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"BLENDED LEARNING" – EMERGING APPROACH FOR DEVELOPING SCIENCE PROCESS SKILLS

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Abstract

This paper elaborates the blended learning as a new approach for science learning through analyzing the learning theories and relationship between science process skills and learning. It is aimed at identifying the significant predictors of blended learning for developing science process skills. A theoretical analysis was done by the researcher for identified the significance of blended learning. We analyse different science process skills and them interrelation for developing concepts.

Key Words: Blended Learning, Science Process Skills, Active Learning.

1.1 Rationale

Science offers more than scientific knowledge. There are three basic dimension of science teaching and all three are equally important. The first of these is the content, the basic concepts, and our scientific knowledge. This is the dimension of Science that most people first think about, and it is certainly very important. The other two important dimensions of science are processes of doing experiments and scientific attitudes. The third dimension focuses on the characteristic attitudes and dispositions of science. These include such things as being curious and imaginative, as well as being enthusiastic about asking questions and solving problems. Another desirable scientific attitude is a respect for the methods and values of science. Hence science should be experimental and activity based activity learning. Basic and applied sciences have many abstract concepts. That's why students experience problems in learning. The laboratory work and activities contribute to active learning. Constructivist approaches, investigative approaches, tests of phenomenon, problem-solving skills, scientific thinking give a logical reasoning and explanation of abstract concepts.
UNECCO and WHO (2020) also reported during pandemic, distance learning and paradigm shift in teaching learning process has accelerated around the world. Active and innovative digital tools and resources are easily available that allow educators and learners to active and collaborative learning. So in present scenario blended learning is accepted as a new concept of learning that connects active online and digital medium. It is also considered as a classroom management system (Moran 2010). Blended learning is "New approach for Relearn". In general, we can say that blended learning is the combination of conventional or traditional direct classroom interaction activities and online digital

activities of teaching learning process. Specially in science teaching learning process blended learning is adapted as a new approach of learning. The main objective of this research study to elaborate the all aspects of blended learning for developing science process skill in teaching learning process.
Blended learning, also known as hybrid or mixed-mode learning, a portion of the traditional face-to-face instruction is replaced by web-based online learning. Yet, as McGee and Reis (2012, p.18) pointed out that there is consensus about a number of aspects of blended learning, but he does not show any consensus about the exact structure of a blended course. He asserts that "a snapshot system that personifies those unique elements of a blended course can inform, model, and clarify how blended course differs from other delivery designs." Educational institutions generally used 'blended' to refer to a combination of face-to-face teaching and online teaching. Graham et al. (2014) also found that in the research on blended e-learning, most of the blended models adopted the combining of online and face-to-face instruction. Blended learning is a widely researched phenomenon. Drysdale et al. (2013, p. 98) reviewed over 200 masters' theses and doctoral dissertations related to blended learning and have found that the graduate research on blended learning was increasing.
Means, B., Toyama, Y., Murphy, R., Bakia, M., and Jones, K. (2010). Evaluation of evidence-based practices in online learning, Yadav & Mishra (2013). conducted a "Study on the Impact of Laboratory Approach on Achievement and Process Skills in Science among Students" The purpose of the study

was to compare the effects a laboratory on students' developments of Science process skills. Tatli and Ayas (2011), conducted the study on Effect of virtual Chemistry laboratory on students' ability to recognize laboratory equipment. The study examined the effect of a virtual Chemistry laboratory on student Science process skills. Feyzioglu (2009). conducted the study on Investigation of the relationship between Science Process Skills with efficient laboratory use and Science achievement in Chemistry education. The aim of the study was to investigate that Science Process Skills with laboratory use are correlated with Chemistry achievement. From the above studies reviewed, it can be infered that, the results of different studies show an inconsistent finding. In studies like Stozhko & Pervukhina (2017). Yadav & Mishra (2013) and Feyzioglu 2009, the findings clearly establishes online virtual lab as an instruction tool for developing Science process is more effective as compared to real lab. The studies like. Tatli and Ayas (2011), Omar, Zulkifli & Hassan (2009) revealed that computer simulation/virtual lab is as effective as conventional lab. The studies reviewed above also employed different subjects and even disciplines. Therefore, subject specific findings cannot be arrived at. It was also found that there is a gap literature in terms of application of simulation for laboratory instructions purposes in the field of Science education, which could contribute to not only laboratory cost reduction, but also to the availability of such laboratories to those who cannot attend traditional classrooms. The review further established the fact that the reviewer of present study could not trace comprehensive and good study in Indian situation except that very few like Rajendra& Divya (2010). There is a need to study the aspects of blended learning in terms of effectivness. The concept of blended learning employed in these studies is also altogether different. The educational environment under which these studies were conducted was also varied and difficult. Therefore, it is not be possible to arrive at some kind of generalization based on the review of these studies. Furthermore, most of these studies, conducted are outside India i.e. in western culture, where providing education through computer and on-line in reality. There are no strong studies undertaken in India. Blended learning is still not very much in use in India particularly in school education system. However, it is also true that the concept of blended learning has started entering into educational institution and is likely to be a reality in few years to come. It is in this context that it is appropriate time to study the various dimension of blended learning. The present study is a humble attempt in this direction.

1.2 Science learning and Science Process Skills

Science Process Skills are a learning approach that integrates to develop students' skills in understanding the concepts, and developing necessary facts and values. In this learning approach students are able to construct and develop conceptual understanding, and scientific temperament.
According to Screen (1996) – "***Science Process Skills are the sequence of events that are engaged by researchers while taking part in scientific investigation they may be classified in to two types***".

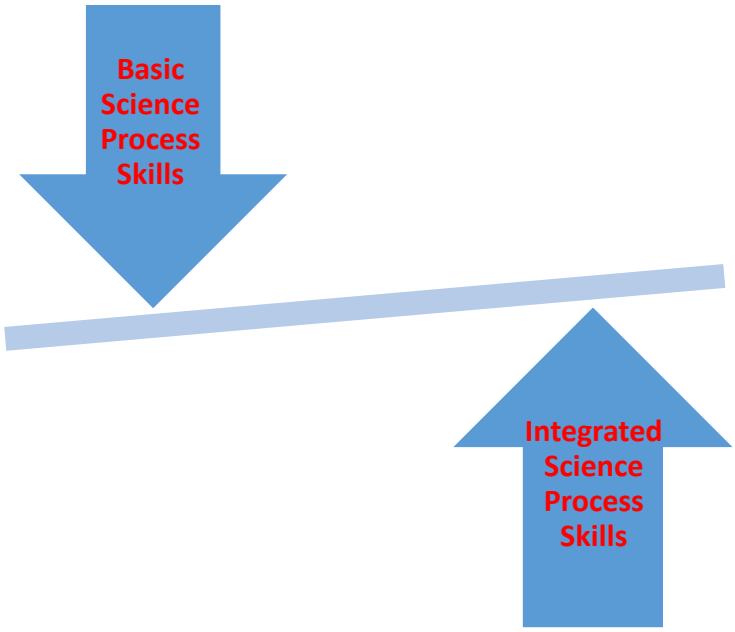

Figure-1.1
Types of Science process skills

Brotherton and Preece further classified the basic and integrated Science Process Skills.They classified six basic Science Process Skills as observation, communication, classification, measurement, inference and prediction. Integrated Science Process Skills classify as graphics, hypothesis, interpreting data, controlling variables and experimenting. These skills for learner emphasize the use of five sense organs in the lab. The concept of doing Science learning is very important for developing process skills among learners.
Basic Science Process Skills are interdependent, implying that more than one of these skills may be displayed and applied in any single activity (Funk et al., 1979). The basic Science Process Skills develop gradually, as do concept. Figure 1.2 present detail can be classify of Science process skill.

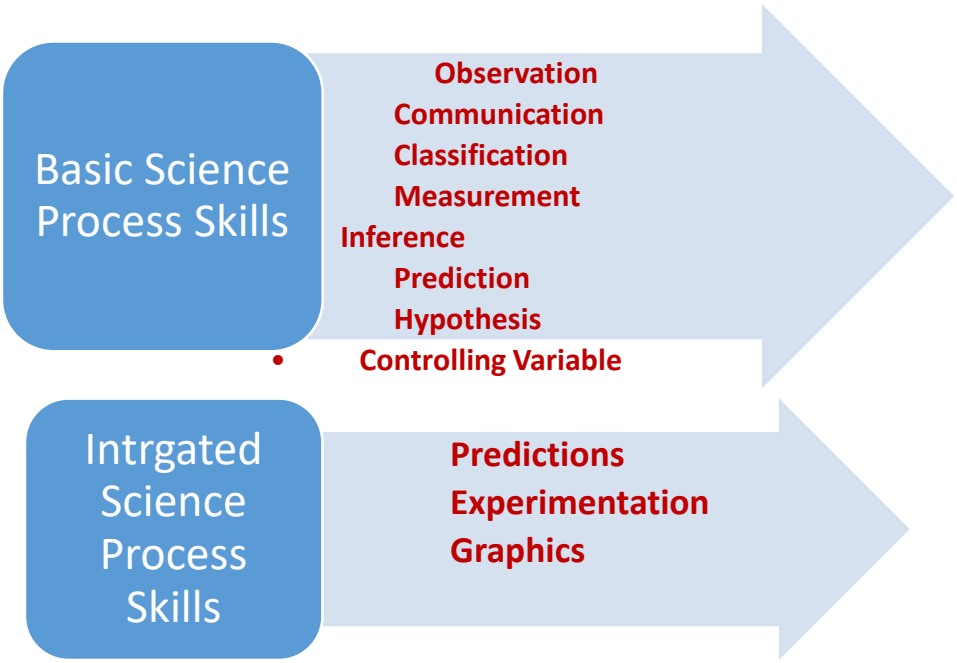

Figure-1.2
Classification of Science process skills

The active learning has a central role to play in enhancing the progression of these basic process skills. They pave the platform for developing concepts. Skills are the basic protocols for conceptual understanding.

The observation skill: - The skill of observation is the most fundamental of all lab work. According to Miller (1987). observation is defined as "observation skill as an activity in which learner, engage in throughout their lives." Learners observe and compare the things. Observation skill developed among learners by designing such activities where learners are required to observe stages like- use several senses while making observation.
The communication skill: -Communication is the process of sharing information with others. Communication is essential in science lab, given its collaborative nature. This actually refers to a group of skills, all of which represent some form of reporting and gathering data. It may be in form of tables, charts, and graphs.
The skill of measurement: - Measurement is the only process skill that is in form of numerical terms. The nature of this entails the description of some system attribute by comparison to a standard of reference.

The skill of classification: - The skill of classification is a process of grouping objectives on the basis of observation skill. This is very useful and important skill because of an underlying assumption that kinship in one regard may entail kinship in others. Classification involves grouping items into like categories.

The skill of Inferring: -The skill of inferring is the process of developing relation, and drawing conclusion based on past experience. Special attention is given to distinguish between observation and inferences and between the observer and what is observed.

The skill of predicting: -The skill of predicting involves various tasks such as data organizing, graphing data, and understanding functional relationship between measured variables.

1.3 Present Scenario of Learning from Lab and Science Process Skills

There is a progressive conceptual development within each skill. As this development proceeds, it becomes increasingly interrelated with corresponding development of other processes. These skills cannot exist in vacuum. All skills are interrelated and interdependent. Integrated process skill can be achieved only after attainment of basic process skills and hence Science process skill can be arranged in hierarchal order presented in figure 1.3.

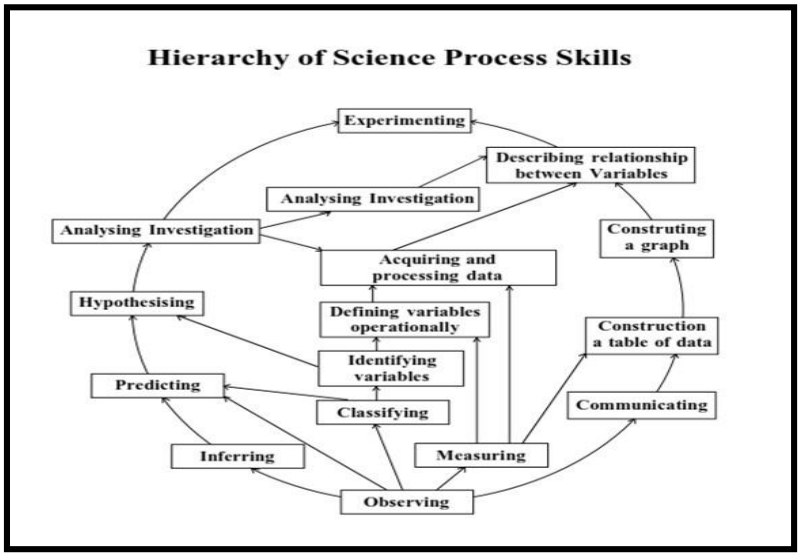

Figure-1.3
Hierarchy of Science Process Skills

Blended learning technologies consist of two major components**:**

a**)** Blended learning Management **-** capabilities that enable training organizations to centrally define, manage, and schedule software**.**

b**)** Blended learning Delivery **-** capabilities that give learners a secure, personalized, and highly interactive experience**.**

Those who provide blended learning technologies are going to significant trouble to handle complexity**.** While some software applications are designed to be deployed on a desktop or single shared server, many enterprise applications consist of multiple components, supplied by multiple, deployed on multiple servers**.** These applications represent a complexity that requires specialized capabilities to manage, control and ultimately **"**orchestrate**"** laboratory resources**.** Management in the blended learning context consists of the ability to keep track of an application**'**s composition, resource requirements, and deployment dependencies**.** Something must manage the underlying software stacks, the libraries and resources necessary for deployment, and the images necessary for interaction between learner and software, and that something is the blended learning management system**.** The key components to a blended learning solution typically address the following management capabilities**:**

- Configurable Workflows**–** Flexible scripting is required to implement a training organization**'**s business processes and logic **–** in particular, workflows that govern how software labs are deployed, configured, and ultimately accessed**.**
- Scheduling**–** A true management system includes robust scheduling to maximize productivity and eliminate resource conflicts**.** The scheduling system allows requests for software labs to be reliably analyzed **(**capacity planning**)** and systematically executed taking into account both scheduled and on**-**demand needs**.**
- Course Catalogues **–** These enable management of instructor**-**led and self**-**paced courses and the shared software labs they use**.** They are not insignificant in that they can provide an umbrella of

Learning Management System (LMS)-type capabilities, such as instructor and student assignments, links to course materials (such as laboratory exercises), and surveys.

- Customization – Virtual labs are not off-the-shelf solutions; instead, they typically must be incorporated into an organization's existing processes for training development and delivery. This means that they may be integrated with LMS platforms, virtual classroom tools, and online learning portals.
- Reporting– Virtual labs should include practice and resource reporting to help measure and improve effectiveness. Should resources be overly burdened, solid reporting capabilities – just like any management solution – should be available to help organizations understand how resources are being used and how students are learning. At a more technical level, a blended learning solution has built-in services to intelligently manage and control the setup, configuration, and teardown of software labs regardless of their complexity, the number of students, or the duration of use – whether it's a self-paced laboratory that's needed for just a few hours, or a laboratory that's part of a multi-day, instructor-led course.

1.4 Learning Theories and Blended Learning

The role of blended learning is not just the bloom of the new paradigms in teaching and learning, but also to improve the effective and meaningful educational process. Learning induces a constant, measurable, and specific behavioral change in the learner to formulate a new mental construct. Over the view point of learning theories, we will build a strong base work of blended learning for science learning.

a. Behaviorism

The stimulus response learning which occurs with behaviorism is effective when learners need to remember and repeat information. The foundational nature of the Chemistry course requires certain knowledge be consistently repeated in subsequent courses such as systems of units, unit conversions, significant figures, vector arithmetic, conservation of energy, and conservation of momentum. To build the learner's ability to respond correctly, drill and practice with immediate and reinforcing feedback must be available. These practice activities should increase in difficulty and complexity for completion on the learner's schedule and be repeatable until the learner achieves proficiency. Blended learning initially utilize these basic activities because there is no restriction for time and place for developing more complex movements required insubsequent experiments for concept and principle.

b. Constructivism

As Woolnough & Allsop (1991, p. 8).137 say, "*For more able students the pedestrian pace enforced by preprogrammed practical work in order to deduce what is blindingly obvious can be very frustrating*". A major change in the goals and purposes of the lab work took place when an alternative approach to Science learning, constructivism, began to gain acceptance. Constructivists hold that learning is an interpretive development, as new information is given sense in terms of the student's prior knowledge. From a constructivist point of view, each learner actively constructs and reconstructs his or her understanding rather than receiving it passively from a more authoritative source.

Redish (1997).178-182 a salient supporter of a constructivist approach in physics teaching, said:

"*As a physics teacher I am not satisfied to have my students memorize a few equations and algorithms and be able to apply them in limited examples. I would like them to understand what physics is about, how it works, and why we believe it. I would like them to understand the basic concepts and the different representations used by physicists and to understand how these relate to the real world. I want them to see links between the different ideas in physics and to build a strong, accurate, and useful intuition for physical phenomena suggests that social interaction is crucial as learners internalize new or difficult.*"

In the blended learning the learner can work at their own pace to understand the requirements of the learning objectives and examine new material**.** Learners can be guided through the learning process in steps by prompts which elicit inputs followed by reinforcing feedback**.** Multiple opportunities for practice and assessment can be provided until learners become proficient**.** Learners are then directed to the next step in the sequence until the performance requirements of all objectives has been achieved**.**

c. Social Constructivism

Moreover, using a viewpoint known as social constructivism, Vygotsky **(**1978**).** 136 explained the significance of the relationship between language and action as students learn in social settings**.** With respect to learning science , Vygotsky**'**s theory suggests that social interaction is crucial as learners internalize new or difficult understandings, problems, and processes**.** The lab is a place for social exchange and exploration **(**and expansion**)** of ideas; it is indeed a place for personal maturation and cognitive growth**.**

1.5 Conclusion

In the blended learning the learner can have co**-**operative learning with the help of simulation which provides sharing of knowledge and experience among learners, collective enquiry, assessment and improvement, group activity for active learning**.** This active learning provides to learner advances towards new areas of acquisition of knowledge where he tries to compare his new findings with the existing concepts**.** Applications for Science learning is agreed with everyone; however the actual role of the laboratory is not like this. According to Hofstein (1988), "*students were still performing experiments in the lab in a "cookbook" approach which focused on development of low level Science skills".* (Pushkin 1997,). concluded "*when lab manuals dictate to students like "what to think, how to think, and when to think, laboratory activities essentially lose impact for learning".* Despite the significance of experimentation in Science learning, real laboratories often fail to transmit the thrill of discovery to the greater part of students which is essential for development of concepts and principles (Laboratories 1997).

In short, lab work, as currently put into practice, has too many avoidable obstacles to learning (Johnstone 1984; Newman 1985). If this is the case, we need to take a different view of teaching Science learning particularly while in real laboratory, a view based on exploring, developing, and modifying student's concepts rather than attempting to displace or replace them.

An instructional practice that has emerged over the last two decades began with what is commonly termed the blended learning, in Science learning. Improving laboratory instruction has become a priority in many institutions, driven, in part, by exciting computer simulation based programs being developed at various schools.

Science learning is taught in India in general as a bundle of abstractions without practical experiences. This has resulted to students' low acquisition of Science Process Skills which has become more evident in the mass failure of conceptual understanding in Science learning. Science Process Skills are relevant and appropriate for all Science subjects, in particular Science learning at the senior secondary schools.

Blended learning has offered tools for active learning. It represents its capacity to create new opportunities for solving problem and different learning styles. Furthermore, technology not only help students create an active learning environment to solve problems but also help them in finding their own problems.In blended learning online virtual labs are interactive, it is now easier to create active environment in which students can learn by doing in receiving feedback, and immediately refine their conceptual understanding and build new knowledge.It can also very useful to visualize difficult to understand concept which are difficult to state verbally (Linn et al., 1996). Concisely, online laboratory is used as a tool to enhance student's educational experience by creating a variety of methods to meet special needs, teach children how to manage information and allow for opportunities

to develop higher level thinking skills. This approach leads the occurrence of new paradigm in teaching and learning. One of the most effective alternative solutions of above for Science learning is Blended learning through blended learning. This approach goes beyond current interactive simulations where students may manipulate variables but independent decision-making is constrained. The central idea of blended learning is the implementation of a laboratory environment that offers students all the attendant manipulative features, ability to make mistakes and measurement errors where the conditions are very similar to those realized in real laboratories.

Hence, there is need to find out the level of acquisition of the process skills, and influence of gender and class size, since process skills are very fundamental to science and there exists a serious educational gap in this area in bringing these skills into the classroom.

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