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A COMPARATIVE STUDY OF EFFECTIVENESS OF CONCEPT MAPPING AND BLENDED LEARNING ON SCIENCE ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS

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Abstract

The aim of education should be to teach how to think rather than what to think- to improve the cognitive thinking so it enables us to think for ourselves and goals of the life. In education, the increasing awareness of the learner-centered, teaching-learning process has generated a lot of attention towards the learners, how long they keep the content learn, how they conceptualize the content and how they help themselves to organize their knowledge to enhance meaningful learning. Scientific knowledge is increasing massively, even in the advanced countries are mobilizing their resources to keep pace with one another. The problem facing science educations in our country is both quantitatively and qualitatively. The teachers determine the value of cognitive aspect. Various method of teaching has been made to engage the students in the learning, but not all are relevant to their lives. There are a number of innovative techniques, one of them is concept mapping and other one is blended learning which helps the learner to create interest and develop the scientific attitude among pupil towards science.

Keywords- Science Education, Academic Achievement, Concept Mapping, Blending Learning, and Teaching & Learning .

Review of Related Literature

One of the essential aspects of research work is the review of the literature. It plays a crucial role in the planning of the new study. It provides background for the development of the present study. This chapter includes the summary of the studies related to concept mapping learning strategy and blended learning strategy.

2.1 Studies Related to Concept Mapping

Brown (2003) conducted the study on group approach to concept mapping which was ideal for conceptual understanding of the concept in high school where students were facing difficulty to understand the concept. The researcher here used the concept mapping where students were working in groups and found several ways for learning. Total 97 students in their Biology classes were taken for the study in which pre & post-tests were administered & gained scores were used as a dependent variable. The results indicated that the classes involved in group concept mapping performed better in the classes as compared to students working as individuals. The researcher was able to clear the misconception of science concept and students were able to teach each other using concept mapping strategy.

Gopal (2004) examined the concept mapping – A pedagogical tool for Grammar lessons. The researcher collected the data of 94 students of IX standard of the Army Public School Delhi. One section was selected as the experimental group and the other was the control group. The units selected for the study were some topics from grammar and English prose. The experimental group was taught by using concept maps and the control group was taught with lecture method. In the experimental group the grammar lesson proceeded with the prior knowledge and in the prose lesson, concept map was developed. After 30 lessons achievement test was conducted on the topic covered in the class. Mean, standard deviation, and spread of the scores around the mean shows that the two groups were comparable on the test taken before the study began. The post-test showed the mean and the standard deviation were higher in the experimental group than the control group and the t test showed the a significance at 0.01 levels. This signals that concept map instructions signals a better performance in grammar lessons.

Stordart (2006) conducted the studies on using concept maps to assess the science understanding and language production of English Language learners. The researcher described the use of concept mapping to assess the understanding of science concepts and science, language production of elementary students who were English language learners (ELL). It was challenged for the researcher as assessment of science content understanding in ELL students because it was difficult to determine whether students' performance reflects their understanding of the concepts or their language proficiency, but concept maps allowed the students to demonstrate what they have learnt in their primary or second language or both. The researcher here, used 400 students in grades 2- 5. The ELL student's performance was analyzed in four categories: (1) number of propositions, (2) scientific accuracy, (3) depth of explanation and (4) science vocabulary and the results showed that concept maps can be used to assess growth in ELL understanding of science concepts.

Asan (2007) studied the concept mapping in science class, a case study of fifth grade students. The researcher conducted the study on twenty three students at Ata elementary school, Trabzon, Turkey. Afterwards author administered the teacher- constructed pre and post -tests which contained 20 multiple choice questions. He used to expose the pupils either in the experimental and control groups, same teaching techniques covering a unit of heat and temperature. After the teaching the students were given the same pre-test, afterwards the control group was given a traditional oral review of the material and the experimental group was exposed to the review by the use of inspiration, which is computer based concept mapping tool. After the review, the research administered the post-test in both groups and the test scores were analyzed to see the statistical difference. The results from the study indicated that concept mapping had a noticeable impact on student in science classes.

BouJaoude and Attieh (2008) investigated the effect of using concept maps as study tools on achievement in chemistry. The studied, examined (i) whether or not the construction of concept maps by students improved their scholastic achievement and ability to solve higher order questions in chemistry, (ii) the researcher also investigated the differential effect of the treatment of gender and achievement level, and (iii) also explored on the relationships between performances on concept maps with chemistry achievement. Total 60 tenth-grade students were randomly divided into two groups. The study spanned for six weeks in a class that met five times a week. The researcher covered the content of acid-base titration and equilibrium in weak acids. Researchers administered the pre and post-tested by using a teacher-constructed chemistry test and the results showed that there were no significant differences in the achievement total score and favouring the experimental group. Moreover, there were also sex-achievement interactions at the knowledge and

comprehension level questions favouring females and achievement level – achievement interactions favouring low achievers. Finally, the researcher focused on the co-relation and found to be a significant correlation of scores on high-level questions and the convergence and total concept map scores.

Olloyed and Adeoye (2009) investigated the comparative effect of the guided discovery (GD) and concept mapping teaching strategies for senior secondary school students (SSSS) chemistry achievement in Nigeria. A sample of 360 SSS chemistry students who have been registered for SSCE drawn from 4 secondary schools in Bauchi Local Government Area was taken. A 40-item Chemistry Teacher Made Achievement Test (CMAT) with characteristics ($0.35 \leq + \leq 0.72$; $0.21 \leq d \leq 1.00$ and KR 20 = 0.86) was administered to the students to generate the data for analysis. The test items span all the intellectual levels of the cognitive domain. There were (retention) treatments. A t-test statistic was used to analyze the data obtained. The results indicated that there was no significant difference in the mean scores of the students due to the method post - test (retention) treatments. There was also no significant difference due to gender when the mean scores of the students in each of the methods adopted were compared to the post- test (retention) treatment.

Karakuyu (2010) investigated the effect of concept mapping on their physics achievement and attitudes toward physics lesson. Author took 58 ninth-grade students from the two classes who were enrolled for a general physics course in a high school in Turkey. One of the classes was randomly chosen as the experimental group (28), constructed electricity concept map and the other was controlled (30) group, did not receive any presentation on concept mapping. The data were collected through pre- and post- test administered as Physics Achievement Electricity Test (PAET) and Concept Maps Attitude Scale towards Physics (CMASTP). The study conducted for six weeks and the class met two times in a week. The content that was to be taught 'electricity'. The results showed that the experimental group students gained more positive attitude than the control group and drawing concept map instruction was more effective in the experimental group than the control group in improving the achievement in physics.

Sthapak (2011) investigated, the study on the role of scholastic achievement on the eighth graders cross-domain concept mapping ability. The study was conducted by survey method. Total 99 students in eighth grade were taken to find the relationship between scholastic achievement and cross-domain concept mapping ability for which the researcher used a self- made inventory tools. The results showed that there was a positive significant relationship between cross-domain concept mapping ability and academic achievement. The value of 'r' found to be highly significant. The positive relationship in the cross-domain map required for the optimal functioning of the brain proved that the null hypothesis was rejected, as there was no significant relationship between academic achievement and cross-domain concept mapping ability of students. It may be inferred that there was a positive relationship between academic achievement and cross-domain concept mapping. The students who scored more in academic achievement found to have better ability in cross-domain concept mapping. It revealed the significance of 'r' between academic achievement and cross-domain concept mapping. Besides testing the hypothesis, the researcher also found the intra relationship between the components of cross-domain concept map and intra relationship between the components of academic achievement and the interrelationship between the components of both the variables. The results showed that nearly all the different components of the cross-domain concept map have a significant relationship with one another, except the relationship between language and attitude, social studies and attitude, which were being not significant. It also showed that interdisciplinary

knowledge is necessary for constructing a cross domain concept map. However, at the same time, the researcher found the social studies and environmental attitude shared an insignificant relationship whereas social studies (S. St.) was considered as a subject which generates the environmental attitude of a child. The results showed that all the values of 'r' were significant between all the components of A.A. This further indicated that achievement in Science and S.St. played a significant role in a child's A.A.

Singh and Sharma (2012) investigated the effect of concept mapping strategy on the learning outcome in relation to intelligence and study habits. The sample comprised of 200 students of 9th class, one group was randomly assigned to the experimental group and another group was a control group. The student from the experimental group taught through concept mapping strategy. The result of the study showed that concept mapping strategy were significantly superior to traditional method in teaching retention of social studies.

Udeani and Okafor (2012) investigated the comparative effectiveness of the expository and concept mapping, instructional strategy of presenting secondary school biology concepts to slow learners. Total one hundred and twenty four biology slow learners were identified and randomly assigned to the expository group (N=62) and concept mapping group (N=62) and taught the concept of photosynthesis. The groups were then post- tested after two weeks of teaching for any significant differences in their biology achievement. The analysis of post-test scores indicated that the group taught by the concept mapping, instructional strategy performed significantly ($p<0.05$) better than their expository group counterparts. Specifically, female slow learners taught with the concept mapping, instructional strategy performed significantly ($p<0.05$) better than their male counterparts taught by the same method.

Agboola and Oloyede (2013) compared the effectiveness of concept mapping and peer tutoring instructional strategies in improving the academic performance of secondary school students in Chemistry. The study adopted the non-equivalent pre-test, post-test group design. The population for the study consisted of senior secondary school Chemistry students in Osun State, Nigeria. 57 senior secondary school II (SS II) Chemistry students in two intact classes from two schools in IFE Central Local Government Area constituted the study. The students assigned to concept mapping and peer-tutoring treatments groups randomly. Three instruments used for the study and for the collection of the data. Chemistry Achievement Test (CAT), Attitudes of Students Towards the use of Concept Mapping Instructional Strategy in Teaching and Learning of Chemistry (ASTCMSC) and Attitudes of Students Towards the use of Peer-Tutoring Instructional Strategy in the Teaching and Learning of Chemistry (ASTPTSC) used to find the effectiveness of the concept mapping. The data obtained were analyzed using t-test, One Way and Two Way Analysis of Variance (ANOVA). The results showed that there was a significant difference in students' performance when concept mapping and peer tutoring instructional strategies were used to teach Chemistry ($t=6.67$, $p<0.05$). Students in the concept mapping group (SD=5.31) performed better than those in peer-tutoring group (SD=5. 77).

Reddy and Venkatasubbaiah (2014) investigated the effect of concept mapping as a teaching strategy. They contrasted the similar idea of mind mapping. They used the quasi-experimental method for the investigation. The data included the experimental and control group of secondary school students. Pre and post-test was used for the collection of the data. The study developed the concept maps with other a supporting material to reach the certain selected concepts in science for the experimental group, whereas control group were used to study the effectiveness of concept mapping as a teaching strategy. The researcher used the self-prepared concept mapping scale and they valid its reliability varying in age from 0.83

to 0.93. The analysis found that concept mapping was an effective teaching strategy compared to conventional teaching and improved the achievement of students in science. The strategy also helped in the attainment of concepts and found to be effective tools to evaluate science concepts. Even there was no difference found on a gender basis.

Nwagbo and Okonkwo (2014**)** investigated the effect of concept mapping teaching strategy on students' achievement in environmental concepts in Chemistry. The influence of gender on students' achievement was investigated. The design was quasi-experimental, specifically the non-equivalent control group design. The sample consisted of 313 senior secondary two Chemistry students, randomly drawn from four schools. Two research questions and two null hypotheses guided the study further. Environmental Chemistry Concepts Achievement Test (ECCAT) used for data collection. The data were analyzed using mean, standard deviation and Analysis of Covariance. The results revealed that students in the experimental group (concept mapping) gained significantly higher achievement mean score than those of the control group (lecture method). It was concluded that concept mapping was better than the lecture method in enhancing students' achievement in environmental concepts in chemistry. The result also revealed that the male students significantly achieved higher than the females.

Singh and Chawla (2015) investigated the effect of concept mapping strategy on achievement in chemistry of IX graders in relation to achievement motivation. The Study was intended to investigate the effect of teaching through concept mapping on the achievement in Chemistry in relation to achievement motivation. The sample consisted of 302 (151 experimental group and 151 controlled group) IX class students from two Government schools of Ludhiana city. The experimental group was exposed to concept mapping method and the controlled group was exposed to conventional methods (lecture and discussion). The results of the study showed that achievement in Chemistry of the group taught by concept mapping was significantly more as compared to group taught by conventional method in both low and high achievement motivation groups.

Indani (2015) investigated to study the effectiveness of digitalize concept mapping in terms of understanding concept of Educational Research among M.Ed students. The researcher developed the digitalize concept maps for teaching Educational Research to M.Ed students . A researcher used the self-instructed achievement test to proceed further, where he took the pre-test and post-test of a sample of 37 students. The students were selected through purposive sampling method. The analysis showed that 't' value is 9.12 which is significant at 0.01 level, where table 't' value is 2.77 and the mean scores of the pre-test and post-test differ significantly and therefore the researcher concluded that concept mapping helped students to understand the concepts of Educational Research. Concept mapping strategy, employed to develop, organize and representing the knowledge and can be used for self-learning and note making also.

Erdogan (2016) investigated the effectiveness of concept mapping on Turkish students' academic success. The researcher investigated the effectiveness of the concept mapping, instructional strategy compared to the traditional teaching method. Meta-analysis was used to calculate the effect size of the concept mapping strategy on academic success. The analysis included the experimental studies conducted in Turkey between 2000 and 2015 which compared the concept mapping instructional strategy and traditional method. Total 216 masters, doctoral theses, and 114 articles were found on the topic. Among all, 73 studies were selected which met the inclusion criteria. These were combined through meta-analysis. At the end of the study, the concept mapping, instructional strategy has been determined to have a significantly positive effect on the Turkish students' academic success

(ES=1, 119; p <0,05). The findings of the study indicated that the effect of concept mapping, instructional strategy in terms of academic success was higher than traditional method.

Garwood and Hammoud (2017) studied the teaching students concept mapping to enhance critical thinking in a mental health nursing course. The purpose of the research was to explore the level of critical thinking among the students enrolled in a mental health nursing course by using a constructivist approach and utilizing concept mapping as a teaching and learning tool. The researcher measured the critical thinking of students, using a pre and post-HESI specialty exam, which was designed to measure the critical thinking ability of students. The learning outcomes were the students exceeded the national average of 23/30 (73%) in 30 categories of critical thinking and achieved acceptable or recommended levels in 5/5 areas of critical thinking in an HESI Critical Thinking exam. The researcher concluded that the outcome of the HESI critical thinking exams demonstrated that students were successful developing critical thinking, synthesis of data to guide clinical decisions and demonstrate contextualized judgment and reasoning with the help of using concept mapping learning strategy.

Patrick (2017) studied the concept mapping as a study skill: effects on student achievement in biology. The purpose of the study was to determine the use of concept mapping as study skill which influenced the students' achievement in biology. The study was designed as quasi experimental where pre-test and post-test was applied. The population for the study was consisted of 280 SSII students from where 120 students were selected and 100 students were used for analysis while 20 students dropped out during the study. To guide this study five-research questions were raised and three hypotheses stated and tested at 0.05 level of significance. The data were collected by using the biology achievement test. Another instrument used for data collection was the use of an interview schedule to determine the students' perception of the usefulness of concept mapping in their studies. The findings of the study included that there was a significant increased in a test scores of students who used concept mapping as a study skill across achievement tests 1-6 and all the students were also interviewed and it was found that concept maps helped them to determine relationships among concepts, sharpened their understandings and increased their critical thinking. It was also concluded by the author that concept mapping could serve as an appropriate alternative strategy for studying biology since what is learned, now it can be retained for a long time also.

Marzetta et al. (2018) studied the concept mapping with English Language Acquisition (ELA) and Gifted/Talented (GT) elementary students learning science and sustainability. The study represents an 'education for sustainability' curricular model, which promotes science learning in an elementary classroom through equity pedagogy. A study consisted of total 25 fourth-grade students from an urban, public school in Denver, Colorado, where concept maps were used as a tool for describing and assessing students' understanding of ecosystem interactions. Concept maps provided a holistic, systems-based assessment of science learning in a sustainability curriculum. The concept maps were also scored and analyzed using SPSS to investigate potential differences in learning gains of English Language Acquisition (ELA) and Gifted/ Talented (GT) students. Interviews of the students were also conducted after the concept maps were administered, then transcribed, and inductively coded to generate themes related to science learning. Interviews of the students also encouraged them to explain their skills and provided a more accurate interpretation of the concept maps. The findings of the study revealed the difference between pre- and post-concept map scores for ELA and GT learners and they were not statistically significant but students showed an increased knowledge of ecosystem interactions during interviews.

Concept maps, helped them as part of an education for sustainability curriculum, can promote equity by providing diverse learners with different—yet equally valid—outlets to express their scientific knowledge.

2.2 Studies Related to Blended Learning

Bonk et al (2002) examined learning from focus groups of blended learning. The purpose of the study was to investigate how various distance-learning technologies affect the student learning in a high-level course in the military. The training comprised of three phases: asynchronous, synchronous and residential instruction. Initial site visits indicated that the course was extensively planned and supported. At the end of the training, all participants were interviewed about their online experiences. The findings of the study revealed that each group mentioned distinct advantages and dis-advantages of the different components of the course. For example, on-line learning appeared to allow for greater and timelier feedback, authentic and meaningful learning, problem-solving, communication, and convenience. At the same time, participants faced several problems, including the lack of learning management system flexibility, technology downtime, and overwhelming tool choices and content to learn. They also felt that due to time commitments of the program, many students dropping out of the program. The feedback was taken by using Ten key Web-based instruction considerations or issues mentioned across participants; meaningfulness of the content; content size; course development and organization; the role of the on-line instructor; structuring small groups; flexible and active learning; use of technology; assessment practices; and general skills such as on-line communication, problem-solving, and teamwork. Participants offered many relevant recommendations also for fine-tuning this program as well as building similar programs.

Garrison & Kanuka (2004) studied the blended learning: uncovering its transformative potential in higher education. The author discussed the transformative potential of blended learning in the context of the challenges facing by higher education. Based upon a discussion the term blended learning, has potential to support a deep and meaningful learning. By using this technique, the students shift to rethink and restructure their learning experiences. The conclusion showed the blended learning was consistent with the values of traditional higher education institutions and proved the potential to enhance both the effectiveness and efficiency of meaningful learning experiences.

Sancho et al. (2006) examined a blended learning experience for teaching microbiology. They combined the traditional practices and e-learning to teach microbiological methods to pharmacy students. They used virtual laboratory modules to acquire non-manual skills such as visual and mental skills for data reading, calculations, interpretation of the results, deployment of an analytical protocol, and reporting results. By questioning about microbiology case based problems, learning achievement of the students was evaluated and the students' perceptions were obtained by assessment questionnaire. The data were analyzed and revealed that by combining different learning scenarios, the acquisition and competencies of the students was attained. The knowledge acquired by the students was also satisfactory and the participants valued the experience.

Hejmadi (2007) studied the effectiveness and efficiency of teaching large classes through novel e -resources on cancer biology. A researcher, aimed to investigate the development and evaluation of blended learning resources in the biosciences, by combining online learning with formal face-to-face lectures and supported by formative assessments. A researcher used a variety of media, which included three main components. (i) An interactive online tutorial, based on the cellular processes of DNA replication , damage and

repair in relation to oncogenesis, (ii) The researcher evaluated the students by using formative assessment in the form of multiple choice questions to allow the students for self evaluation also and (iii) The workshop has been also organised for the small group to encourahe deeper learning. The online tutorial was designed using flash at software to help conceptualize complex cellular processes in time and space. The online tutorial was supported by formative quizzes, references and printed notes. The finding of the study included the introduction of these resources in 2005 which led to significant improvements in summative assessments across cohorts as compared to scores of 2004. Students who scored high, gave value to the usefulness of self-paced learning and enhanced the learning process. Teaching in small group workshops and the tutorials were also found to be effective and allowing better interaction with the students, encouraging confidence and deeper learning among students. The efficiency of the teaching was also improved and pressure become less. This could be concluded that the use of blended learning as a means of improving both effectiveness and efficiency of large group teaching also.

Burgess (2008) studied whether a blended learning approach is suitable for matured, part-time finance students. The objective of the study was to investigate the suitability of blended learning approach on finance students who studied part-time. The author used many dimensional case studies on blended learning and the students' experiences at the university of Winchester, U.K. The author used the different modules for the study and evaluated the students on the basis of questionnaires. The study found that during blending learning courses, students started the use of internet at home and work. Then they were shifted to the use of modules and VLE which supports their studies and learning which helped to improve their knowledge and skills also.

Bridget et al (2009) studied the achievement and satisfaction in blended learning versus traditional general health course designs. The purpose of the study was to evaluate student achievement and satisfaction with blended learning course delivery as compared to a traditional face-to-face class format in a general health course. The authors have done surveys and distributed the sample randomly selected classes during the fall 2007 semester: three blended and one traditional sections participated. The data were collected from 251 students and the results revealed the total satisfaction scores between blended (54.986) and traditional (49.788) classes were significantly different ($p< 0.01$). When focus was given for achievement by students of blended and traditional sections there were found to be mixed findings, yet blended students' overall grades were significantly higher ($p=0.048$) than traditional sections.

Masrur (2010) investigated the impact of web based resource material on learning outcome in open distance higher education. The study was on the impact of web based resource material practices on MPhil, Teacher education course of the AllamaIqbal Open University. A sample of 68 students was selected. Thirty-eight students comprised the control group, whereas another group of 30 students was named as the experimental group. The study included the control group, self-instruction material comprising of two study guides (six credit hours course), recommended book, four assignments, and assignment submission schedule. The experimental group received the same package plus CD having web based articles related to each unit of study guide, and a list of websites for further reading. After the submission of assignments a one week workshop on the topic assigned to him/her before the commencement of the workshop. The final examination was held at the end of the semester. The marks obtained by both groups were compared by t-test. The scores of the experimental group were higher on all assessment components. The results concluded that the integration of IT in teaching-learning increased the understanding of subject related

knowledge.

Marwah and Bawa (2011) reported the potential of using blended learning for higher educational structure through WebCT. The researcher explored the possibility of making blended learning a potential prospect for higher education. The researcher used descriptive method to find out the potential of using blended learning for higher educational structure through WebCT. The findings showed that the use of blended learning through web based technologies was the new age mantra that has the potential to become one of the key success factors for making higher education wide spread and versatile in all aspects.

Shinde and Deshmukh (2012) conducted a study on blended learning methodology in school education. The author took the secondary school students from India and conducted a pilot study. During the study online teaching methods was used by them to teach the lesson and reported that the use of blended learning improves the practices in both virtual and face-to-face settings. The researchers also point out the teacher's experiences in delivering instruction online where they can also teach face-to-face courses.

Yapici et al (2012) conducted the study to determine the effect of the blended learning model on high school students' biology achievement and on their attitudes towards the Internet. The study was carried out with 107 students (47 of were in the experimental group, and 60 of were in the control group) attending NevzatAyaz Anatolian High School in Diyarbakır in Spring Term of the academic year of 2009-2010. In the experimental group, the courses were taught based on the blended learning model via a website (www.e-biyoloji.net), while in the control group, the courses were taught based on traditional teaching methods. An Internet Attitude Scale= 0.97) and an achievement test of 40 questions (KR-20= 0.88) were used for data collection. For the analysis of the data, mean scores, independent t-test and paired samples t-test were used. The results revealed that the blended learning model contributed more to the students' biology achievement than traditional teaching methods and the students' attitudes towards the Internet developed statistically significantly.

Owston et al. (2013) examined the relationship between student perceptions in blended learning courses and their in-course achievement. The research was conducted at a large urban university that embarked on a major initiative to scale-up blended learning across its campus. Student perceptions (N=577) were assessed in four areas deemed important to the university. The overall satisfaction with blended learning, convenience afforded by blended learning, a sense of engagement in their blended course and views on learning outcomes. The final course grade was the dependent variable and cumulative grade point average was the covariate in an ANCOVA design. A remarkably strong relationship was found between perceptions and grades. The high achievers were the most satisfied with their blended course as compared with low achievers. The researcher would take once again the experiment and preferred the blended format, moreover fully face-to-face or online. High achievers also found blended courses more convenient, more engaging, and they felt that they learn key course concepts better than in other traditional face-to-face courses.

Khodabandelou et al. (2014) studied the moderated effect of gender in relationship between community of inquiry and perceived learning in blended learning environments. The study was done in response to Garrison et al. (2010) who suggested that there was a need to determine moderation effects of gender on the relationship between CoI elements and perceived learning. A total of 348 undergraduate students was collected from three public universities in Malaysia as a sample of the study. A study included the research instrumentation, participation, online and face-to-face session, the community of inquiry questionnaire, and a perceived learning scale. All the questionnaires were validated by a

panel of experts, reliability of the instrument was tested in a pilot study and assumptions of Structural Equation Modeling (SEM) were checked before analyzing the data and the findings of the study showed that although differences between the two groups of undergraduate students (male and female) were statistically significant and the amount of differences were not enough to moderate the relationship between CoI components and perceived learning in undergraduate blended learning environments. However, the findings of the study also indicated the differences between the two groups of undergraduate students (male and female) were statistically significant.

Kassab et al. (2015) conducted the study of the relationships between the quality of blended learning experience, self-regulated learning, and academic achievement of medical students: a path analysis. Perceptions of medical students (N=171) from the Royal College of Surgeons in Ireland, Medical University of Bahrain (RCSI Bahrain), on the blended learning experience were measured using the Student Course Experience Questionnaire (SCEQ), with an added e-Learning scale. In addition, self-regulated learning was measured using the Motivated Strategies for Learning Questionnaire (MSLQ). Academic achievement was measured by the scores of the students at the end of the course. A path analysis was created to test the relationships between the different study variables. Path analysis indicated that the perceived quality of the face-to-face component of the blended experience directly affected the motivation of students. The SCEQ scale "quality of teaching" directly affected two aspects of motivation: Control of learning and intrinsic goal orientation. Furthermore, appropriate course workload directly affected the self-efficacy of students. Moreover, the e-Learning scale directly affected students' peer learning and critical thinking but indirectly affected meta-cognitive regulation. The resource management regulation strategies, time and study environment, and effort regulation directly affected students' examination scores (17% of the variance explained). There was no significant direct relationships between the SCEQ scales and cognitive learning strategies or examination scores.

Karayama (2016) studied the effect of blended learning approach on academic success and determine the trends of these studies. Total 51 studies, were accessed as a full text based on the keyword "blended learning" in higher education, academic search engine by using the purposive sampling method, and were subjected to content analysis through the Publication Classification Form (PCF). The studies were reviewed in terms of "study subject area, year of publication, research method, sampling method, sample group and size, data collection tools and data analysis methods". Frequency and percentage ratios were used in the analysis of data and the findings are presented in tables. The Findings showed that studies on blended learning were mostly conducted in 2012. It was found that quantitative research method was preferred more, simple random sampling stood out, primary school students were mostly included in the sample group, and the sample group generally consisted of between 31-100 people in these studies. As a data analysis method, the single data analysis method was preferred more and the academic success was frequently addressed as the research subject.

Suciati and Sunarno (2017) studied the implementation of blended learning model toward student's achievement viewed from student's creativity. The experimental research study was done to see the effect of blended learning and the authors created a groups to whom pre-test-ansd post-test was done on the population of 262 students in grade XI of SMA Negeri l Pati Academic Year 2013/ 2014, 32 students of XI-IPA 2 were selected by random cluster sampling technique. The data were collected by using test and non-test techniques through observations, a questionnaire, and documented and analyzed by using one way ANOVA with an alpha of 5% level of significance. The Results showed that the

implementation of the blended learning model viewed from students' creativity was effective in terms of student achievement.

Bazelasis and Doleck (2018) investigated the impact of blended learning on academic performance in a first semester college physics course in the context of college d'enseignement general et professionnel (CEGEP) pre-university science students. Although it was explained by the definition that the blended learning strategy, recently added to the college of science classroom, which demonstrated that blended learning can create a more positive and active learning environment and enhance both the quality of instruction and student learning outcomes in Science, Technology, Engineering, and Mathematics (STEM) education. The study was done to address the gap by examining the effectiveness of instruction in the mechanics course in the physics pre-university program at an English CEGEP and compared the blended learning approach with the traditional lecture-based instruction. The results of the study suggested that the blended learning approach leads to more conceptual change, acquisition of more skills, and higher performance.

Utami (2018) studied the effect of blended learning model on senior high school students' achievement. The study was done by using the experimental research method with randomized control group. Pre-test and post-test design was applied for the study to see the effect of blended learning. The study was carried out with 63 students who were attending information and communication technology course, where 31 of were selected in the experimental group and 32 of were selected in the control group. In the experimental group, teacher used to taught with blended learning as instructional model, while in the control group, the course was taught based on traditional teaching model. The data was collected from the result of learning objective test with 35 questions. The results showed that the learning of experimental group was higher than the learning of control group and based on the result it could be concluded that the blended learning model contributed more to the students' achievement.

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