

# Teaching Learning with Constructivist Approach

<sup>1</sup> Mr. Amit M. Patil , <sup>2</sup>Mr. Sachin S. Kudte

<sup>1,2</sup>Assistant Professor

<sup>1,2</sup> Department of Mechanical Engineering,  
<sup>1,2</sup> G.S. Moze College of Engineering, Balewadi, Pune, Maharashtra

**Abstract**—Today's world teaching learning process is taking various new dimensions. The paper presents a study about different Constructivist Models used in educational systems. These models help in the improvement of teaching learning practices for the betterment of students as well as teachers. Constructivist theory says that student needs to construct their own knowledge. Constructivist Learning Theory used by various researchers shown better results in terms of student's achievement and success during learning of any course.

**Index Terms**— Approach, Constructivist, Learning, Student, Teaching (key words)

## I. INTRODUCTION

Developing countries are in the process of transforming Educational systems from traditional into innovative teaching learning methods. Teachers are expected to go beyond traditional teaching approach and come up with new innovative and out of the box ideas for teaching to the students. Jean Piaget stated the theories of constructivist approach (1952, 1970a, 1970b, 1977) and Vygotsky (1962, 1978). The constructivist approach is about study of classroom culture and the mechanisms of their emergence and stability. As per constructivist principles, learning is a process in which individuals construct knowledge (Aleandra da Silva Figueira-Sampaio et al., 2009). Communication, negotiation, cooperation, reflection, discussion and reciprocity are qualities of Constructivist approach. (Hasan Karal et al., 2009). Constructivist approach are active learning, learning through cognizing, meaningful learning, learning through exploring. Constructivist principles are applied for facilitating e-learning modules for training to employee for highly specialized skills. (Aleandra da Silva Figueira-Sampaio et al., 2009). The SANLAB project is considered as a unique and original software based on constructivist learning model. (Eralp Altun et al., 2009). The constructivist instructional model used in this study maps constructivist principles to the instructional design by means of a more pragmatic approach. (Fernando Alonso et al., 2009). TPACKing is a process of knowledge construction and equilibration through which the TPACK unique to the individual teacher is built. Investigations using the TPACKing framework would help in the understanding of current teaching practices. Some of the teachers included in this study appeared to partition off some of their content, pedagogy, or technology knowledge and interactions when constructing their TPACK. (Mark W. Olofson et al., 2016). The conceptual model of relationships among constructivist learning environment perception variables like Personal Relevance, Uncertainty, Critical Voice, Shared Control, and Student Negotiation and scientific epistemological belief variables like fixed, tentative and learning approach (Kudret Ozkal et al., 2009). Effects of the Constructivist Learning Approach on the classroom management in which various aspects of classroom management such as Classroom Organization, Learning Climate, Learning Duration and its Evaluation, Using Educational Technology and Learning Environment out-of-School, Multiple Intelligence Areas, Learning by Implementation, Questioning Learning, and Student Growth are studied (Ahmet Kaya et al., 2009). The constructivist-based teaching models used in science education and 'Orff' learning stages in detail because basic principle of these models is very similar for all courses of education (Sezen Özeke 2009). It is important to know what students expect from any constructive approach like e-learning (Hasan Karal et al., 2009). In order to determine the applications of constructivist approach in science course scale was developed and found that whether constructivist approach is applied on science class (Ercan Akpınar et al., 2009). Many researchers have contributed about using ICT or e learning as tool for the Constructivist approach. Authors have investigated various cases in educational system about significance of constructivism. This research paper presents review of constructivist learning theory and there application in education to overcome from traditional teaching-learning methodologies.

## II. CONSTRUCTIVIST MODELS

(Florence Mihaela Singer et al., 2008) New model presented for teaching and learning cycle focused on IMmersion, STRucturing, and Applying and called as IMSTRA. This model talks about relationship between the teacher's role and the students' learning activities. This model is applied for 3rd grade class of Science and Curricula of 1<sup>st</sup> to 4<sup>th</sup> grade mathematics is designed. Professional development program for rural areas which consists of domains of: mathematics, biology, chemistry, physics, and ICT were developed within the IMSTRA model designed. IMSTRA is implemented either by cylinder or spiral approach. IMSTRA model facilitates constructive learning approach. (Eralp Altuna et al., 2009) The SANLAB is developed based on the information which consists of level of effective usage of chemistry labs by the teachers, attitudes of the teachers towards using laboratory and views of the students related to laboratory activities and effectiveness, (2) Development of virtual chemistry laboratory educational software including various activities based on problem based learning (PBL), concept maps (CM) and 7E model in constructivist learning theory, (3) Investigation of the effectiveness of the educational software. SANLAB aims for repeating experiments at their own pace, accessing experiment results in time, changing variables of the experiments receiving immediate feedback. Due to this student are able to apply scientific principles, improve their problem solving skills link concepts and make experiments consciously.

The SANLAB project is considered to be unique and original software based on collaborative constructivist learning model. SANLAB is useful for both chemistry teachers and students at secondary school especially those who have none or limited opportunity of using chemistry labs and performing experiments. (Mark W. Olofson et al., 2016) TPACK as TPACKing: an active process carried out by the teacher in which s/he constructs knowledge for teaching in the technology-rich setting. TPACKing represents a modification in the understanding of the TPACK model using a radical constructivist vision. Teachers with similar technological, pedagogical, and content knowledge make different pedagogical choices and employ different teaching practices. This prompted a shift in focus from the content and characteristics of knowledge to the process of constructing that knowledge. Application of radical constructivist approach to view the active TPACKing process as another way to employ the TPACK framework when considering the work of in-service teachers. (Sezen Özeke 2009) developed 3 stage teaching model for learning cycle and extended it as 4, 5 and 7 stage model for teaching science course. This model is teacher centered. The authors have come up with new approach named as Orff Learning Stages for Music course. Orff aimed that students learn by interacting with their environment and acting upon it through exploration and experimentation, play and discovery. Both of these learning approaches are the part of constructivist approach and are considered as approaches to construct understanding based on experiences of the learners. (Hasan Karal et al., 2009) Classrooms are becoming advanced with the employment of technological tools such as electronic portfolios, presentations, video conference programs, databases. Haptic is one kind of robot which enables human machine communication. Haptic has software and hardware configuration. Software has simulation features with sound, visibility, interaction facilities and hardware, it is in interaction with software which has simulation feature, arranges perceptions according to encoding. Haptic is able to create constructivist approach in students through constructing his or her knowledge, making comments, to learn cognizing and experiencing. The study is carried out by interviewing the teachers about haptic performance in science course. The study reveals that haptic is able to promote constructivist approach by showing knowledge to students concretizing it. Students are sensing concepts like gravitation, weight in virtual environment. This will help in eliminating student's misconceptions and the abstract concepts' learning would be easier. (Hasan Karal et al., 2009) In this research, a testing apparatus was developed which will help students in learning energy cycle and hydrolysis events through exploring and cognizing in primary Science and Technology course which covers contemporary need of Renewable energy. The apparatus is being related to everyday life will increase interests of students to subject. Along with it helps students for creating their own knowledge about environment which is nothing but constructivist approach. The apparatus is designed as per the student's requirement and usability. The main feature of this apparatus is that can be used for teaching other courses. (Mihaela Garabet et al., 2010) Conceptual map method in helps students for decision making. The conceptual map method explores the area of the symbolic, metaphysical and constructive potential of the human mental, being accepted the fact that there are mental representations, fixed or fluid images leaving traces, send messages, transmit essences of our thinking through a condensed language, frequently under iconic shape. In this study conceptual map method is applied for Physics course with objectives as Define the connections and relations between concepts in studying Physics, Draw connections with the themes and concepts studied during different school subjects to synthesize the extended subjects content, Evaluate the pupils' performances at Physics because they reveal the way how they think and use what they have learnt. The conceptual maps encourage this process through the one who learns to pay attention to the existing relations between concepts or creating knowledge. (Lorenzo Moreno et al., 2007) A constructivism and collaborative methodological approach applied for teaching ILP Architecture with an e-learning platform (Moodle) and a simulator of ILP architectures (SIMDE). The system is applied with four phases such as Preparation, Experimentation, Presentation Demo and Final phase. The students have shown a deeper knowledge as well as a higher level of motivation during this course. Due to good results, this system is applied for various other courses. (Florentina Iofciu et al., 2011) The study of magneto resistive materials is carried out based on cognitive map. During this study Cognitive Analyzing of the task (CTA) is technology is proposed. Cognitive map consists of Morphological and Structural Characterization, Magnetic Characterization and Techniques for measuring of Electro conductivity and Magneto conduction. Cognitive maps are able to show all the knowledge hierarchical ordered, using a friendly interface as to be easily understood by the students. Cognitive map is applied as collaborative environment for group of students and informatics tool. (Sevinc Kurt 2011) Constructivist Design Model is used for the evaluation of architectural education because learning environment, which is mainly based on the structure of design. The Constructivist Design Model has seven learning environment phases as Generative Learning, Situated Learning, Situated Learning, Cognitive Flexibility, Anchored instruction, learning in social and/or multiple contexts, learning through multiple perspectives. The design of learning environment has key points as Realistic practices, Emphasis on case studies, Developing multi perspectives and multi contexts, Design in social context, Dealing with the complex problem, Reflecting on the process, Student control. Constructivist principles in design education accomplish on the idea of constructing knowledge is to create meaning by doing, and that the resulting knowledge 'creation' is unique unto the individual (Francesca Bertacchini et al., 2012) Chaos theory considers non-linear dynamical systems with deterministic behavior that evolves in an apparently random sensibility to initial conditions. The authors have come up with a model named Edutainment for teaching secondary school students in order to study difficult science topic as Chaos. The model has two stages: manipulation of real and virtual objects and the realization of a virtual theatre performance on Chaos. The study result shows that student's competence and interest in learning is increased. (Ruey S. Shieh 2012) The authors have presented a constructivist methodology named as (TEAL) Technology Enabled Active learning used in teaching physics for 11<sup>th</sup> grade high school students. TEAL is interactive, technology-enabled pedagogy. TEAL teaching learning method is carried out by integrating lectures and hands-on activities, including demonstrations, simulations, and the use of IRS. TEAL affects both high school student performance as well as teachers' teaching. The limitations of TEAL resulted into designing three experimental conditions as (1) TEAL (2) no technology active learning, and (3) no technology didactic learning. (I. Garcia et al., 2013) Authors had proposed computational platform for teaching mathematics. This research has two main objectives (1) develop a computational platform to support the traditional Mexican method of education with practical mathematics problems.(2) analyze how this computational tool affects student motivation, collaboration and discussion. This computational platform is supported by student model, domain model, and interactive model. Constructivist

platform integrated with simulated environments will increase understanding of elementary children's mathematical education, especially for children with problems learning how to solve mathematical problems. (Michael Chau et al., 2013) In this research, it is evaluated that how the 3D virtual environment can facilitate students in achieving learning outcomes. Second Life was chosen as our platform because it is the largest and the most popular virtual world environment. The research is done for two points as the perceptions of virtual world as an educational platform by students on achieving learning outcomes and the measure on actual achievements of students learning outcomes. Second Life has created an immersive and game-like environment that allows users to create their personalized learning experience. Through The use of virtual environment as a learning platform has a positive impact on the Students learning outcome achievement. The interesting and interactivity of virtual environment can bring benefit to the learning. (Mihaela Voinea et al., 2014) This work presents students interest in learning mathematics course on different levels of education, which is determined by the constructivist approach. The students interest in mathematics course is in sinusoidal form. As the students' progress from pre schooling there interest in studying Mathematics is decreasing. In addition to this constructivist approach with emphasis on the affective domain of learning, on fostering positive motivation, with an emphasis on solving concrete, helps to create students' interest in mathematics. (Gökhan Demircioğlu et al., 2014) The author had investigated effect of laboratory activities based on the 5E model of constructivist approach on 9th grade students' understanding of solution chemistry. The 5e model phases are entre, explore, explain, elaborate and evaluate. This model will aid in removing students misconceptions about chemistry. Model has increased student's success but also enabled them to make relationships between their daily life and the concepts related to chemistry. (Gabriela Carmen Oproiu 2015) The author has investigated Moodle (e-learning platform) for teaching learning. MOODLE system consists of itself as a virtual learning environment (VLE), where the learning process is completed online, representing a software open source and is destined to support a collaborative learning environment. The MOODEL is good in promoting teaching learning activity because it gives freedom of teaching to teachers, but not able to eliminate teaching learning activity because It is desirable that teaching staff become more active and interested in using the new teaching environment. (Juan Arango et al., 2015) explored the use of Virtual Learning Objects (VLO) in the teaching of differential calculus in the area of Management Sciences. For creating VLOs free software GeoGebra is used. VLOs are taught using audio-visual means for simulation problems. The study helps student for becoming familiar with the software and acquire skills to treat resource optimization problems. (Ahmet Gurses et al., 2015) Interactive Direct Teaching Based on Constructivist Learning (IDTBCL), learning is evaluated as a mental transition or an oriented change from understanding (two dimensions) to conceptualization or conception (three dimensions). Model is based on assumptions as It should be searched learner's cognitive and awareness level about subject to be taught and Interaction between instructor and learners should be consistently stimulated, Conceptualization requires using of inductive and deductive processes by both instructor and learner, Conceptualization success depends on the depth of instructional content instead of its superficiality. The IDTBCL approach is rated positive for higher for the students' achievements. (Lindsay Noel 2015) This paper presents an analysis on the impact of blogs on constructivist education. It will also elaborate pedagogical recommendations for creating effective constructivist educational environments with blogs. Blogs have various features that enable them to support constructivist educational activities, in the areas of cognitive engagement and social interaction. Blogging is able to support constructivism in a number of ways but, certain aspects negatively affect constructivist learning. Blogs are used to create a constructivist learning environment that supports knowledge development through engagement, reflection and collaboration.

(Che Nidzam Che Ahmad et al., 2015) The authors have investigated effect of constructivist environment in science classroom on students learning. The authors have also investigated the students opinion about this approach. Quantitative approach was utilized as a survey data collection method to answer the research questions. The study result indicated that Educational facilities, physical learning environment and Technical specifications are needed to be considered in order to plan and construct effective constructivist learning environment in school. (Elson Szeto 2015) The authors have investigated Community of Inquiry as an instructional approach, which consists of three instructional approaches as teaching, social and cognitive. This instructional approach promotes blended synchronous learning and teaching experiences. These three approaches together form educational experience and this model is called as CoI Community of Inquiry. This research has focused three main points as 1. CoI framework implementation as an instructional approach to blended synchronous teaching –learning. 2 Identify instructional roles of the teaching, social and cognitive presences emerge in the process of the blended synchronous phase. 3 Identify Instructional effects of the three presences on the instructor's and students' experiences. Evaluation of face-to-face, asynchronous or synchronous online and blended learning modes are performed with ICT. This paper reports the case study on extending the CoI framework as an instructional approach in a blended synchronous learning mode. The study also focus on the learning through constructivist approach in which the teaching as mix of direct and constructivist instructional strategies to simultaneously teach the online and face-to-face students in the blended synchronous mode. The social presence instructional component involved constructing student interactions by facilitating peer online or face-to-face communication and support while the students participated in the learning activities. The cognitive presence instructional component has formative assessment for learning in which students must complete individual course work, group projects, a quiz and participate in open and group discussion activities. The mixed instructional strategies by teachers has transformed his performance to play multiple roles of presenter, facilitator, moderator and coordinator based on constructivist theory. (Dr. Soraya García Esteban et al., 2014) This paper shows use of constructivist theory for teaching English for Specific Purposes (ESP) with the help of internet, web 2.0 and using different multimedia tools. The objectives of this work are Facilitating the acquisition of English by using internet and different media tools such as the Web 2.0., Enhancing the technical integration of the four language skills viz. listening, writing, speaking and reading, Practicing the English language and the different skills by developing communicative tasks, Promoting interaction and collaboration in the target language by working on texts, images, sound or other multimedia content and Using technology to work out, edit, publish and share information. The study results states that recognition of technology and the web 2.0 as facilitator, contributes to develop cooperative learning and

social constructivism through the development of virtual tasks using social media like Blogs, wikis. It also assists interaction and real communication through e-mail, YouTube, chats, etc. with a methodology focused on students' interaction and collaboration.

### III. CONCLUSION

The discussion presented in this paper is about various constructivist models like IMSTRA, TEAL and TPACK which are being used in teaching learning process. The use of e-learning platform is one of the main resources in order to promote the constructivist theory of learning. The work cited here summarizes that in order to overcome traditional teaching learning approach, constructivist learning theory is appropriate. This constructivist learning theory approach not only create students own knowledge but also creates interest for learning the course. The models presented here are very good with constructivist learning but also came with the requirement that more research is required for these models in order to improve the performance of the mode.

### IV. ACKNOWLEDGMENT

I wish to thank all the colleagues from G. S. Moze College of Engineering for their constant support. Also I wish to thank my best friends Mr. Abhijit Malage, Mr. Pavan Choudhari, Mr. Amol Kolhe and Dilip Panchal for their valuable suggestions.

### REFERENCES

- [1] Aleandra da Silva Figueira-Sampaio , Eliane Elias Ferreira dos Santos, Gilberto Arantes Carrijo, (2009), A Constructivist Computational Tool to Assist in Learning Primary School Mathematical Equations, *Computers & Education*, Volume 53, pp. 484–492.
- [2] Hasan Karal, Ilknur Reisoglu, (2009), Haptic's Suitability to Constructivist Learning Environment: Aspects of Teachers and Teacher candidates, *Procedia Social and Behavioral Sciences*, Volume 1, pp. 1255–1263.
- [3] Eralp Altun, Baris, Demirdağ, Burak Feyzioglu, Alev Ates, Ilker Çobanoğlu, (2009), Developing an Interactive Virtual Chemistry Laboratory Enriched With Constructivist Learning Activities for Secondary Schools, *Procedia Social and Behavioral Sciences*, Volume 1, pp. 1895–1898.
- [4] Fernando Alonso, Daniel Manrique José M. Viñes , (2009) , A Moderate Constructivist E-learning Instructional Model Evaluated on Computer Specialists, *Computers & Education* Volume 53, pp. 57–65.
- [5] Mark W. Olofson , Meredith J.C. Swallow, Maureen D. Neumann , (2016), TPACKing: A Constructivist Framing of TPACK to Analyse Teachers' Construction of Knowledge, *Computers & Education*, Volume 95, pp.188-201.
- [6] Kudret Ozkal, Ceren Tekkaya , Jale Cakiroglu , Semra Sungur , (2009), A Conceptual Model of Relationships Among Constructivist Learning Environment Perceptions, Epistemological Beliefs, and Learning Approaches, *Learning and Individual Differences*, Volume 19, pp. 71-79.
- [7] Ahmet Kaya, Burhanettin Dönmez , (2009), An Evaluation of the Classroom Management Approaches of the Class Teachers Implementing "Constructivist Learning Approach", *Procedia Social and Behavioral Sciences*, Volume 1, pp.575–583.
- [8] Sezen Özeke,(2009), Connections Between the Constructivist-based Models for Teaching Science and Music, *Procedia Social and Behavioral Sciences*, Volume 1,pp.1068–1072.
- [9] Hasan Karal, Tugba Bahçekapılı, Ilknur Reisoglu, (2009), Usability of Testing Apparatuses About Renewable Energy Resources in Constructivist Class Environment, *Procedia Social and Behavioral Sciences*, Volume 1, pp.1264–1271.
- [10] Ercan Akpınar, Demet Erol, Bülent Aydođu, (2009), The Role of Cognitive Conflict in Constructivist Theory: An Implementation Aimed at Science Teachers, *Procedia Social and Behavioral Sciences*, Volume 1, pp. 2402–2407.
- [11] Mihaela Garabet, Cristina Miron, (2010), Conceptual Map – Didactic Method of Constructivist Type During the Physics Lessons, *Procedia Social and Behavioral Sciences*, Volume 2, pp. 3622–3631.
- [12] Lorenzo Moreno, Carina Gonzalez, Ivan Castilla, Evelio Gonzalez, Jose Sigut, (2007), Applying a Constructivist and Collaborative Methodological Approach in Engineering Education, *Computers & Education*, Volume 49, pp. 891–915.
- [13] Florentina Iofciu , Cristina Miron , Stefan Antohe, (2011), A constructivist Approach of Advanced Physics Concepts: Using a Cognitive Map for the Study of Magnetoresistive Materials, *Procedia Social and Behavioral Sciences*, Volume 15,pp. 461–465.
- [14] Sevinc Kurt, (2011), Use of Constructivist Approach in architectural education, *Procedia Social and Behavioral Sciences*, Volume 15, pp. 3980–3988.
- [15] Francesca Bertacchini, Eleonora Bilotta, Pietro Pantano, Assunta Tavernise, (2012), Motivating the learning of science topics in secondary school: A Constructivist Edutainment Setting for Studying Chaos, *Computers & Education*, Volume 59, pp.1377–1386.
- [16] Ruey S. Shieh, (2012), The Impact of Technology-Enabled Active Learning (TEAL) Implementation on Student Learning and Teachers' Teaching in a High school context, *Computers & Education*, Volume 59, pp. 206–214.
- [17] I. Garcia, C. Pacheco, (2013), A constructivist Computational Platform to Support Mathematics Education in Elementary School, *Computers & Education*, Volume 66, pp. 25–39.
- [18] Michael Chau , Ada Wong , Minhong Wang , Songnia Lai , Kristal W.Y. Chan , Tim M.H. Li, Debbie Chu, Ian K.W. Chan , Wai-ki Sung, (2013) , Using 3D Virtual Environments to Facilitate Students in Constructivist Learning, *Decision Support Systems*, Volume 56, pp. 115–121.
- [19] Mihaela Voinea , Monica Purcaru, (2014), Boosting Romanian students' interest in learning mathematics through the constructivist approach, *Procedia - Social and Behavioral Sciences*, Volume 127,pp. 108 – 113.

- [20] Gökhan Demircioğlu, Gülşen Çağatay, (2014), The effect of Laboratory activities based on 5e Model of Constructivist Approach on 9th Grade Students' Understanding of Solution Chemistry, *Procedia - Social and Behavioral Sciences*, Volume 116, pp. 3120 – 3124.
- [21] Gabriela Carmen Oproiu, (2015), A Study about Using E-learning Platform (Moodle) in University Teaching Process, *Procedia - Social and Behavioral Sciences*, Volume 180 pp. 426 – 432.
- [22] Juan Arango, Diana Gaviria, Alejandro Valencia, (2015), Differential Calculus Teaching Through Virtual Learning Objects in the Field of Management Sciences, *Procedia - Social and Behavioral Sciences*, Volume 176, pp. 412 – 418.
- [23] Ahmet Gurses, Cetin Dogar, Kubra Gunes, (2015), A New Approach for Learning: Interactive Direct Teaching Based Constructivist Learning (IDTBCL), *Procedia - Social and Behavioral Sciences*, Volume 197, pp. 2384 – 2389.
- [24] Lindsay Noel, (2015), Using Blogs to Create a Constructivist Learning Environment, *Procedia - Social and Behavioral Sciences*, Volume 174, pp. 617 – 621.
- [25] Elson Szeto, Community of Inquiry as an instructional approach: What effects of teaching, social and cognitive presences are there in blended synchronous learning and teaching, *Computers & Education* 81 (2015) 191-201.

