronous e-learning performance and executive functions of elementary students. The earlier researchers (Becker, Miao, Duncan & McClelland, 2014; Thomson & Gathercole, 2006) supported this result found synchronous e learning has significant effect on learning performance over traditional group participants.

The regression line is obtained using the method of least squares. Any line y = a + bx that we draw through the points gives a predicted or fitted value of y for each value of x in the data set. For a particular value of x the vertical difference between the observed and fitted value of y is known as the deviation, or residual. The method of least squares finds the values of a and b that minimize the sum of the squares of all the deviations. The equation of a straight line is given by y= a + bx, where the coefficients a and b are the intercept of the line on the y axis and the gradient, respectively. Figure 2 a, b & c for synchronous e-learning performance, working memory, self-monitoring and task initiation of elementary school students.

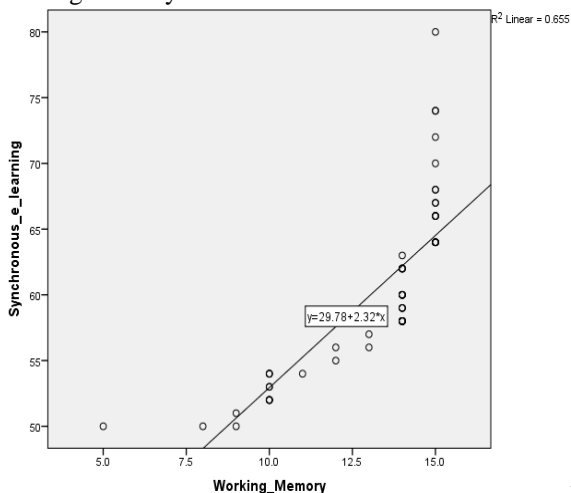Fig4.3.1a Synchronous e learning performance, working memory

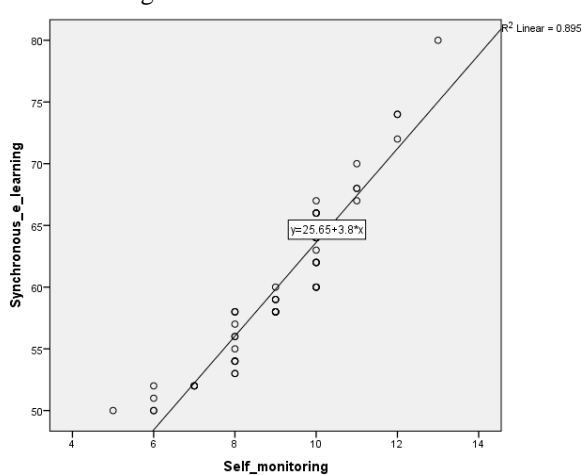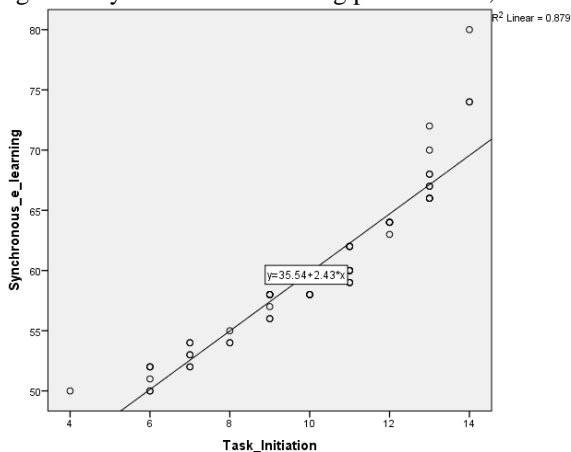Fig4.3.1b Synchronous e learning performance, self-monitoring

Fig4.3.1cSynchronous e learning performance, task initiation

The equation of the regression line for the synchronous e-learning performance & convergent thinking skills, synchronous e-learning performance &divergent thinking skills, synchronous e-learning performance &creative thinking skills data is as follows: In synchronous e-learning performance = 28.78 + (2.32 × working memory) and synchronous e-learning performance = 25.65+ (3.8 × self- monitoring) (calculated using the method of least squares, which is described below). The gradient of this line were 2.32 & 3.8 indicated that for an increase of convergent thinking skills the expected increase in synchronous e-learning performance. Similarly, the synchronous e-learning performance = 35.54 + (2.43 ×Task Initiation). Here, the gradient of this line is 2.15, whichindicates that for an increase of creative thinking skills the expected increase in synchronous e-learning performance. The details of the regression model is interpreted in figure 4.3.1 a, b & c for asynchronous e learning performance, working memory, self-monitoring and task initiation of elementary school students (*see* fig 2).

Testing of Hypothesis 3: There is no hierarchical significant relationship among the synchronous e-learning performance and attention benefits of elementary students

Table 3.1 Synchronous e-learning attention time span, attention representing, attention analyzing

	N	Mean	SD
Synchronous e-learning Attention Benefits	60	60.08	6.606
Attention time Span	60	8.55	3.938
Attention Representing	60	9.63	3.162
Attention Analyzing	60	6.80	2.979

Table 3.1 reveals the Mean, Standard Deviation (SD) of post-test score of synchronous group of participants. The post-test mean and SD of synchronous e-learning group participants was post-test was (mean= 60.08 & SD = 6.606) Attention Time Span Mean and Standard Deviation (SD) was (mean= 8.55 & SD= 3.938) and Attention Representing Mean and Standard Deviation (SD) was (mean= 9.63 &SD= 3.162) and Attention Analyzing was (mean= 6.80 &SD= 3.162). However, the Mean and Standard Deviation of Attention Representing was better over both the Attention Time Span and Attention Analyzing.

Table 3.2 R, R^2, adjusted R^2 and Durbin-Watson of Synchronous e-learning attention time span, attention representing, attention analyzing

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.961[a]	.924	.923	1.837	.924	705.210	1	58	.000	
2	.969[b]	.938	.936	1.670	.014	13.194	1	57	.001	
3	.972[c]	.945	.942	1.597	.006	6.284	1	56	.015	.745

a. Predictors: (Constant), Attention time Span
b. Predictors: (Constant), Attention time Span, Attention Representing
c. Predictors: (Constant), Attention time Span, Attention Representing, Attention Analysing
d. Dependent Variable: Synchronous e-learning

In table 3.2 the column labelled R are the values of the multiple correlation coefficients between the predictors and the outcome. When convergent thinking skills, divergent thinking skills, creative thinking skills were used as the predictors, this is the simple correlation between synchronous e-learning and, attention time span (0.961),attention time span, attention representing (0.969) and attention time span, attention representing and attention analyzing (.972).

The next column gives us a value of R^2, which is a measure of how much of the variability in the outcome is accounted for by the predictors. For the first model, its value is 0.924, which means that convergent thinking skills accounts for 92.4% of the variation in synchronous e- learning. However, for the final model (model 3), this value increases to 0.942 or 94.2% of the variance in synchronous e learning. Therefore, whatever variables enter the model in block 2 account for an extra (94.5-92.4) 2.1% of the variance in synchronous e-learning scores (this is also the value in the column labelled R−square change but expressed as a percentage.

The adjusted R^2 gives idea of how well the model generalizes and ideally, it would like its value to be the same, or very close to, the value of R^2. In this table, the difference for the final model is a fair bit (0.945 – 0.942= 0.3 or 0.3%). This shrinkage means that if the model were derived from the population rather than a sample it would account for approximately 0.3% less variance in the outcome.

The Durbin-Watson tests statistics identified the correlations between errors. Specifically, it tests whether adjusted residual are correlated. In short, it assessed the assumption of independent errors. The tests statistics can verify between 0 and 4 with a value of two meaning that the residuals are correlated. A value greater than 2 indicates a negative correlation between adjusted and residuals whereas a value below 2 indicated a positive correlations. The closer to 2 that the value is better and for this data the value is .745 which is closer to 2 that the assumption has almost certainly been met.

Table 3.3 ANOVA of Synchronous e-learning, attention time span, attention representing, attention analyzing of elementary school students

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2378.928	1	2378.928	705.210	.000[b]
	Residual	195.655	58	3.373		
	Total	2574.583	59			
2	Regression	2415.705	2	1207.853	433.336	.000[c]
	Residual	158.878	57	2.787		
	Total	2574.583	59			
3	Regression	2431.736	3	810.579	317.768	.000[d]
	Residual	142.848	56	2.551		
	Total	2574.583	59			

a. Dependent Variable: Synchronous e-learning
b. Predictors: (Constant), Attention time Span
c. Predictors: (Constant), Attention time Span, Attention Representing
d. Predictors: (Constant), Attention time Span, Attention Representing, Attention Analysing

The output contains an analysis of variance (ANOVA) that tests whether the model is significantly better at predicting the outcome than using the mean as a 'best guess'. Specifically, the F-ratio represents the ratio of the improvement in prediction that results from fitting the model (labelled 'Regression' in the table), relative to the inaccuracy that still exists in the model (labelled 'Residual' in the table).

If the improvement due to fitting the regression model is much greater than the inaccuracy within the model then the value of F will be greater than 1 and SPSS calculates the exact probability of obtaining the value of F by chance. For the initial model the F−ratio $(1, 58) = 705.210$ p$< .05$, which is very unlikely to have happened by chance ($p < .001$). For the second model the value of F $(2, 57) = 433.336$, which is also highly significant ($p < .05$), and in the final model the F $(2, 56) = 317.768$, which is also highly significant ($p < .05$). We can interpret these results as meaning that the final model significantly improves our ability to predict the outcome variable (*see* table 4.4.3)

Table 3.4 Coefficients of Synchronous e-learning attention time span, attention representing, attention analyzing of elementary school students

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	46.296	.571		81.112	.000		
	Attention time Span	1.613	.061	.961	26.556	.000	1.000	1.000
2	(Constant)	43.377	.957		45.345	.000		
	Attention time Span	.856	.215	.511	3.977	.000	.066	15.221
	Attention Representing	.974	.268	.466	3.632	.001	.066	15.221
3	(Constant)	41.990	1.069		39.265	.000		
	Attention time Span	1.109	.229	.661	4.836	.000	.053	18.871
	Attention Representing	1.616	.362	.773	4.459	.000	.033	30.362
	Attention Analyzing	-1.023	.408	-.461	-2.507	.015	.029	34.164

a. Dependent Variable: Synchronous e-learning

In multiple regressions, the model takes the form of an equation that contains a coefficient (*b*) for each predictor. The first part of the table gives us estimates for these *b* values and these values indicate the individual contribution of each predictor to the model.

The *b* values tell us about the relationship between synchronous e-learning performance and each predictor. If the value is positive, we can tell that there is a positive relationship between the predictor and the outcome whereas a negative coefficient represents a negative relationship. For the data both predictors have, positive *b* values indicating positive relationships but a predictor like divergent thinking indicated negative. So, as convergent thinking skills increases, synchronous e-learning performance increases and as creative thinking, increase so does synchronous e-learning performance. The *b* values also tell us to what degree each predictor affects the outcome if the effects of all other predictors are held constant (*see* table 3.4).

Each of these beta values has an associated standard error indicating to what extent these values would vary across different samples, and these standard errors are used to determine whether the *b* value differs significantly from zero (using the *t*-statistic that you came across last year). Therefore, if the *t*-test associated with a *b* value is significant (if the value in the column labelled Sig. is less than 0.05) then that predictor is making a significant contribution to the model. The smaller the value of Sig. (and the larger the value of *t*) the greater the contribution of that predictor. For this model, attention time span, t (158) (81.112+26.556) = 107.668, $p <.05$, and attention representing, t (157) = 39.265, $p < .05$) are significant predictors of synchronous e-learning performance. From the magnitude of the *t*-statistics we can see that the synchronous e-learning performance had slightly more impact than attention analysing t (156) = -2.507, $p = .05$).

The *b* values and their significance are important statistics to look at; however, the standardized versions of the *b* values are easier to interpret because they are not dependent on the units of measurement of the variables. The standardized beta values are provided by SPSS and they tell us the number of standard deviations that the outcome will change because of one standard deviation change in the predictor. The standardized beta values) are all measured in standard deviation units and so are directly comparable: therefore, they provide a better insight into the 'importance' of a predictor in the model. The standardized beta (β) values for attention time span is 0.053 p $<.05$, attention representing is 0.033 p$<.05$ and for attention analyzing 0.029 p$<.05$. This tells us that

convergent thinking skills, divergent thinking skills, creative thinking skills have   statistically significant impact in the model.

Table 3.5 Excluded Variables[a] Synchronous e-learning attention time span, attention representing, attention analyzing

Model		Beta In	T	Sig.	Partial Correlation	Collinearity Statistics Tolerance	VIF	Minimum Tolerance
1	Attention Time Span	.466[b]	3.632	.001	.434	.066	15.221	.066
	Attention Representing	.118[b]	.786	.435	.104	.058	17.127	.058
2	Attention Analyzing	-.461[c]	-2.507	.015	-.318	.029	34.164	.029

a. Dependent Variable: Synchronous e-learning
b. Predictors in the Model: (Constant), Attention time Span
c. Predictors in the Model: (Constant), Attention time Span, Attention Representing

Table 3.6 Collinearity Diagnostics[a] Synchronous e-learning attention time span, attention representing, attention analyzing

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions (Constant)	Attention time Span	Attention Representing	Attention Analyzing
1	1	1.910	1.000	.05	.05		
	2	.090	4.597	.95	.95		
2	1	2.900	1.000	.01	.00	.00	
	2	.096	5.500	.33	.04	.00	
	3	.004	27.248	.66	.96	1.00	
3	1	3.878	1.000	.00	.00	.00	.00
	2	.114	5.833	.23	.01	.00	.00
	3	.005	26.745	.10	.98	.07	.24
	4	.002	42.918	.67	.00	.93	.75

a. Dependent Variable: Synchronous e-learning

Collinearity is a phenomenon in which one predictor variable in a multiple regression model can be linearly predicted from the others with a substantial degree of accuracy. Here there are two statistics one is tolerance and other is VIF. In tolerance statistic $1-r^2$ (r^2 is the amount of variance in dependent variable in a multiple regression explained by a combination of all of the independent variables). If the tolerance is below .20 it means, at least 80 % of the variance of this independent variable is share with some other independent variables. It means that the multiple correlation of the other independent variable with this independent variable is at least .90(because .9*.9=.81).in the recent data the tolerance of convergent thinking skill .100 is just above .2 similarly in the final model 3 convergent thinking skill, divergent thinking skills and creative thinking skill tolerance statistics .025(25%), .052(52%) and .028(28%) respectively has the variance of these independent variables were share with other independent variables (*see* table 4.4.5).

Another statistics used for multi Collinearity is the variance inflation factor, which is just the reciprocal tolerance of statistics. VIF provides an index that measures how much the variance (the square of the estimates SD) of an estimated regression coefficient is increased because of the Collinearity. A VIF of greater than 5 is generally considered evidence of multi Collinearity. If we divide $1/R^2$ we will get (1.1198) which is exactly same as the VIF statics shown above.

Hence, the null hypothesis is rejected and there exists hierarchical significant relationship among the synchronous and asynchronous e-learning performance and attention benefits of elementary students. The earlier researchers (e.g. Salo, Salmela, Salmi, Numminen & Alho, 2017) supported this result found synchronous e-learning has significant effect on learning performance over traditional group participants. The regression line is obtained using the method of least squares. Any line y = a + bx that we draw through the points gives a predicted or fitted value of y for each value of x in the data set. For a particular value of x the vertical difference between the observed and fitted value of y is known as the deviation, or residual. The method of least squares finds the values of a and b that minimize the sum of the squares of all the deviations. The equation of a straight line is given by y= a + bx, where the coefficients a and b are the intercept of the line on the y axis and the gradient, respectively.

Figure 3 a, b & c for synchronous e learning performance, attention time span, attention representing, attention analyzing of elementary school students.

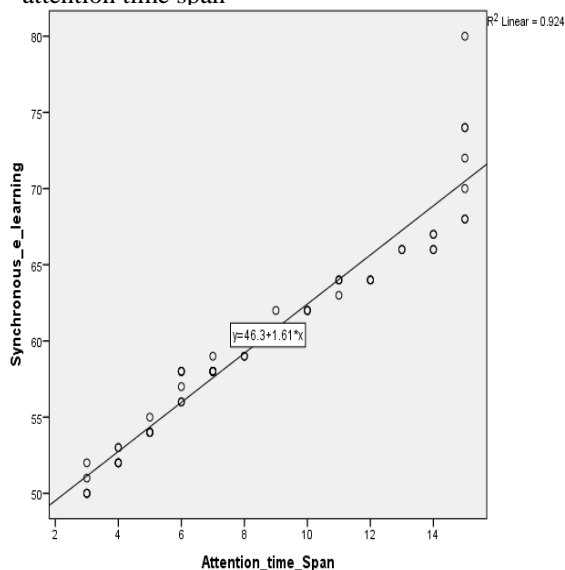Fig4.4.1 a Synchronous e learning performance, attention time span

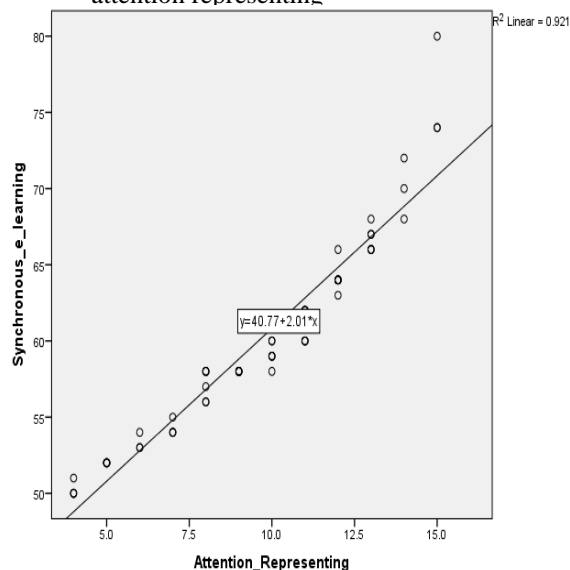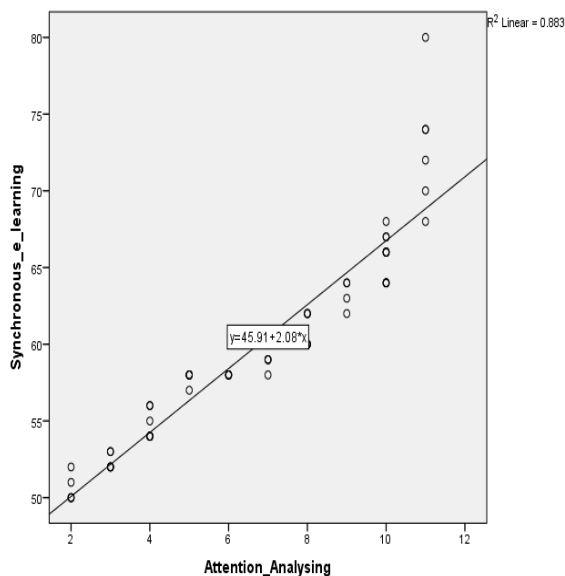Fig4.4.1 b Synchronous e learning performance, attention representing

Fig 4.4.1 c Synchronous e learning performance, attention analyzing

The equation of the regression line for the synchronous e-learning performance & convergent thinking skills, synchronous e-learning performance &divergent thinking skills, synchronous e-learning performance &creative thinking skills data is as follows: In synchronous e-learning performance = 46.3 + (1.61 ×Attention Time Span) and synchronous e-learning performance = 40.77+ (2.01 ×Attention Representing) (calculated using the method of least squares, which is described below). The gradient of this line is 1.47, which indicates that for an increase of convergent thinking skills the expected increase in synchronous e-learning performance. Similarly, the synchronous e-learning performance = 45.91 + (2.08× Attention Analysing). Here, the gradient of the lines are 1.61, 2.01 and 2.08 respectively which indicates that for an increase of creative thinking skills the expected increase in synchronous e-learning performance (*see* fig 4.4). The details of the regression model is interpreted in figure 4.4.1 a, b & c for asynchronous e learning performance, attention time span, attention analyzing and attention representing of elementary school students.

FINDINGS AND DISCUSSION
The findings of the present study reveal that the thinking skill was hierarchical and significantly related to synchronous e-learning performance of the students. The independent variables like convergent thinking skills,

divergent thinking skills and creative thinking skills of the experimental group participants were directly correlated with their learning performance because Durbin- Watson value is (.469) was nearby .2. This finding was equivalent to the earlier researchers by (e.g. Blakemore & Choudhury, 2006; Broadbent & Poon, 2015; Canvas, 2009; Petchtone & Sumalee, 2015; Songkram, 2015; Vainikainen, Hautamaki, Hotulainen & Kupiainen, 2015) found that formal thinking of an individual's level were statistically significant factors for verbal and quantitative reasoning. It was found that the Executive Functions was hierarchical and significantly related to synchronous e-learning performance of the students. The independent variables like working memory, self-monitoring and task initiation of the experimental group participants were directly correlated with their learning performance because Durbin-Watson value is (.479) was moreover (.2). This result was supported by earlier researchers (e.g. Becker, Miao, Duncan & McClelland, 2014; Bull, Espy & Wiebe, 2008; Kane & Engle, 2002; Rued, Posner & Rothbart, 2010; Thomson & Gathercole, 2006) found that executive functions of working memory and inhibition plays a significant role in learning situations. It was found that the Attention Benefits was hierarchical and significantly related to Synchronous e-learning performance of the students. The independent variables like attention time span, attention representing and attention analyzing of the experimental group participants were directly correlated with their learning performance because Durbin-Watson value is (.745). This finding was equivalent to the earlier researchers by (e.g. Cowan, Nugent, Elliot, Ponomarev & Saults, 1999; Perez & Solis, 2007; Salo, Salmela, Salmi, Numminen & Alho, 2017) found that though attention, working memory and executive functions are separated but it sustained a fast improvement in performance of the learners. The study claimed that students perceived benefits to synchronous e-learning environment and this result was supported by (Giesbers, Rienties, Tempelaar & Gijselaers, 2013; Harlow & Bacco, 2011; Stewart; Dewiyanti, Gruwel, Jochems & Broers, 2004), but the results was not corroborated by the researchers (Bower, Dalgarno, Kennedy, Lee & Kenny, 2015; Granda, Garcia, Nuno & Suarez, 2010) found that the learning outcomes before, during and after blended synchronous learning lessons was not effective for the learners. Now question may be raised why synchronous e-learning performance was useful for the participants. Does the WhatsApp assisted learning is more effective approach? To answers these questions the present study was undertaken by the researcher.

In Indian context, secondary schools students and their parents have smartphones to use which creates a sound environment among the learners to get self-acquainted with new knowledge or informations by themselves.To some extend a question may arise is synchronous e-learning applicable in all Indian secondary schools, if so to what extent, if not why?This recent study clarify that WhatsApp was really an innovative instructional tool, which motivated the learners and encourage to perceived the real learning linkage between different concepts which are accepted and supported by (Szeto, 2014 &Wang, 2008) found that synchronous e-learning styles are helpful to compared e-learners with their academic performance of the learners. It is so applicable because with the implementation of new techniques and teaching aids in classroom creates an interesting settings for the students to learn or understand the concepts more clearly. It motivates and attracts the learners to learn the same thing through different modes or styles i.e. why synchronous e-learning is applicable in all Indian secondary schools. When we are discussing about an online learning in relations to the present context a question may raise that does WhatsApp is accessible in all Indian schools during the formal schooling time, if yes, then how it is possible? Yes, WhatsApp learning can be made accessible in all Indian secondary schools during the formal schooling time as we know now in the present time all are familiar with the smart electronic gadgets and how, where and why to use it. The learning environment in Indian secondary schools was not fully technology supportive where students were getting traditional lectures for their clarification of concept. In this context, the researcher thought of applying a new online and offline learning style i.e. synchronous e-learning (WhatsApp) in the experimental class. During formal schooling hours if we introduce WhatsApp to students it can make the learning process more interesting and affordable to all equally. To know the significant effect of WhatsApp supported learning the researcher has undertaken the present study. During our emergency time, WhatsApp plays an important role in sending and receiving messages, information's, documents or any other related materials and it saves our time, energy and money. In present scenario many changes has come up in the real teaching learning process so, to know more about those related topic we have to go through different studies and sometimes a question may raise that in present world, how the researchers are applying WhatsApp in the formal learning process and is it useful for both formal and non-formal situations? When we looked into the present situation many options are available for conducting or providing information to the learners. As we know many changes has come up which leads to drastic mobility among different parts of the world. Now, in this modern era learning can be termed by different meaning like e.g. blended learning, flipped classroom learning, hybrid learning and synchronous e-learning etc. For understanding the new changes in the teaching learning situation the present study has been undertaken. Many researchers are applying WhatsApp in their research study areas linking up with different areas of interest. The present study was supported by (Asterhan & Tammy, 2011; Bower, 2011; Chang & Wu, 2015) found that online discussion has significant effect over face to face discussion format. During the formal learning process WhatsApp can be implemented for providing study

materials, pdf files and information's to the students. It is an online mode of learning styles which is very useful in teaching learning situation as it provides a flexible freedom to everyone to use it at his/her own pace. Yes, WhatsApp learning is applicable in formal as well as non-formal situation because it is an online and offline mode of learning styles.

Different researchers studies leads to different directions and to know it deeply some questions can be in this way- Does the results conflict with other researchers findings, if so, then how many research from Indian counterparts and how many from abroad? Yes, to some extend conflicts arises between the researchers of different countries. But there is no single study supported from India is found in regards to the result for the present study in using WhatsApp. On the other hand in some European and American countries supports (Giesbers, Rienties, Tempelaar & Gijselaers, 2013; Harlow & Bacco, 2011) Stewart; Dewiyanti, Gruwel, Jochems & Broers, 2004) found that synchronous communication can be useful for the learners as the online mode of learning through WhatsApp gives freedom to the learners to learn at his/her own pace of interest and time bound. The study claimed that thinking skill was hierarchical and significantly related to synchronous e-learning performance of the students. The independent variables like convergent thinking skill, divergent thinking skill and creative thinking skills of the experimental group participants were directly correlated with their learning performance. The findings was supported by earlier researchers (Blakemore & Choudhury, 2006; Broadbent & Poon, 2015; Canvas, 2009; Petchtone & Sumalee, 2015; Songkram, 2015; Vainikainen, Hautamaki, Hotulainen & Kupiainen, 2015) found that formal thinking of an individual's level were statistically significant factors for verbal and quantitative reasoning. The present study was Quasi Experimental Design were there was no chance of randomization in the selection of the sample unit rather it encourages the random selection of 1 or many classes. So, on the basis of the design 3 classes of 3 schools were randomly selected for traditional intervention. Somehow the researcher has tried to minimize the internal validity through ANCOVA and Regression Analysis and through motivating the students to maximum use of the WhatsApp and email during their experiment. In a synchronous e-learning experiment class all the students were not equally utilizing their thinking skill during the interventions, but the maximum students' performance became high and as a whole thinking skill of students was highly correlated with the dependent variable. However, it was also found that the R^2 of creative thinking was much better than divergent thinking skill and convergent thinking skill of the students. The thinking skill of the learners' performance was more skewed towards the learning performance because of WhatsApp mode of interactions and interventions as the Google era generations students were more comfortable to learn independently at their own pace and convenience. Rather formal schooling is time bound and works on parents and teachers suggestion and decision. Again, question was raised whether this ideology or intervention is applicable to all Indian schools and among all Indian class of students. The researchers are sure about the phenomena that it could be possible to implement in all the Indian schools, but if government, stakeholders, administrators, teachers, parents and students himself or herself take interest to apply in the teaching- learning process. The study claimed that the executive functions were hierarchical and significantly related to synchronous e-learning performance of the students. This result was supported by earlier researchers (e.g. Becker, Miao, Duncan & McClelland, 2014; Bull, Espy & Wiebe, 2008; Kane & Engle, 2002; Rued, Posner & Rothbart, 2010; Thomson & Gathercole, 2006) found that executive functions of working memory and inhibition plays a significant role in learning situations. The independent variables like working memory, self-monitoring and task initiation of the experimental group participants were also correlated among the learners performance respectively. It reveals that synchronous e-learning enhances the learning performance of the learners who are directly related with factors of learning styles. The recent study confined there is a significant relationship between synchronous e-learning styles with working memory, self-monitoring and task initiation learning performance of the secondary school students. This result was not supported by some earlier studies (e.g. Carlsona, Mosesb & Bretona, 2002) found that combination of inhibition and working memory do not shows any relation between EF and false belief understanding. In a synchronous and asynchronous e-learning experiment class all the students were not equally utilizing their executive function during the interventions, but the maximum students' performance became high and as a whole executive function of students was highly correlated with the dependent variable. However, it was also found that the R^2 of Task initiation was much better than working memory and self-monitoring of the students. The study claimed that the attention benefitwas hierarchical and significantly related to synchronous e-learning performance of the students. The independent variables like attention time span, attention representing and attention analyzing of the experimental group participants were also correlated among the learners performance respectively. It justify that synchronous e-learning enhances the learning performance of the learners who are directly or indirectly related with factors of learning styles. Again, question was raised whether this ideology or intervention is applicable to all Indian secondary schools or not? The researchers are sure about the phenomena that it could be possible to implement in all the Indian schools, but if government, administrators, teachers, parents and students himself or herself take interest to use it in the teaching- learning process. Also, in present time all are familiar to smart gadgets- how, where and why to use it. That is why the study claimed it is possible to implement not only in all Indian schools

but also in other countries too. This result was supported by earlier researchers (Cowan, Nugent, Elliot, Ponomarev & Saults, 1999; Perez & Solis, 2007; Salo, Salmela, Salmi, Numminen & Alho, 2017) found that though attention, working memory and executive functions are separated but it sustained a fast improvement in performance of the learners.

CONCLUSION

If we see the European, American and other advanced countries of the world, we can find that their classroom is highly assisted with all new technologies like smart classrooms, internet accessibility and different other useful gadgets. In this study, the researcher found that developing countries should adopt e-learning techniques or styles assisted learning in their classroom. Synchronous e-learning in Indian classroom is still in progress, not all the classroom of secondary schools is facilitated with smart classroom or internet connections etc. The learning environment in Indian secondary schools are not fully technology supported as, many schools are applying traditional lectures for the clarification of concepts inside the classroom. In this context, the researchers thought of applying a new online learning styles i.e. synchronous (WhatsApp) e-learning in the experimental class. To know the significant effect of WhatsApp supported learning in relations to thinking skills, executive functions and attention benefits the researcher has undertaken the present study. As a result, it was observed that technology supported learning was much better and it was supported by earlier researcher (Cheng & Wu, 2015). However, few researchers who conducted the studies in European and American countries did not support the result (Granda, Garcia, Nuno & Suarez, 2010). Now-a-days teachers are acquiring and upgrading knowledge regarding video-conferencing, using different software like IMO, Skype, Google-Duo, Orientation and Refreshers courses. The literatures found that Synchronous e-learning has significant relationship with the learning performance of school, college and university level students. It was found that there exists a significant effect of synchronous e-learning performance over traditional approach of learning among elementary students. This was because of the technology assisted Synchronous e-learning motivated the learning performance of experimental group students. The present findings can be apply in underdeveloped countries if the government, policy-makers, stakeholders, teachers, parents and students take initiative and interest to implement new style in teaching learning process. There should also be the provision of smart classrooms, internet facilities, and e-learning programs in teaching learning process. However, few researchers who conducted the studies in European and American countries did not support the result (Bower, Dalgarno, Kennedy, Lee & Kenny, 2015) found that learning outcomes before, during and after blended synchronous learning was not statistically significant approach respectively. It was found that there is a significant hierarchical relationship between synchronous learning styles with thinking skills learning performance of secondary school students. This was supported with the earlier studies conducted by most of the developed countries in the countries(Samarraie, Teo & Abbas, 2013 &Songkram, 2015). The independent variables like convergent thinking skill, divergent thinking skill and creative thinking skills of the experimental group participants were directly correlated with their learning performance. To implements the recent findings in Indian context the responsibility should be taken by Indian government, stakeholders, administrators and other authority to promote convergent thinking, divergent thinking and creative thinking by using synchronous and asynchronous e-learning modes among the learners respectively. There should be maximum utilization of virtual learning like internet, email, WhatsApp, Skype and imo etc. in teaching learning process to meet the recent results in secondary schools. It was found that there is a significant hierarchical relationship between synchronous learning styles with executive functions learning performance of secondary school students. This was supported with the earlier studies conducted by most of the developed countries in the countries (Kane & Engle, 2002; Thompson & Gathercole, 2006). The independent variables like working memory, self-monitoring and task initiation of the experimental group participants were directly correlated with their learning performance. Different strategies are available to improve executive functions (Stroop Task, Saccadic Test and Inhibitory Control) of students that could promote high performance and retention among Google generation students. It was found that there is a significant hierarchical relationship between synchronous learning styles with attention benefits learning performance of secondary school students. This was supported with the earlier studies conducted by most of the developed countries in the countries (Bosse & Valdois, 2009; Chen & Wu, 2015). The independent variables like attention time span, attention representing and attention analyzing of the experimental group participants were directly correlated with their learning performance. Different programme and policies like frequent IQ test, yoga, meditation and other co-curricular activities should be implemented in educational system to improve attention benefits of students that could be transfer into learning situation to improve the learning performance of the learners.

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