7 E's of Constructivism in E-learning Skills of University Faculty

Manjunath Kamath [1], & Anil Kumar [2]

[1] Research Scholar, Institute of Management & Commerce, Srinivas University, Mangalore, India,
ORCID ID: 0000-0001-9474-6767; E-mail ID: vrind005@gmail.com

[2] Registrar, Srinivas University, Mangalore, India,
ORCID ID: 0000-0002-6736-8649; E-mail ID: akgnairs@gmail.com

Area of the Paper: Business Management.
Type of the Paper: Case Study.
Type of Review: Peer Reviewed as per |C|O|P|E| guidance.
Indexed In: OpenAIRE.
DOI: https://doi.org/10.5281/zenodo.7582988
Google Scholar Citation: IJCSBE

How to Cite this Paper:
Kamath, M., & Kumar, A., (2023). 7 E's of Constructivism in E-learning Skills of University Faculty. *International Journal of Case Studies in Business, IT, and Education (IJCSBE), 7*(1), 62-73. DOI: https://doi.org/10.5281/zenodo.7582988

International Journal of Case Studies in Business, IT and Education (IJCSBE)
A Refereed International Journal of Srinivas University, India.

Crossref DOI: https://doi.org/10.47992/IJCSBE.2581.6942.0246

Paper Submission: 15/10/2022
Paper Publication: 30/01/2023

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Manjunath Kamath [1], & Anil Kumar [2]

[1] Research Scholar, Institute of Management & Commerce, Srinivas University, Mangalore, India,

ORCID ID: 0000-0001-9474-6767; E-mail ID: vrind005@gmail.com

[2] Registrar, Srinivas University, Mangalore, India,

ORCID ID: 0000-0002-6736-8649; E-mail ID: akgnairs@gmail.com

ABSTRACT

Purpose: *The goal of this research paper is to stress on the Information Technology skill of the University Faculty in achieving 7 Es of the constructivist E-Teaching/Learning process.*

Methodology: *It also uses secondary data of well-known books, reputed journal articles, authentic websites, and popular reports. Based on observations from the research papers also we have found that 7Es constructivist learning is better than traditional instruction-based learning.*

Findings: *The analysis shows that the skill component of education should be taken very seriously. The very application of Information and Communication Technology (ICT) skill has achieved good results in achieving better learning outcomes with reference to knowledge management processes like knowledge acquisition, storage, distribution, and use. This has encouraged the majority of people or communities to share, clarify and improve content using technologies. Constructivism must employ one or more techniques like problem solving, Role playing, Discussion, and simulations along with models like 7Es or 4As to construct new knowledge from existing knowledge for future learners so that innovations help learning process for easy or less time- consuming activity.*

Research limitations/implications: *Total change of existing education/training system is beyond one person or small community. But incremental reform steps can be taken so that the future is less cumbersome and living is easy.*

Originality/value: *Past experiences have shown us that technological advancement does not come easily, it is conjugation of constant skill application and research. This study addresses the importance of skill generated from learning/teaching concepts in the education sector and how it can be enhanced through various innovative teaching/learning ways.*

Paper type: *Case study paper*

Keywords: Skill, Information and Communication Technologies, Development, SWOT analysis.

1. INTRODUCTION :

Skilling is a lifelong process not limited to training institutes or education sector. Man continuously learns new skills as age progresses and evolves into better humans. However, in real world / market oriented, skilling is a process through some trainers or resource persons. Skill is a trait or ability inherent or learnt from others that makes people's life easy. Example for skill is typing, programming or teaching skill.

Skill of any working professional can be classified as Generic skill and Technical skill (Domain skills) [1] and this applies to all professional fields including teaching. Teachers/Faculty need to have 12 Generic Skills to do efficient teaching. They are:

a) Oral and Written Communication [2]
b) Research and Innovation [2]
c) Problem Solving [2]
d) Commitment to quality [2]

e) Information and Communication Technology (ICT) [2]
f) Critical Evaluation [2]
g) Team Work [2]
h) Adaptability and Sustainability [2]
i) Independent Lifelong Learning [2]
j) Leadership and Decision-making [2]
k) Ethical Standards [2]
l) Responsibility and Accountability [2].

Different definitions of Information and Communication Technology have been given by many researchers for the purpose of clarity, researcher has discussed only one definition.
Information and Communication Technology is defined as capabilities offered to organisations by computers, software applications, and telecommunications to deliver data, information, and knowledge to individuals and processes [3]. The skills given above would help a University Faculty to manage classroom environments and make learning interesting. Of all the above Faculty skills, ICT skill is the current trend since Covid-19 or pandemic broke out. The Information and Communication Technology (ICT) tool usage would make learning more long-lasting and help to make remote teaching/learning more achievable. Below mentioned sections discuss some concepts related to Teaching /Learning processes that are used, the world over.

2. LITERATURE SURVEY :

Arkorful, V., & Abaidoo, N. (2015) explains term e-learning for the use and attainment of knowledge that are predominantly distributed and facilitated by electronic means [4]. E-learning is defined as the usage of information and communication technology as a complement to traditional classrooms, wholly online learning or mixing the two modes in diverse processes of learning in higher education institutions [4].
The e-learning can be divided basically into two types, consisting of the internet-assisted and computer-assisted e-learning [4].
Some of the advantages of this type of e-learning based education for university students are mentioned below:

- Place and Time of Access [5]
- Equity in Access [5]
- Further improve group collaboration [5]
- Many other resources direct access [5]
- Global dimension of educational service can be extended [5]
- Monitoring the measure of progression in courses [5].

Some researchers consider E-learning disruptive in the educational process. Some of which are mentioned below:

- Physical absence of teacher [5]
- Access to unhelpful information [5]
- Limited students' feedback and assessment [5]
- Inappropriate for courses like medical and agricultural education where hands-on need to be provided [5].

E-learning can be further divided into three different modes i.e., Adjunct, Blended or Wholly online modes [6]. Adjunct e-learning means sometimes using information technology tools and infrastructures to assist in the teaching/learning process and sometimes not [6]. Blended learning means using the capabilities of both classroom (physical) as well as digital or e-learning simultaneously [6]. Wholly e-learning means using the capabilities of digital and network infrastructure to impart knowledge and disseminate information [6]. The wholly online mode of education can be further categorised as individualised learning and collaborative learning [6]. Individualised e-learning means pace of learning, content and instructional technology are based on the interests and abilities of each learner [6]. Collaborative e-learning is one in which learning is in groups or teams and some I.T tools like google meet or zoom meetings would help in remote gathering [6]. So information or knowledge might come from any team/group member [6]. Group meets regularly online to discuss the problem at hand to find

a solution [6]. Collaborative e-learning can be in Synchronous or Asynchronous mode [6]. The group members might exchange information or messages simultaneously (synchronous mode) and exchange messages at different times (Asynchronous mode) [6]. Blended e-Learning mixes various event-based learning activities, including live e-learning, face-to-face classroom, self-paced and student-centred learning which increases learners' interactivity, social content, and learning quality [6].

Constructivism is a theory which says learners create knowledge from existing knowledge as they interact, read, feel or exchange information [6].

The productiveness of Constructivism is that it enhances students' capabilities to problem-solving readiness in complex situations [6]. The teacher's role in Constructivism theory is trying to understand how the students would describe knowledge and to guide them to refine their understanding and clarifications to correct any inaccuracy arising at a preliminary stage and enhance the learner's knowledge quality [6]. Both theories, Conversation theory and Collaboration theory supplement the Constructivism theory. Conversation theory is based on a discussion in the learning environment where these two parties (students and Teachers) collectively put as learners, interact and collaborate to help create knowledge [6]. Contemporary learning through technology-assisted settings now empower students to self-learning techniques [7].

Self-efficacy is a mental aspect, influenced by cognitive processes that form human desire, point of view and deed [8]. For educators, it is a self-belief aspect that decide his/her potential and inspiration to perform achieve student engagement in tech-supported teaching [8]. Educators who use ICTs in their classrooms is found to have higher ICT self-efficacy [8]. Distance/remote learning gives "access to learning when the source of information and the learners are separated by time and distance, or both" [9]. Distance/Remote learning is another mode of Education where Educators and Learners are not place bounded. They are free and can move around and still take the benefit of course contents and Lectures at convenience but the problem with this approach is Learning process in Higher Education is not all complete until the construction or creation of Knowledge [9]. So distance learning has to have some form of interaction in real-time which is only possible through technology, ICT in particular [9]. Without interaction, collaboration or both, Knowledge creation is not possible [9]. ICT tools like line Skype or Google meet and Cisco Webex come in handy in Distance but online courses are way becoming popular nowadays [9]. The principles of construction are:

i) Knowledge is always constructed [10]
ii) People learn how to learn, as they learn [10]
iii) Learning is always an active process [10]
iv) Learning is contextual [10]
v) Knowledge is personal [10]
vi) Learning exists in the mind [10]
vii) Motivation is key to learning [10].

The types of constructivism that educators can use to help their learning strategies:

- Cognitive (logical interconnection between new knowledge and old one in learning) [10].
- Social (knowledge construction requires efforts from lot many people, knowledge is never constructed alone) [10].
- Radical (knowledge is always invented, not discovered and it doesn't tell us anything about learner who construct) [10].

Vast amount of information saved in one's life is Long-term memory, whereas little quantity of information which is held in brain is working memory, helps in execution of cognitive tasks [11]. A basic difference between education and learning is that education should help accumulation of skills that will assist continued learning after the student leaves university. Working memory according to information processing theories, was considered as a step to long-term memory [11].

A thermostat can be viewed to be learning when it takes corrective actions if room temperature goes above or below a certain set point. This is called single-loop learning [12]. The thermostat, however is not able to ask itself any question like can it be set at 70 degrees? that would promote double-loop learning [12]. Double-loop learning is vital because in its absence people are unable to review their estimates and hypotheses in order to design and implement a better quality of life [12].

Constructivists claim that technologically deterministic approach should not guide ICTs but rather guided in the context of cultural, social, economic and political dimensions of using technology [13].

Cognitive Constructivism dwells on the idea that a learner's cognitive powers have to be stimulated to solve advanced learning in a Higher Education environment. Cognitive Constructivism uses online or offline tools to promote the use of enhanced brain or cognitive powers for solving problems in problem-based learning [13]. There is another dimension of Constructivism in Learning, this is Social Constructivism [13]. This is social constructivism, Collective learning or Group learning is contextual, active and social where the role of parents, teachers, peers and other community members become important [13]. The synonym for student includes words like pupil, scholar, mentee, recruit, junior, learner and disciple. For originality some of these can also be used instead of original word student.

Education 1.0/ learning 1.0 where the meaning is dictated by Teachers, where as in education 2.0 or learning 2.0 where the meaning is socially constructed [14]. Education 3.0 or learning 3.0 where meaning is contextually reinvented and socially constructed [14]. Classrooms in learning 1.0 does not involve technology. Education 2.0 or learning 2.0 cautiously adopts technology in classroom teaching [14]. Education 3.0 is a universal approach where education/learning is everywhere. In learning 1.0, learning happens only from teacher to student. Education 2.0, teaching happens from Teacher to pupil and pupil to pupil [14]. Education 3.0 or learning 3.0 involves teaching in all perspectives irrespective of their past experience, hence teaching can happen from teacher to pupil, pupil to pupil, pupil to teacher [14]. In learning 1.0, college is located inside a building [14]. In Education 2.0, colleges are inside a building or online [14]. In education or learning 3.0, colleges or centre of learning is everywhere from temples to playing arena, coffee bar, salon, swimming pool, that is anywhere and everywhere. In learning 1.0 and 2.0, teachers are learned and licensed professional whereas your educators in Learning 3.0 could be anybody and everywhere [14]. In education 1.0 industry views graduates as assembly line workers [14]. Industry in education 2.0 views the graduates as low-level assembly line workers in knowledge economy [14]. In education or learning 3.0, industry views graduates as co-workers and entrepreneurs [14].

Constructivist 7E (Eisenkraft, 2003) is an approach consists of 7 steps such as Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend. Two new stages were added over 5E learning model, that is Elicit (getting prior knowledge) and Extend [15]. “Eliciting” is process of getting or producing information from the learner by asking questions normally by teacher for some scenario to enhance reactive answering by the former using prior knowledge. Example is one in which Teacher asks what would happen if you mix vinegar and salt? Mind mapping is usually used technique for eliciting information from the recipients. “Engage” is the activity where students are to be supported to find answers by doing or researching the web contents. While doing some projects in computers, students “engage” themselves to find out some answer for their coding problems. “Explore” is a kind of activity where learner doesn’t know the results of the activity or event. Exploratory learning mostly an adventurous journey where often learner finds new facts or results mostly unexpected. Example of “Explore” is researcher often studies outer space using telescope of good magnitude or size. “Explain” or Explanations for their results are an application-oriented response for their just concluded activity of learning. Explanations are something like press conferences a leader attends and makes statement after important happening or occasions. In “Elaborate” step, learners construct new knowledge in the form of document for other learners or readers who are interested in that particular topic. Illustrations for elaborate is new finding like finding new virus after clinical lab tests or coming up with renewed product version after design, implementation and testing step. “Evaluate” is the activity to justify the recordings or results of the just concluded activity for learning outcome for example coach of particular team evaluates the players after each match and gives some recommendations so that team moves in right directions. “Extend” their knowledge in other topic or subjects. For example, you can apply some of the concepts of engineering in management also. Like Requirement Elicitation and Analysis can be an activity that can be applied both in Management as well as in Engineering. Google scholar and Google search are the two search engines used for search of the literature. Literature through years after 2000 were searched to get idea about the topic and its relevance in the learning context.

Table 1: Related research on Constructivism and learning methodologies results.

S. No.	Area	Contribution	Reference

1.	Constructivism	Social constructivism is primary step for all the individual learning. Learners at the start of the learning process normally get information from the social circle which may be peers, classmates, teachers, parents then once they mature, they assimilate information by themselves and get involved in individual construction of knowledge.	Roya Jafari Amineh1, Hanieh Davatgari Asl (2015) [16]
2.	Constructivism different forms	There appears to be dualistic relationship between actual reality and mind constructed reality. Using this findings perception is constructed as pickup of information controlled by mental working. Observation is amalgamation of belief and experiences. Non-Dualistic approaches of implication Kuhnian principle of existence of truth as connector in between knowledge and reality. For comparing truth with reality we should know how truth is constructed in mental structure.	(Riegler, A, 2012) [17]
3.	Instructional Designers for online course	Paper described the instructional designer's role to be: (1) Training using technology and online methods. (2) Shifting courses from one learning management to another. (3) Faculty experts creating online courses. (4) Producing multimedia resources for learning. (5) Empowering faculty to create environment for learning efficiently using technology. (6) Enhancing student learning using learning management systems (7) Supporting faculty in online assessments to minimize cheating.	(Halupa, C., 2019). [18]
4.	Cloud-Based E-learning	Cloud based learning systems include tools such as Easy Generator, Lectora Online, eCoach, Ruzuku, iSpring Learn LMS through one among these services like Anything-as-a-Service, Infrastructure-as-a-Service, Platform-as-a-Service, Software-as-a-Service, Storage-as-a-Service, Network-as-a-Service.	**(**Siddiqui, Shams & Alam, Shadab & Khan, Zaki & Gupta, Ashok., 2018). [19]
5.	Higher order Thinking skills (HOTS)	HOTS of the students are still very low at all levels of education from elementary to Master program. Support of various online learning models, methods, material, worksheet, and	(Ichsan, I. Z., Sigit, D. V., Miarsyah, M., Ali, A., Arif, W. P., & Prayitno,

		learning media can improve students HOTS.	T. A., (2019). [20]
6.	Traditional and Inquiry-Based Learning Pedagogy	The traditional learning is believed to increase learners' outcomes and keeps them active during the learning process. Learner's knowledge and skills is increased when we apply inquiry-based learning approach in the class (online and offline).	Khalaf, B. K., & Mohammed Zin, Z. B., 2018). [21]
7.	5E learning model	The implementation of the 5E model, which is based on self-inquiry-based learning in teaching intends to foster the most desired learning.	Bekteshi, E. et al., (2022). [22]

3. OBJECTIVES :

The paper aims to show strength of 7E constructivism approach of learning method which is basically inquiry-based learning for complete understanding of the subject under discussion. Also perform SWOT Analysis of the 7 Es of constructivist learning method.

4. METHODOLOGY :

The paper is constructed using secondary data from the research materials published (Books, Reports, Thesis and Journal papers). Paper is constructed with understanding of the topic of the title and imagination of the concept. During the construction various subtopics need to be discussed and well-articulated**.** Search engines like Google scholar and Google search are used extensively for searching findings and deriving observations from the papers mentioned in the reference.

5. FINDINGS :

The table 2 below gives gist of keywords like Constructivism and 7 Es model of constructivist learning which are related to research topic and their corresponding findings from the research papers.

Table 2. Gist of keywords related to research topic and their findings.

S. No.	Keywords	Issues/Findings/Observations/Current trends
1.	Constructivism	Synthesis of multiple theories diffused in to one form is constructivism [23]. We can have 'critical' or 'conventional', 'thick' or 'thin', 'neo-classical' or 'postmodernism', 'liberal' or 'realist' constructivist tendencies [24]. Constructivism is an opportunity for learners for concrete and contextually meaningful experience [25]. Large-scale lessons, cooperative learning, Constructionism are three approaches to achieve constructivism into a classroom [26]. Constructionism is also an example of constructivism [26]. Three examples of cooperative learning are jigsaw classroom, structured controversies and reciprocal questioning [26]. External character of knowledge is emphasized in Cognitive constructivism [27]. One can reach the knowledge of truth, or reality, existing outside of individuals experience in cognitive constructivism, unlike social constructivism [27]. Constructivism, based on its focus on identity and self-conception of the individual, the formation of knowledge that is internal referred to as individual Constructivism or Cognitive constructivism [27]. Therefore, according to the social constructivists, based on a system of consensual sharing, testing, evaluation and social interaction can help to produce more reliable and more extensive knowledge [27]. The constructivist viewpoint holds that learning is a self-controlling process [27].

		Constructivist learning (CL) supports different individual viewpoints of reality and particular positions [27]. Constructivist learning is supporting new ideas that oppose existing views [27].CL is making new models of knowledge viewpoints (three-dimensional) and structures (semantic) for describing the reality [27]. Constructivism's complexity makes it problem for anyone to think it as a whole, and then to simplify it become quite hard without a properly designed lesson [28]. Constructivist approach teaches through the motto "learning by doing it" hence provides experience to the students in all kinds of learning environment [28]. Constructivism approach has characteristics such as Personalization/Customization [29], Responsibility [29], Critical Thinking [29], Self and Collaborative Assessment [29]. In addition, Conversation theory is based on interaction approach of the learning system, it believes that the collaboration and interaction between pupil and Educator play a trivial role in learning process and would ultimately help in creating new knowledge [29].
2.	7 Es model of constructivist e-learning	Mechanism or model guiding learners through a cycle of seven stages of learning activities that include: elicitation, engagement, exploration, explanation, elaboration, evaluation, and extension is called The 7Es learning model [30]. Educators must use more methods like the 7Es constructivist inquiry-based instructional model to enhance curiosity of students in their subjects [30]. Moreover, phases of 7E learning model frequently arouse interest among students [31], This model is based on the constructivism theory [32]. It is possible to map Scientific Approach to learning stages like Observe ("Elicit"), Ask ("Engage"), Gather information ("Explore" and "Explain"), Associate ("Elaborate"), Communicate ("Evaluate" and "Extend") [32]. This 7E Inquiry-Based Learning is aptly supported by the learning approaches such as Problem Solving, Experiment, Sightseeing-Observation, Brainstorming, Example Case, Question-Answer, Simulation, Role Play, Group Work, Discussion and Presentation [33]. The 7E model is blended with various suggested approaches and strategies such as hands-on activities, student-centred learning, inquiry, collaborative learning, problem solving, constructing own knowledge from multiple sources, and sharing ideas in different ways as well as judging and respecting other ideas [34]. The following seven components of constructivist teaching and learning [35]: (1) debates, arguments, discussions [35], (2) conceptual dilemmas and conflicts [35], (3) sharing of ideas with others [35], (4) resources and actions targeted toward solutions [35], (5) reason and concept probe/exploration [35], (6) satisfying student expectation in learning [35], and (7) sense-making [35], authentic examples [35]. Educators can mix 7E instructional technique with one more instructional technique like 4As model: activate prior knowledge, acquire new knowledge, apply knowledge and assess knowledge [36]. Four Pillars of Learning developed for UNESCO are Learning to Know (for beginners), Learning to Do (for professional success), Learning to Live Together (for coexistence living in society), Learning to Be (for complete personality and inward learning and spirituality). A Learning Community looks for wellbeing of the community by bringing learning and people together [37].

Table 3: How ICT technologies would support 7E constructivism approach of learning.

S. No.	Stages in 7E constructivism learning	ICT support in 7E Learning Process
1.	Elicit	Videos of some process can be shown to learners to check their prior understanding and enquire about similar process elsewhere in some other subject or in life [38].
2.	Engage	Animation can be used to demonstrate how a system performs its task making students engage in the learning process [38].
3.	Explore	Students are asked to build the circuits using the "virtual laboratory software", they can be asked to connect different components available in the tool box [39].
4.	Explain	Learners can be asked to conclude on the just finished project on computer software like TC or visual studio .Net platform [39].
5.	Elaborate	Values from just concluded survey can be tabulated using Excel spreadsheets [39].
6.	Evaluate	Using barcharts and pie charts in software like Excel or Word Teachers or Educators can give some valuable recommendations to parents or students for better Learning outcomes [39].
7.	Extend	Students can be asked to extend the existing knowledge or knowledge just created in ICT software like PowerPoint to other areas of life [39].

6. SWOT ANALYSIS OF THE CONCEPT :

Table 4 given below describes SWOT analysis of 7 Es of constructive learning model over other model like 5 Es,4As and 3 Es. Strength of the 7 Es learning approach is that more emphasis is placed on prior knowledge of the subject or topic and tacit understanding for constructing new knowledge [40]. New knowledge constructed because of 7 Es approach leads to longetivity of knowledge in memory than that created from traditional learning [41]. The 7 Es learning approach had significant effect on male and female critical thinking skills and learning retention equally [42]. Weaknesses of the above model is that all the course sections or topic may not have enough time for all the steps of the 7 Es model of learning [15]. It may work well when learners have basic knowledge about the topic [15]. May not work well when educating the entirely new and unseen subject or topic [15]. Opportunities of this model of learning is that at each step some amount of knowledge construction is possible [15]. All the learning theories like Conversation, Construction and Collaboration are well supported in the above learning method [15]. Threats is that it may take longer time to yield results, hence patience is the necessity [39]. Knowledge constructed at each step is absolutely necessary for cognitive structure of overall construction [39]. Learners would construct wrong knowledge if not monitored properly by supervisor or teacher or guide.

Table 4: Strength, Weakness, Opportunities, Threats (SWOT) of the 7Es model are discussed below.

STRENGTH	WEAKNESS
i. In 7 Es constructivist learning approach more emphasis is placed on prior understanding and tacit knowledge that can be used as a basis for the learning to take place [40]. ii. Enables learners to link new knowledge with previously learned knowledge or experiences and helps to create new knowledge using their cognitive abilities [41]. iii. Adds to functional learning among learners that lasts for a longer period than that caused by traditional learning [41].	a. All the course sections may not have enough time for all the steps of the 7E model of learning [15]. b. It may work well only when learners have basic knowledge about the topic [15]. c. It may not work wonderfully when teaching entirely new and unseen subject [15].

iv. The 7E learning cycle model had a significant positive effect on male and female students' critical thinking ability, achievement and learning retention equally [42].	
OPPORTUNITIES	**THREATS**
A. It is activity based or learning by doing approach, construction of new knowledge may be by-product of this model [15]. B. All the learning theories like conversation, collaboration and constructivism theory well supported in this model [15].	I. Since it is multi step approach, takes time to get results. Patience is the key [39]. II. Since it uses knowledge constructed in each of the seven steps, so results of all the steps are absolutely necessary [39]. III. Learners would construct wrong knowledge if not monitored properly by teachers [15].

7. SUGGESTIONS FOR THE RESEARCH :

The constructivism is a vast topic with lot of subtopics under it. It is extremely difficult to ignore one topic and choose some other topic. So it should be chosen after thorough study of literature and relevance in the current context.

8. CONCLUSION :

After the study it is found that 7 Es inquiry based instructional method of learning can be effective in understanding the problem, solving the problem in step-by-step manner and for recording the intermediate stage results for future learners who can use it as a case study for their work in finding a solution to their problem.

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