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JAGAT GURU NANAK DEV
PUNJAB STATE OPEN UNIVERSITY, PATIALA

(Established by Act No. 19 of 2019 of the Legislature of State of Punjab)

CERTIFICATE COURSE

IN

CREATIVITY AND INNOVATION IN SCHOOL EDUCATION

CISE-1

CREATIVITY AND INNOVATION IN SCHOOL-THEORETICAL FRAMEWORK

Head Quarter: C/28, The Lower Mall, Patiala-147001

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CERTIFICATE COURSE IN CREATIVITY AND INNOVATION IN SCHOOL EDUCATION

COURSE: CREATIVITY AND INNOVATION IN SCHOOLS: THEORETICAL FRAMEWORK (CISE-1)

Unit 1: CREATIVITY: CONCEPT, PROCESS & INTERRELATIONS

STRUCTURE

1.0 Learning Objectives

After completing this unit, you will be able to:

- explain the concept of creativity
- describe innovation and learning
- explain creative skills
- enlist myths of creativity
- describe source of creativity

1.1 Introduction

"Electricity is not only present in a magnificent thunderstorm and dazzling lightning, but also in a lamp; so also, creativity exists not only where it creates great historical works, but also everywhere human imagination combines, changes, and creates anything new."

Lev Vygotsky (1930/1967, cited in Smolucha, 1992, p. 54)

We have just crossed over the span of 20 years into this century and we have already seen that everything in this century is changing at a very high rate. Uncertainty, turbulence, disruptiveness seems to be key features in this century. The next decades will be even more challenging than we have ever imagined. To deal with such a scenario, Creativity is an asset to human beings. To remain relevant in the fast-changing world, we need to find creative solutions of unexpected problems before all of us. Demand for creativity in 21st century will continue to grow.

The concept of creativity is as old as the Hindu Vedic literature. Now a days, the central question in our schools and colleges is- "How to develop Creativity?" In the 21st century, it is the most desirable trait in every field. NPE-2020 also focuses upon developing creativity among students. As we are witnessing lots of changes in the present world, this goal focused thinking process which is uncommon, new and valuable, will be of great use in every field. Some creative works influence the human civilisation. Many creative works in art and painting, inventions in science and technology emerge from the ideas which were never thought of, in the history. Earlier, it was thought that creativity is related with selected humans working in different creative fields. Some are born with creative qualities, traits or genes. But with the passage of time, it was realised that creativity belongs to all. One need is to develop creative aptitude and positive attitude to succeed in life. We have to encourage it in our schools, homes and work places, for unlocking the full potential of each and every individual. In the present unit, we will learn about the concept of creativity, discuss the meaning of creativity and we will try to know the creative process. This unit will also explore the interrelations and intercultural perspective related to creativity. We will learn about creative skills, sources of creativity and different myths related to creativity in our society. Through discussions on these topics, you all will enjoy to learn about creativity & innovations. As we all know, some think that creativity is an important thing that makes humans different from apes. Others recognize that even apes, other primates, mammals and some birds adapt to survive by being creative. We will try to explore all these in this Unit.

1.2 Concept of Creativity

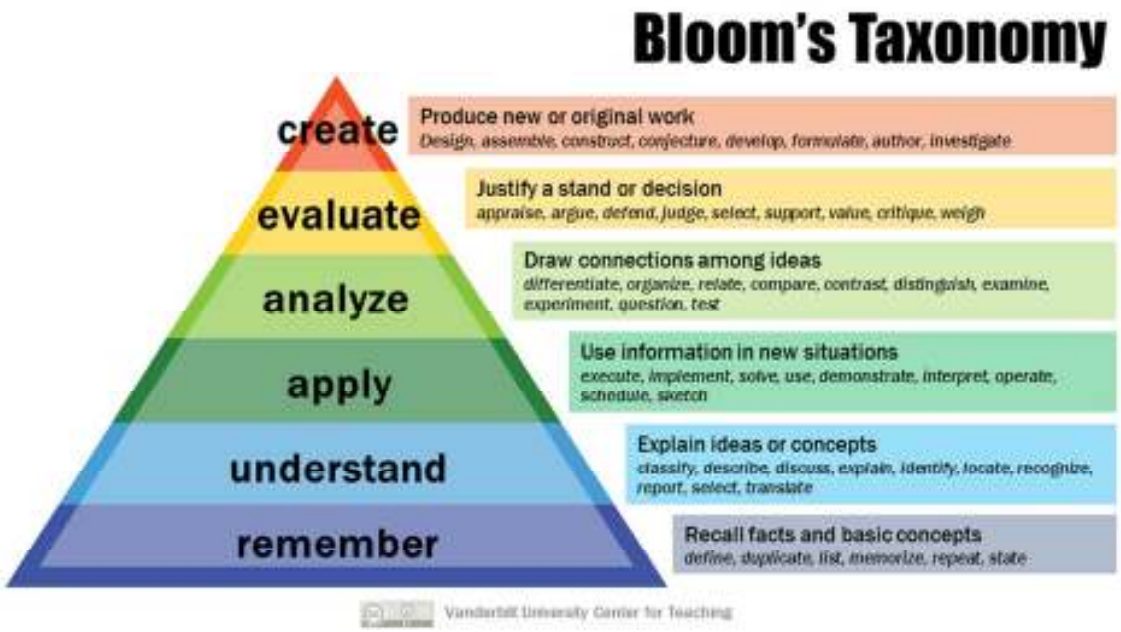
1.2.1 Who is Creative

Creativity means creating something with one's own ideas that are novel and useful in one or another context. There is no doubt that God is the Creator of everything. We all are small agents of this larger creative process. Now the question arises- Can anyone be creative or does it belongs to a selected few? Are there any individual differences in it, as in intelligence? Many people debate over the question whether creativity is genetic or learned. The answer to this debate is that it is actually both. Literature on creativity shows that intelligence and creativity relationship is a point of controversy since a long time. Research of Guilford and his associates had tried to explore this area. Research reports have shown a weak relationship between the two creativity and intelligence but an individual requires a minimum level of IQ (often arbitrarily set to 120, Guildford, 1967) to be creative, but this relationship is weak (Torrance (1977). It is an open area for more research to reach to the conclusion. Some writings report that creativity exists in every human being. Creativity is a natural trait in humans. It's amount, dimension & manifestation may vary from one individual to another. Creativity is a process. It can also be improved/learned with conducive environment.

A person doing new and exciting things actually engages himself/herself in a way that takes the person one step closer to reaching the full potential. A person can show creativity in decorating his/her house, another in science laboratory and even other in playground. Generally creative people tend to be energetic, but it does not mean that they always remain engaged in a focused creative or artistic task. Some creative people may be imaginative, inquisitive, and even take a long rest and suddenly act on the areas of their interest. Creativity is talent; many people are born with this talent but fail to nurture it throughout their lives.

1.2.2 Meaning of Creativity

Bloom's revised Taxonomy has given six levels of cognitive learning. Each level is conceptually different. The six levels are named as remembering, understanding, applying, analysing, evaluating, and creating.



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Cognitive activity directed towards some creative work refers to creative thinking. It is placed at the highest level in the above cited Bloom's revised Taxonomy. Creative thinking is one of the most important skills out of the ten life skills defined by World Health Organization (WHO). WHO has defined life skills as, "the abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life."

Creativity is defined in a number of ways by different psychologist, philosophers and educationist. Some of the theories in literature like God-given Gift theory, Psychoanalytic theory, Taylor's level theory & Investment theory have tried to define creativity. Sternberg (2006, p. 88) stated that Creativity comprises of several different aspects:

- abilities
- knowledge
- styles of thinking
- personality attributes
- motivation, especially intrinsic motivation
- environment

In creativity there is freedom from rigid thought pattern. Creativity is defined as something different from intelligence and as a parallel construct to intelligence, but it differs from intelligence in that it is not restricted to cognitive or intellectual functioning or behaviour. Instead, it is concerned with a complex mix of motivational conditions, personality factors, environmental conditions, chance factors, and even products (Michalko, 1998). According to

Guilford, creativity includes divergent thinking, with respect to traits of fluency, flexibility, and originality of thought process. Torrance defined creativity as a process of becoming sensitive to problems, deficiencies, gaps of knowledge, missing elements, disharmonies and so on. Apart from these mentioned theories, different attempts have been made to explain creativity. One is focused upon it as a process, other as an outcome, or the goal, and yet another one is influenced from cultural and philosophical views. Generally, creativity is an ability to produce, generate, or discover new ideas, explanations, and possibilities. It means an original, useful and novel idea. Creative person is producing or using original and unusual ideas. Creativity involves the use of imagination or original ideas to create something. Creativity is the ability of a person or group to make something new and useful or valuable. Creativity can be seen in all areas of life - science, art, literature and music. Creativity can be understood as being a multidimensional construct, involving cognitive variables, personality characteristics, family, educational aspects, and both social and cultural elements. These dimensions interact with each other according to individual thinking and creative styles and are therefore expressed and found in many different ways (Sternberg, 2010; Wechsler, 2008). NACCCE defined creativity as 'imaginative activity fashioned so as to produce outcomes that are both original and of value' (NACCCE, 1999, p. 29). Creativity can be defined in many ways. The P21's Framework for 21st-Century Learning (Binkley, 2012) defines creativity as follows:

Think Creatively

- Use a wide range of idea creation techniques (such as brainstorming).
- Create new and worthwhile ideas (both incremental and radical concepts).
- Elaborate, refine, analyse, and evaluate original ideas to improve and maximize creative efforts.

Work Creatively With Others

- Develop, implement, and communicate new ideas to others effectively.
- Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work.
- Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas.
- View failure as an opportunity to learn; understand that creativity and innovation are part of a long-term, cyclical process of small successes and frequent mistakes.

A Creative school is one where students are able to use imagination and critical thinking to create new and meaningful forms of ideas, where they can take risks, be independent and flexible. Instead of being taught to reiterate what was learned, students learn to develop their ability to find various solutions to a problem. Coming up with various out-of-the box solutions is known as divergent thinking and there is no one way of cultivating this skill - largely due to the newness of the concept and the limited scientific information on creativity.

1.3 Creative Process

The creative process is a set of mental processes that regulate the creation of ideas that are both new and valuable. Philosophers are of the view that this process is natural and one has no control over it and on other side scientific explanations make it a step wise procedure. A large number of research studies in the field of psychology are scattered, but establish that creativity is complex and multidimensional. The history of research on stages of creativity began with Graham Wallas (1926) who suggested that creative thinking follows four successive steps:

- Stage of preparation
- Stage of incubation
- Stage of illumination
- Stage of verification

Joy P. Guilford says that the creative processes comprise of a wide range of elements, including fluency, flexibility of thought, originality, sensitivity to problems, the capacity to transform the known, cognition, memory, and personality traits. Other psychologists have also tried to explain the creative thinking process from different dimensions. In this unit we will discuss common steps of creative process:

Preparation: It involves investigating in a chosen area of interest, exploring your mind, knowing related materials and meaning. All this provides a base of previous knowledge and experience. However, avoid too much relying on prior knowledge which can easily restrict the creative process. A person involved in creative process normally tries to explore different available ideas. For example, a teacher watches different types of lesson on a particular subject from different online platforms. Experiencing the teaching style, content, innovative ways to convey the message gives you an idea of what more ate the possibilities to make it

more creative and innovative. Preparation widens your attention and lets you know the products, practices, and culture in a field.

Incubation: After preparation stage, Incubation time is a very important stage. It means giving an individual's subconscious mind in particular, proper time to incorporate whatever he/she had learned and practiced in the previous stage of preparation. This stage involves the absence of active practice. In simple words, time for some physical rest, but your mind is at work. A change of environment plays a key to incubating ideas. A new situation/environment allows an individual to receive different stimuli which may not be directly associated with the creative problem in hand. Incubation allows your mind to integrate your creative problem with your memories in subconscious mind. It is not possible to do when you are consciously working on the creative problem related tasks. Many innovative and creative people develop hobbies involving some physical activity to keep their minds busy while they allow ideas to incubate.

Insight: Insight is a term for the moment, when the solution to a creative problem suddenly becomes readily accessible to your conscious mind. This is a stage where the creative idea bursts forth from its preconscious processing into conscious awareness. This is the moment of time when your preparation, practice, and period of incubation merge into a genius stroke. It is often followed by feelings of elation.

Evaluation: Evaluation is the purposeful examination of ideas. You will want to compare your insights with the products and ideas you encountered during preparation. You also will want to compare your ideas and product prototypes to the goals you set out for yourself during the preparation phase. Creative professionals will often invite others to critique their work at this stage. You are looking for assurance that your standards for evaluation are appropriate.

Elaboration: The final stage in creative process is elaboration. It is the actual stage of production. Your invention may not be refined or fully complete, but it must function well at this stage. Elaboration also can involve the production of some piece of artistic work. You can also establish a small testing of your product to get feedback and evaluations of your products from actual users. This feedback can give you valuable information that can help to make the product or service as successful as possible.

1.4 Creative Skills

As we have discussed in above sections that some of the people may be creative by birth, they have genetic advantage with them but it does not mean that others cannot do creative work. Creative skills can be developed over time with some well-designed efforts. Creative skills are important for administrators, teachers as well as students. Countries across the globe are altering their education systems to develop creative skills among the young generations in schools. As creativity can be manifested in different activities in an organisation, so it is difficult to sum up creative skills in a list. Some of the examples are given below:

- **Observation:** You can discover fresh ways of doing things by observing the world around you. Watching how people work can inspire you to think of ways to help them be more efficient. Knowing the whole situation with keen observation is an important creative skill. Try to find all the connections. Creative person always finds connections between different ideas. These connections are used to think in diverse areas to solve problems.
- **More focus on ideas as compare to facts:** Creativity requires use of imaginative power of a person. Each creative person is giving importance to idea, as variety of idea help in a creative work. Focusing on fact is key component of critical thinking instead of creative thinking. Here you need to understand that idea generation is key skills of creativity.
- **Think alternatives:** Along with generation of new ideas, it's also important to accept new ideas in creativity. If you can accept new knowledge without judgment then you are on the right path. Mind should be open to any new idea.
- **Asking Questions:** Finding different ways to know a concept, by asking many questions is an important part of creativity. Never try to stop questioning. Asking question provides better understanding and knowing more and more details. It can also help a person to do that task in a novel way.
- **Experimenting:** Experiment brings out your creativity. Creative people see each failure as a new opportunity for learning and improvement. They keep on experimenting and learning from the failures.

- **Reflection:** Continuous reflection on the available and created work helps to adopt the best and creative idea into action in particular situation. Use your imagination to explore unexplored dimensions or areas.
- **Less judgemental:** Creativity require flow of ideas. A person should be less judgemental so that idea generation should not be blocked. Let all the diverse ideas come and then the best one will be chosen for a particular situation. Creative persons are more independent in their judgements.
- **Problem-Solving:** It is also a part of creative skills. De Bono (2007), found that the creative problem-solving exercises can also improve creative thinking skills.

Self-Check Exercise -1

Define Creativity. What are the four steps of Creative Thinking?

1.5 Myths of Creativity

As you will go into the details of the concept of creativity, you will find that there are some misconceptions or myths related to creativity. Myths are generally held by people but incorrect beliefs which are grown as means to explain the phenomena that are hard to understand. Knowing these myths help us to understand the concept and its application in field in a better way. In literature, myths of creativity are given by different authors (Sharp, David Burkus). For the ease of understanding, we are discussing some common myths in context of students, that are relevant to the educational institutions:

1. Creativity is limited to arts subjects: Creativity is not limited to only arts subjects. In history many creative people were from the field of science and other subjects too. So, it is not true to corelate creativity with a few subjects only, such as art and music only. Creativity is a way of problem solving and it can happen in any subject/area.

2. Easy transfer of learning: Knowledge and skills are so context specific that children may simply fail to recognise that something they had already learned in one area can be easily functional in a new situation too. Elders can help children to make this connection easy for children.

3. The creative process is fun: Creativity may seem like a fun activity as compared to more serious 'work' in the classroom. But the creative process may pose many challenges. Creativity requires attention, perseverance and willpower to succeed. Creativity needs to be taken seriously.

4. Creativity is limited to 'few': Some people feel that creativity is only when a big invention or work is created, like by winners of Nobel Prize and great artists. This is termed as Big-C Creativity by researchers but we should not ignore little-c creativity. The small creative ideas related to your everyday life are also part of creativity. Each child may have a different combination of personality traits, abilities & experiences at home/school that affect his/her creative potential. Some children will miss the opportunity to develop their creative potential, due to lack of encouragement and support in pre-school and school.

5. Creativity is limited to free play and unstructured arts activities: Children do benefit from free play and unstructured arts activities. But relying entirely to play and art work can become routine, repetitive and monotonous. Children need variety of activities, stimulation and creative problems to solve, these enhance creativity. Adults can also help children to develop their creative skills through play.

6. Knowledge and skills have no contribution in creativity: Some people believe that for creative work there is no need of any knowledge or skill because existing knowledge blocks creativity. On the other hand, basic knowledge and skills are important for creativity. Existing knowledge and skills are the starting point for young children's play.

7. You can't teach creativity: Rigid structures in our schools or homes can badly crush children's creativity. It does not imply that schools or homes cannot teach creativity. Teachers and parents can frame some flexible instructions and rules for children which will not create hinderance in creative work. You can easily nurture creativity with conducive environment. All children are born with the capacity to be creative, but their creativity needs to be nurtured, encouraged and supported.

1.6 Sources of Creativity

Sternberg's (2006) in a research paper on 'the nature of creativity' explained investment and confluence theory to understand creativity. it explains about a confluence of six distinct but interrelated resources (Lubart,1944): intellectual abilities, knowledge, styles of thinking, personality, motivation, and environment. Confluence approach suggests that for creativity to occur, multiple components must converge.

1. Intellectual abilities/ Intellectual skills: The following three skills are particularly important:

- the synthetic skill to see problems in new ways and to escape the bounds of conventional thinking

- the analytic skill to recognise which of one's ideas are worth pursuing and which are not, and
- the practical–contextual skill to know how to persuade others of—to sell other people on—the value of one's ideas.

The confluence of these three skills is also important. Analytic skills used in the absence of the other two skills results in powerful critical, but not creative, thinking. Synthetic skill used in the absence of the other two skills results in new ideas that are not subjected to the scrutiny required to improve them and make them work. Practical–contextual skill in the absence of the other two skills may result in societal acceptance of ideas, not because the ideas are good, but rather, because the ideas have been well and powerfully presented.

2. Knowledge: One needs to know enough about a field to move on forward. On the other hand, knowledge about a field can result in a closed and entrenched perspective, resulting in a person's not moving beyond the way in which he or she has seen problems in the past. Knowledge thus can help, or hinder creativity.

3. Styles of thinking: Thinking styles are preferred ways of using one's skills. If an individual is able to think globally as well as locally, distinguishing the forest from the trees and thereby recognising which questions are important and which ones are not, it helps the individual to become a creative thinker.

4. Personality: Research investigations have reported that certain personality attributes for creative functioning are important. These attributes include- willingness to take sensible risks, overcome obstacles, tolerate ambiguity, and self-efficacy. However, attributes are not limited to these only, often creative people decide to think in a different way as compare to others.

5. Motivation: Intrinsic, task-focused motivation is an essential condition for creativity. The research of Amabile (1983) and others has shown the importance of such motivation for creative work and has suggested that people rarely do truly creative work in an area unless they really love what they are doing and focus on the work rather than the potential rewards. Motivation is not something inherent in a person: One decides to be motivated by one thing or another.

6. Environment: Everyone need supportive and rewarding environment for developing creative ideas. One could have all of the personal/internal resources desirable to think creatively, but lack of conducive environmental support for enhancing creativity, results that that a person might never be able to display his creativity.

Confluence: Concerning the confluence of these six components, creativity is assumed to include more than a simple sum of a person's level on each component. First, there may be thresholds for some components (e.g., knowledge) below which creativity is not possible regardless of the levels on other components. Second, partial compensation may occur in which strength on one component (e.g., motivation) counteracts a weakness on another component (e.g., environment). Third, interactions may occur between components, such as intelligence and motivation, in which high levels on both components could multiplicatively enhance creativity

Other sources of creativity are:

- **Role-Play Situations:** It allows students and teachers to think over the issue in an innovative way. This can bring new & creative ideas.
- **Brain Storming Sessions:** Using brain storming in our classrooms can help to get plentiful ideas. It can be used as one way for developing creative thinking.
- **Social Circle:** Diverse social circle can enhance creativity of a person as in diverse group you get the opportunity to know many ideas. Diverse group can challenge our assumptions and helps to think out of the box.
- **Mind mapping:** Tony Buzan created this technique. This technique normally starts with a word in the centre and then connected ideas are shown through branches connected by arrows or lines.
- **Acceptance of new opportunities:** Every new opportunity gives you a space to try new things. For enhancing creativity, we need to tolerate ambiguity too.
- **Challenging stereotypes:** When one person is challenging stereotypes and forcing oneself to think beyond the boundaries, it will help to find a creative way. So, motivate the students for experimentation and persistence.
- **Art, music & theatre:** Some of the research studies have shown that engaging in Art, music & theatre can also be a source to develop creativity for many people. The different aspects of theatre, music, art provide opportunity for creative thinking.
- **Asking maximum open-ended questions and always Praising students who provide unexpected answers.**
- **Indicating creative thinking and behaviour in front of students.**

Self-Check Exercise

Discuss the sources of Creativity

1.7 Innovation and Learning

1.7.1 Concept

Human learning starts at birth or even from conception and continues until death. Learning is result of ongoing interactions between people and their environment. Learning is modification of behaviour of the organism. Learning is not directly observable, but it manifests in the behaviour of the organism. Various learning theories have defined learning from different contexts. Most of the learning theories can be grouped into three main parts; Behaviourism, Cognitivism and Constructivism. Gagne has also classified learning into different forms in a hierarchical order. The literature available on learning explains that concept of learning is changing over the time with new researches. We all are also witnessing many changes in every field related to our life including the field of education. These major changes are occurring at a fast rate due to the use of technology. We need to understand that the learning process in schools is also bound to change. This change can be due to the technological factors or non-technological factors. Different innovations in learning can make the process more enjoyable and effective. It will add value and solve problems. Learning involves refining understanding, learning new concepts and broadening the perspectives. For this purpose, our thinking needs to be creative and innovative.

Innovation and Learning has provisions for your schools by sharing a vision for all round development. Students will become the trendsetters, creators and contributors in the 21st century. An innovation in learning happens in a precise teaching and learning situation, through improvisation of existing practice or introducing a novel practice. This innovation in learning helps to achieve greater learning outcomes. In education, an innovation is a deviation from the standard practice that achieves greater learning outcomes. Innovation does not always involve a mechanical, electronic, or digital device. We can take a simple example here to understand innovation in teaching learning process. You must be aware that J. L. Baird discovered TV. The main purpose of TV was entertainment and educators made use of that TV for teaching lessons to students with low internet speed. If it proved more effective than the standard practice of teaching through YouTube lessons/internet-based teaching, it would be an innovation in learning. So, any new device is really just an invention, and only the successful use of it—its application—for a specific purpose, in a specific context, makes it an innovation. The innovation may be methodological, technological, or both. (Redding et. Al. 2013).

Following Activities can be planned in our classrooms for Innovative learning:

- **Project-based learning:** small subject based or interdisciplinary projects can be planned in classroom teaching.
- **Six Thinking Hats:** This approach was given by Edward De Bono. It focuses upon groups to plan thinking process. It will help to think together more efficiently. Edward de Bono said 'Never think twice about something. Three times is better'.
- **Cooperative learning:** Our school system is more focused on developing competition spirit among students, instead of cooperation. So, we need to shift our focus towards cooperative learning methods like STAD, JIGSAW, THINK & PAIR etc.
- **Play-based discovery learning:** Classroom activities must be designed in such a way that students can discover through play-based learning.
- **Context-Based Learning:** Explaining new information by correlating with particular context. It uses experience of teachers & learners.
- **Brainstorming**: Using brain storming in our classrooms can help to get plentiful ideas. It can be used as one way for creative thinking.
- **Inquiry-based learning:** It focuses on the student's role in the learning process as compared to teacher's domination. It aims to develop higher order thinking (HOT) skills.
- **Adaptive teaching:** Learner's need based personalized path through educational content to complete the journey towards creativity.
- **Other student supported activities:** Research studies in education and psychology are reporting various student-centred ways and techniques for effective learning.

Above mentioned activities can contribute in creative thinking in schools and educational institutions but over reliance on any one way is not recommended.

These activities/methods will engage our students in cultivating creativity, using problem-solving skills and developing their competencies for innovation. Teacher need to promote divergent thinking among students through classroom encouragement, by designing open ended questions etc. A culture of innovation, within an educational organization requires 5 phase innovation process:

- Stimulate innovations to improve learning outcomes.
- Enable potential adopters to select innovations appropriate to their context and need.
- Ensure that the innovation is implemented with fidelity to its essential elements and with adaptations to enhance its effectiveness in the given context.

- Facilitate the scaling of the innovation through implementation in multiple classrooms, schools, and districts.
- Provide a system for monitoring the effects of the innovation and its scaling, implementing change as necessary.

1.7.2 Inter-Relationships

Innovation and learning are connected with each other. Changes are occurring across the globe. Each institution is facing increasing interruptions in the ongoing processes, information is in abundance now, and new technologies are influencing the education sector. Innovation in learning is very important to be relevant in the fast-changing world. Institutions are benefited by processing information in novel and productive ways, and making learning environment more innovative. Innovation and learning are complementary to each. Institutions need to develop a conducive environment to harness the benefits of this deep relationship.

1.8 Summing Up

Creativity is a central question in our schools and colleges. It is a goal focused thinking process which is uncommon, new and valuable. Some creative work influences the human civilisations. Creativity follows a four-step process, consisting of preparation, incubation, illumination and verification. Confluence approach in creativity explains that there are six distinct but interrelated resources: intellectual abilities, knowledge, styles of thinking, personality, motivation, and environment. We can believe that many of us can also do a creative work, it is not the property of few. We can learn to unlock the creative potential, explore how the creative process works and what are the myths related to creativity. Innovations and learning are interrelated concepts. In the fast-changing world we need to be innovative in our methods, ways of learning and creating an innovative learning environment.

1.9 Questions for Practice

I. Explain the concept of Creativity.
II. Briefly explain the confluence approach in creativity.
III. Discuss myths related to creativity.
IV. Briefly explain the concept of innovation and learning

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CERTIFICATE COURSE IN CREATIVITY AND INNOVATION IN SCHOOL EDUCATION

COURSE: CREATIVITY AND INNOVATION IN SCHOOLS: THEORETICAL FRAMEWORK (CISE-1)

Unit 2: CREATIVITY: BARRIERS & IDENTIFYING WAYS OF ELIMINATING BARRIERS

STRUCTURE

2.0 Learning Objectives

After completing this unit, you will be able to:

- Explain Creativity among Children
- Analyze different barriers to creativity
- Discuss ways of eliminating barriers to creativity

2.1 Introduction

Education is a major tool in developing human potentials, cognitive functioning, and constructive creativity. Creativity is a unique gift of nature, which has inspired many scientific

inventions, artistic works, engineering adventures and productive activity (Albert Einstein). We need to admit that today's generation may be employed in those sectors or jobs which may not be available now. They need to deal with new problems. In such a scenario educating the students for creative thinking can really help them to cope up with future scenario. We know that creativity is the most valued quality of human beings, because creative acts affect all spheres of life. So, it is imperative to give due recognition to the phenomenon of creativity and its importance in life. The Creator has imparted to every person the instinct of 'creativity' right from birth, as a divine gift, a mysterious phenomenon that sprouts in full bloom only in a few outstanding geniuses. It is very important to know the appropriate environment, techniques and material to be used to provide fertile land to the seeds of creativity. In the process of creativity, there might be some barriers. In this unit our focus will be to know these barriers of creativity and finding suitable ways and means to remove these barriers.

2.2 Creativity and Children

Creativity is an individual's ability to imagine or invent something new. Some creative thoughts are astonishing and brilliant, while others are simply basic, acceptable, practical ideas that no one has considered at that point. Creativity is a special quality in all children and they have an urge to explore and investigate everything. They have a natural tendency to create something new with the aid of whatever knowledge they have at that time. Children have unusual curiosity to observe various objects in the environment, which they like to explore further and assimilate into their store of knowledge. As we know, Child's world is beautiful, full of wonders and excitement. Almost every child at four can paint whatever he sees or feels, he/she can make up imaginative stories, dance spontaneously to the tunes of music, and build toys with blocks. Children have vision and imagination. They see fresh possibilities in each thing and everywhere. All these imaginative characteristics begin to change and die when over structured educational programmes at school or at home mould the natural imagination of the young ones. As children move up the ladder of grades, they learn to usually do what is asked, to follow directions and not to fly freely in the sky. The flights of their own imagination are snubbed in the name of indiscipline. Thus, elders at home and at school, are responsible for suppressing the original imagination of young ones before it could be utilized to their advantage in their creative and

constructive expressions in different forms and shapes befitting their genius individually. Quite often, children ask questions about natural phenomenon. Parents and teachers ignore and crush the joyful inquisitiveness of young children by ignoring or pretending to be not hearing their questions. The child is sometimes punished for his or her being imaginative and is forced to study the class lesson prescribed by adults or acquire knowledge in very rigid, strict and traditional ways. By having such type of an attitude, parents and teachers kills children's creativity. Young children are by their nature very creative and spontaneously constructive. It is our duty as teachers and parents to ensure that their creativity has to be fostered and nurtured in as perfect a manner as feasible; and not to hamper it in any way.

2.3 Barriers to Creativity

A Creative mind has to face a lot of barriers to reach a novel idea or an invention sometimes and on other times it can be sudden and spontaneous also. A check is to be kept on these barriers to develop the creative potential of an individual. It is very important for a school teacher to understand barriers to Creativity and identify the ways of eliminating these barriers for enhancing one's creativity and methods of Creative Problem solving.

- **School Barriers:** From the very beginning of the school years, teachers and education professionals start trying to fill the minds of the students with the core literacy and numeracy, and intellectual capabilities that help them to secure better marks. Most of the stakeholders believe that it will determine the level of ability and talent of the child's growth in school. In reality too much focus on information and knowledge hinders creativity. Conservatism and authoritarian environment of a particular educational institute is also a great barrier in the path of creativity.

- **High standard of Achievement**: Achievement of our works gives us confidence. All successful people like to win and accomplish high standards in their life. This makes them terrified of failure and disappointment. They are frightened from failures in their life and not ready to take any risk. When a positive trait, like achievement or accomplishment, becomes

too strong in someone's life, it becomes a significant obstacle in the path of new experiments. They are not able to break the shackles around them.

- **Fear of Failure**: Fear is a part of human nature. Self-defeating mindset stops us from taking risk of choosing new ways of doing things. Insecurity about doing things erroneously makes individuals to unconsciously sabotage their chances for progress.
- **Impatience/Eagerness**: Eagerness is yet another reason that makes us think that it is difficult to do anything creative. An impatient person starts with the end in mind and searches for the quickest route to reach there. We tend to grab the first solution which comes in mind without analyzing. Our goal should be to improve; to become familiar with everything to learn all we can about what we love; to make the process itself the reward.
- **Perceptual blocks**: Perceptual blocks prevent individuals from being open to novel, unique and original thoughts. Some baseless assumptions are built in the mind that no other solution is possible. So, perceptual barriers made to block creative and innovative thoughts and ideas. It creates hindrance for creative behavior.
- **Motivational & emotional blocks**: Research studies have reported that creativity is also influenced by the emotions. Along with cognitive process or intellectual processes, cycles, feeling, emotions also play a key role in creativity. When a person lacks motivation for creative work or he/she is over-whelmed with emotions/feelings, he/she fails to apply creative thinking. For examples– fear of mockery/rejection, negative reservations about oneself 'I can't do it' feeling affect the creativity.
- **Cultural blocks**: If societal expectations, the traditions, society rules, customs and stereotypes have unnecessary control on individual, it creates a cultural block. People develop fears of being alone/unique and getting separated from the group/society of which they are a part.
- **Conformity**: It is a sort of social influence including a change in belief system or behavior in order to fit in with a group. We are greeting each other as a conformity to social relations. Conformity prevents creativity because even extraordinary thoughts, when they first appear, might seem absurd. We cannot create new things if we are afraid of appearing unusual in the eyes of others.
- **Lack of consistency**: Everyone loves novelty and curiosity. Students are constantly eager to find new friends, get admitted to a next class, read new courses, play new games or get into a

new relationship, but get bored after some time and try to escape it. It really doesn't take courage to start a new project, but to get beyond "the point of frustration." This is why being consistent is one of the most important criteria for building your creative power.

- **Personal Problems**: Creativity demands focus and it is difficult to concentrate if you are into a quarrel with siblings, parents or friends; there is a lot of sound around, you live in a very noisy locality, you are sick or have to look after someone in the family, etc. So, our personal problems also act as a barrier in the path of being creative.
- **Anxiety**: Anxiety is certainly not a typical worry that crosses mind. It does not give any rest to mind; it takes control of your mind and no logical thought can get through it. Anxious feeling about the work stops you to accomplish that specific work.
- **Rigidity**: Tendency to be over-powered by one's thinking habits, leads to defeat of imaginative expression.
- **Lack of knowledge**: Knowledge is the information that we gain through the experiences of our predecessors and our own as of now. However, creativity is needed to put that information together to come up with new results and outcomes. New ideas are based on past knowledge. Your idea might not be successful if you do not know enough, or you lack the relevant skills. Without proper information and knowledge, creativity does not have any substance to work with. Creativity assembles already available information in a manner to come up with new solutions to new issues.
- **Restriction on interaction**: A free and open environment provides students a chance to interact with their peer groups. Such interaction facilitates exchange of ideas, thoughts and information required for creative work whereas in a restricted environment creativity is adversely affected.
- **Lack of support**: Creativity needs support from friends and family in order to secure a conducive environment to work upon ideas. For a creative student, teachers, parents and the peer group play a significant role. Sometimes due to lack of support individuals drop their ideas.
- **Overemphasis on competition**: Competition is a part of today's education system, but it should not be so focused that real creativity is ruined. There should be healthy competition among the students so that they can show their ideas in the classroom while learning.

- **Failure of judgment:** You can have the right idea, but make the wrong decision in executing and developing it. It can also be carelessness about the details; lack of speed that the student does not work fast enough and other people beat him/her to it.
- **Failure of attitude:** Forging a new path where others have not gone before requires courage and the right balance of attitude. Fear of failure causes us to abandon an idea before it comes to fruition. Complacency makes us think we can get away with mediocrity without significant sacrifice. Denial results in a stubborn refusal to abandon a hopeless project and a failure to remedy our own weaknesses.
- **Lack of acceptance and tolerance of criticism**: A creative product, being novel, faces a lot of criticism and is not accepted quickly till it is tested. Students who are not tolerant to criticism or rejection of their product cannot work further towards the improvement of it and hence will not be able to continue with their work.

Self-Check Exercise

Discuss some of the barriers to Creativity

2.4 Ways of Eliminating Barriers to Creativity

- **Conducive and creative environment:** educational institution must have very conducive environment in the organization to promote creativity among students. Encouragement of play is main feature of good environment. There must be place for creative expression in different areas.
- **Sufficient knowledge and experience:** As without proper information and knowledge, creativity does not have any substance to work with, so there is a need to equip the children with satisfactory amount of knowledge and information to provide a base for creative thinking. It is also need to remember that excessive knowledge in one particular area can also create hurdle to think on alternative ways for solving a problem.
- **Develop Inquiry skills:** Inquiry through open ended questions can encourage deep learning as well as it gives a window to look out at a wider perspective. During inquiry students are able to wonder, build background knowledge, develop questions, search for new information, synthesize information, demonstrate an understanding and share their

new learning with others. Throughout inquiry, the students tie everything together through an essential question. It must be used in every class across the disciplines.

- **Questioning technique in class:** Questioning plays an important role in developing critical thinking skills. Questioning technique trains students on how they should think. An expert uses open-ended questions to encourage discussion. We can also incorporate questioning into our everyday interaction with students. Questioning is the best way to activate the minds of the students for creative work.
- **Apply Problem Solving method:** We should not give students answers to issues or problems they are having. Instead, we should break the problem and turn it onto them and ask how they could solve this problem. This provides children with opportunities to develop problem solving abilities, which is a part of the creative process.
- **Student-centered learning environments:** School environment should be varied and flexible to accommodate the needs of all types of learners and provide opportunities to build a collaborative learning community of students and teachers.
- **Positive Motivation and definiteness of aim:** Unless there is a definite aim or purpose, thinking cannot go on the right track. Aim or purpose helps in assembling and channelizing the energy for thinking and makes the students deeply absorbed in the task of critical and creative thinking.
- **Thinking Time:** time should be given to the students to think (or wait time) while using question /answer technique in class. If teacher will give stand by time, students will get enough time to think to give answer.
- **Adequate Freedom and Flexibility:** Thinking is obstructed by imposing unnecessary restrictions and narrowing the field of thought process. Students should be encouraged to think out of the boundaries. Teacher should provide democratic environment in the classroom and also should be ready to accept the different kinds of ideas put forward by the students.
- **Appropriate development of Concept and Language**: Proper care should be taken to develop right concepts. Concepts, symbols, signs, words and language used are the vehicles as well as instruments of thought. If the concept clarity is there, students can analyze the things which foster creative and critical thinking among students.

- **Brainstorming Technique:** Brainstorming is also a technique to develop diverse thinking. This technique permits a group of students to explore ideas without judgment or censure. The children may be allowed to sit in a group for solving the problem and attacking it without any inhibition. This technique is best suitable in today's world.
- **Use of teaching models:** Some of the teaching models developed by some educationists may prove quite beneficial to develop critical and creative thinking like- Suchmann inquiry training, Taba inductive thinking and Bruner's concept attainment models.
- **Play with Ideas:** Allow your students to play with their ideas while they are doing other activities than study. Ask them to broaden their thinking pattern without any fear. Enjoy playing with new ideas.
- **Encourage students to be reflective:** Students should be reflective instead of making judgments or accepting ideas that comes in their mind or those ideas which are presented in front of them by media or by experts.
- **Emphasize alertness**: Students need to be motivated to think on alternative hypotheses, conclusion, explanations, sources of evidence, point of view, plans etc.
- **Develop reading habits:** Reading books makes student's brain muscles work and active participation. Reading books substitutes experiencing, widens their thinking horizon, enables consistent learning, and enhances imagination. Reading helps develop imagination because the brain works to create the new world that students read of in the book. This also allows the mind to experience new events and conflicts by imagining the plot of the story.
- **Rest and Diet:** A very important part of the process of creativity is incubation. At this step, the creative thinker is visibly inactive, but the information related to the problem is getting assimilated within the brain in this period of rest. So, proper rest and diet both are very important for the brain to work in right direction.
- **Learn to Think Positive:** Positive thinking is key to success. Our society is too much fascinated with success, but it is important to know that even the most successful persons have encountered failure. Walt Disney was fired from a newspaper agency for lack of creativity. He tried to get job at some more places but no one recognized his talent. Now our children enjoy his creativity on TV and Disney is now a brand in itself.

- **Practice Visualization:** it is an important cognitive process: an individual purposefully creating visual mental imaginings.

Based on the rapid changes in science, technology and communications, students, who are the future of human race, need to be more innovative and creative. Therefor both the family and schools need to enhance creative thinking of the students. Some of the points given below need due consideration for all stakeholders:

- Being able to go through proses for inventing something new.
- Thinking of useful ideas in order to be able to heighten perception of our surroundings for a unique fruitful end.
- Make children sensitive to the surrounding.
- Respecting children's issues and problems.
- Paying attention to creative environments in organizations such as schools.
- Respecting the value of creative thinking of children
- Considering adequate rest period times in school programs.
- Encouraging creative children for constructive criticism.
- Preparing variety of knowledge in different areas for teachers.
- Preparing live and active teaching methods.
- Making teachers and students familiar with problem solving methods.
- Preparing learning environments away from fear and shyness.
- Education will play a major axis

2.5 Ways to Increase Creativity in Classroom

These are few ways in which creativity in classroom can be increased:

- Don't limit assignments to one format. For example, instead of limiting the student to the writing assignment, they can create a podcast, video, role playing, poem, composing songs, etc.
- Set time aside for creativity. For instance, set aside one hour in a school day to let students explore their ideas

- Use technology to broaden your idea of assignments. For example, you can use Google Maps to teach geography and make the class more interactive.
- Besides using the books in the classrooms, introduce unconventional learning materials into class., like podcasts and videos to create entertainment with education.
- Reward creative ideas, thoughts and products
- Encourage risk-taking, allowing mistakes, and imagining from various perspectives
- Teach teachers to be more creative in classrooms and hold creativity workshops for them

2.6 Summing Up

Creativity can help our students to adapt with a rapidly & constantly changing world around us. The future is uncertain that demands flexible work force across the different working areas. The workforce needs to be equipped with skills of 21st century which are beyond core literacy or numeracy in schools. Today's generation may be employed in those sectors or jobs which may not be available now. They need to deal with new problems. In such a scenario educating the students for creative thinking can really help them to cope up with future scenario. They can try novel and creative solutions at their workplace or in society. This process of creativity can be enhanced at school level but we witnessed that at many places creativity of child is snubbed by some barriers and obstacles. These barriers may have varied nature. We need to identifiy the barriers and find out the ways to remove these barriers. It will make our educational institutions a perfect place for developing creativity among our students.

2.7 Questions For Practice

i. Discuss various barriers to creativity
ii. How to eliminate barriers to creativity
iii. Discuss various ways to increase Creativity in Classroom
iv. State whether following statements are true or false:
    a. Lack of knowledge and experience or improper knowledge and faulty experience is a hurdle in creativity.
    b. Brainstorming is also a technique to develop thinking.

2.8 Suggested Readings and References

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CERTIFICATE COURSE IN CREATIVITY AND INNOVATION IN SCHOOL EDUCATION

COURSE: CREATIVITY AND INNOVATION IN SCHOOLS:THEORETICAL FRAMEWORK (CISE-1)

UNIT 3: CREATIVITY AND IMAGINATION

STRUCTURE

3.0 Learning Objectives

After completing this unit, you will be able to:

- Define Insight
- Explain Imagination
- Describe relationship of Creativity and Imagination
- Recognize the Power of Intuition
- Explain the process of turning creativity into insights, ideas, opportunities and action

3.1 Introduction

Some concepts related to creativity are Insight, Imagination and Intuition. We need to understand these concepts for the overall plans to develop creativity among our students in

educational institutions. The process of turning creativity into insights, ideas, opportunities and action is essential to human culture and our flourishing. The need for education to pay more attention to the development of learners' creativity has become more apparent in this century as it is an important part of 21st century skills. In the last few years creativity is highly recommended skill across the globe in different reports and publications. Demand for creativity skill in employability sector will continue to rise as automation in every field is taking place. Every field needs people with creativity and imagination to deal with rapid changes. Teachers in educational institutions are key resources to facilitate maximum students' creativity and imagination in classrooms.

3.2 Meaning of Insight

In simple words, the meaning of insight is explained on Wikipedia as, 'understanding of the inner nature of things'. It is a type of comprehension or learning which can be used in several ways:

- a piece of information
- as a way to know something
- the answer to a question or problem
- a sudden realization: the Eureka effect

It is an important part of common steps of creative process. In creative process, insight is a term for the moment, when the solution to a creative problem suddenly becomes readily accessible to your conscious mind. The creative ideas come out of the subconscious processing to the conscious awareness. This is the moment of time when your preparation, practice, and period of incubation merge into a genius stroke. It is often followed by feelings of elation.

Sternberg and Davidson conceptualized creativity as the ability to change existing thinking patterns, producing something that is useful, novel and generative. There are some similarities between this conception of creativity and the generally accepted definition of insight, namely "a reorganization of the elements of a person's mental representation of a stimulus, situation or event to yield a non-obvious or non-dominant interpretation". The relationship between insight and creativity had always been controversial. Whether insight is a component of the creative process or simply a form of problem solving that may or may not produce a creative solution, to a given problem.

3.3 Meaning of Imagination

Imagination is the production or simulation of new objects, sensations or ideas in the mind, without any immediate input of the senses. It is also described as the forming of experiences in one's mind, which can be recreations of past experiences such as vivid memories with imagined changes, or they can be completely invented and possibly fantastic scenes (Szczelkun,2018). Imagination is a cognitive process used in mental functioning and sometimes used in conjunction with psychological imagery. It is considered as such because it involves thinking about possibilities (Byrne, 2007).Imagination is not governed by rules or laws, but comes from a place of unlimited energy and capacity. The physical expression of imagination is creativity. Albert Einstein says, “Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world” He explained, “Logic will get you from A to B. Imagination will take you everywhere.” “Imagination is everything. It is the preview of life’s coming attractions.” William Blake has also said on same lines, he says, “The true sign of intelligence is not knowledge but imagination.” “What is now proved was only once imagined.” - When Alexander Graham Bell invented the telephone, it must have seemed like magic. Vividness, originality, and transformative ability are the key characteristics of imagination.

The capacity to imagine makes human beings different from others. It is the key to human progress. A classroom in which students use their imaginations to study content, play with ideas, and discover new possibilities is always an engaging one.

Educational institutions need to pay more focus on the development of imagination and the creativity of learners. It will help to find innovative and useful solutions to problems which are varied and complex in nature. Last few decades and present scenario has shown us that nothing seems to be certain in the materialistic world. It is stormy, challenging and disorderly which was not imagined few years back. To deal with such a scenario, ready-made, prevailing ways and means to resolve the problems may not be sufficient. We need continuously evolving, novel and useful ways to remain active in this world. For this purpose, our education system should focus on developing imaginative and creative citizens. For engaging students, developing deeper levels of understanding, we need to be imaginative in thinking about different ways to teach so as to provoke learning. Educational institutions’ imagination in teaching is built on three essential pedagogic axioms:

- Student learning is deepest when the content or skill being learned is personally meaningful, and the student can see connections and applications of that learning. All

this occurs when creative synthesis takes place and students suddenly see unexpected patterns emerging. These things involve creativity and imagination.

- Retention of knowledge and skill is increased among students when the same content or skills are learned through multiple methods.
- The most memorable critical incidents students experience in their learning are those when they are required to "come at" their learning in a new way, when they have to think in a different way.

3.4 Role of Imagination

Imagination and creativity are composite attributes engaged through an individual's interactions with the world as they seek to achieve something that matters to them. Both are stimulated by curiosity. Most of the educational institutions are killing curiosity and the will to inquire. And the easiest way to kill curiosity is to control the process and outcome of learning too tightly. Tsai (2012) in his paper reported results of the literature review and suggested play and imagination in our classrooms can encourage creativity. All educators need to use imagination and play in their classrooms. So, educational theories and practices that take imagination and creativity seriously, all should always try to encourage inquiry, exploration, play, imagination, investigation and experimentation, enhancing our ability to be creative helps us to open up our minds. Vygotsky (1930/2004) in his theory put forward the relationship between creativity and imagination and stated that imagination serves as an imperative impetus of all creative activity. Smolucha and Smolucha (1986) summarized four key components of Vygotsky's theory of creative imagination:

- Imagination is the internalization of a child's play.
- Imagination is a higher mental function of a consciously directed thought process.
- Creative thinking involves the collaboration of imagination and thinking in concepts, which occurs first in adolescence, but matures in adulthood.
- Artistic and scientific creativity, both require the collaboration of imagination and thinking in concepts.

Imagination is the vehicle of creativity. To being actively creative, the chess player employs his imagination in trying out various available moves ahead. Similar use of imagination occurs in trying out different solutions to intellectual problems and different ways to develop a painting, sculpture, novel, etc. Our School curriculum must give

importance to question, discussion, play, creative ideas and imagination. Development of all these abilities should be the prime focus of our curriculum along with literacy and numeracy.

Tsai (2012) also reported **five principles to reward creative thinking in children recommended by Myers and Torrance (1961):**

- Treat questions of students with respect.
- Treat their imaginative ideas with respect.
- Value the students' ideas.
- Encourage practice-learning without the threat of evaluation.
- Tie in evaluation with causes and consequences.

Hennessey and Amabile (1987) suggested the following ways to stimulate creative behaviour among students in the classrooms:

- Learning should be an enjoyable task for children. Their creativity will be at higher level if they will enjoy the given task.
- Avoid using concrete rewards.
- Avoid competitive situations in every task.
- Evaluation of children's work should be flexible and it should be downplay.
- Children need to be trained for monitoring and assessing their work by themselves.
- Focus should be on intrinsic motivation, through class discourse and discussion.
- Building of self-esteem of children's.
- Always appreciate unique talents of students.
- Provide situations to the learners for free play through different kind of materials.
- Your children should know that you are always giving value to the creativity.

Self-Check Exercise

(i) Distinguish between Insight and Imagination.

(ii) Name the five principles to reward creative thinking in children.

3.5: Recognizing the Power of Intuition

In eastern and western philosophy you will find references of intuition. The concept of intuition has figured in different disciplines like philosophy, psychology and the social and natural sciences from many years from Aristotle through Spinoza (who believed it was the highest form of knowledge). However, in recent years there has been a reappearance of interest in intuition among managers and academics (Dane & Pratt, 2007; Miller & Ireland,

2005; Sadler-Smith & Shefy, 2004; Sinclair & Ashkanasy, 2005). In modern times researches in artificial intelligence has also given importance to intuition in the whole process.

The word intuition comes from the Latin verb 'intueri'. The term intuition has multiple meanings, it can be understood as ability to comprehend or know something instantly based on one's feelings instead of reasoning and clear facts**.** Often in many situations, there's no clear evidence, you need to form your decision on the basis of your intuition**.** We can say that is its quick insight. It is a natural ability that enables to explore something without concrete proof. It is also considered as a gut feeling based on experience.

3.5.1 Characteristics of Intuition

- **Non-conscious:** intuition occurs outside of conscious thought and we have no direct introspective awareness of it (Lieberman, 2000). No doubt that intuitive process is not accessible but its results, judgments or choices, are accessible to conscious thinking of an individual.
- **Holistic:** In Intuition information processing is in non-sequential nature. Some pieces of information which are relevant to the situation are identified unconsciously. They are arranged randomly as Jigsaw puzzle to find the solution. Slowly this process moves toward big picture i.e. solution of a problem. This intuitive ability responds to the on the whole context of situations rather than to remote, abstract, isolated elements. On the other hand, an individual's rational thinking mainly proceeds at systematic step by step procedure.
- **Automatic information processing:** The intuitive system in human brain automatically establishes associations. Similarity, emotional reinforcement and contiguity play a key role in these associations.
- **Rapid processing:** intuition is characterised by speed (Bastick, 1982; Khatri & Ng, 2000; Myers, 2002). Psychologist has reported that processing speed in between 5 years to middle adolescence improves sharply.
- **Affect-Laden**: No doubt intuition is related to cognition but it is affected by the feeling.
- **Low demand of cognitive resources:** As compared to rational thinking, intuition demands less cognitive resources.
- **Some People Are More Intuitive Than Others** as they can make more unusual connections between situations as compared to others

- **Intuition Can Be Improved—With Practice:** Intuition is like any another muscle. It can be strengthened by exercising it.

3.5.2 Creative Intuition

We can broadly categorise intuition into two categories.

- **Expert Intuition:** It is an individual's ability to quickly identify a common situation and in the context of situation automatic access and application of stored knowledge.
- **Creative Intuition**: It is individual's ability to quickly identify valuable and useful ideas without the use of conscious mind. Creative intuition is instantaneous. It synthesizes unconnected memory fragments in a holistic manner into a new information structure.

Many authors accept that creativity and intuition both are important and associated with each other for knowledge creation. But till now, a clear link between two is not established. In spite of this, we cannot neglect the role of intuition in creativity. Intuition is a main element of idea generation process.

3.5.3 Insight and Intuition

Insights and intuition are different from each other. If we compare the concept of 'insight' with 'intuitions', we will see that insight is more definite and intuition is vague response that helps to gives initial direction to the creative work. A body of research reveals that intuition can be not only faster than reflection but also more accurate. Intuition is sensing on other side insight is seeing. Insight is a long process as compared intuition. Whenever we find a solution of a problem through insight, an individual becomes conscious to the logical connections. The ultimate goal of education is to develop the capabilities of students. Teachers are critical resources to facilitate learning experiences of students and responsible for fullest harness of their potentials in schools. Creativity is an essential skill to cope up with fast changing world. Eliciting creativity in every student in the classroom can be a realistic goal for classroom teachers. The teaching of creativity includes form and structure along with freedom of thought and expression. It is very appropriate to provide the student with an imaginative and creative impetus with which he/she cannot only create or establish the frame for his/her own life, but also supply the tools to paint the picture of life. Art with no rules and instruction can be used to activate the imagination. Divergent thinking skills and Risk-taking are other important factors to develop cognitive skills, where the creative child can develop different

avenues of learning. Creative drama in the classroom is a very useful tool to develop creativity and imagination. Although art, drama, visualization, divergent thinking, risk taking, imagination, etc. all are very important cognitive exercises, but in a world where values are very linear, it has posed problems for years in allowing the creative mind to grow and develop.

Self-Check Exercise

What is Creative Institution? What are the characteristics of intuition?

3.6 Turning Creativity into Insights, Ideas, Opportunities and Action

Creative thinking is much more than just a bunch of random ideas. It is the real competence, grounded in knowledge and practice, which supports individuals in achieving better outcomes, usually in constrained and challenging environments. Organisations and societies around the world increasingly depend on innovation and knowledge creation to address emerging challenges (OECD, 2010), giving urgency to innovation and creative thinking as collective enterprises. In the last few decades, many researches have been conducted to explore how human mind works. It is reported that thinking of novel and original ideas are not always coming from flash of insight. It follows a procedure. Starting point of every creative work is the motivation of the person, related to the creative thinking. There are different factors which effect the process of turning creativity into insights, ideas, opportunities and action. Some of the factors which are related to school are given below:

- **Individual Internal factors:** Schools can influence several dimensions of students' internal resources or 'individual enablers' for engaging in creative thinking, including: cognitive skills; domain readiness (domain-specific knowledge and experience); openness to new ideas and experiences; willingness to work with others and build upon others' ideas (collaboration); willingness to persist towards one's goals in the face of difficulty and beliefs about one's own ability to be creative (goal orientation and beliefs); and task motivation. Domain readiness conveys the idea that an individual requires some degree of pre-existing knowledge and experience within a particular domain in order to successfully produce creative work

- **Social Environments:** It might incentivise or hinder creative thinking (described henceforth as 'social enablers'), the classroom culture, the educational approach of

schools and wider education systems, and the broader cultural environment all represent distinct social environments for students. They can all influence the extent to which students' value and invest in their own creative abilities, and can provide incentives or obstacles for engaging in creative thinking. We all must remember that creative thinking is not always in terms of creating extraordinary work. It can be through 'n' number of activities. You, me and everyone have some potentials, we need to find it. Creative thinking is not domain specific, it can be manifested in many activities and domains. Teaching, cooking, writing, singing, dancing, science, arts, commerce all are different areas for showcasing your creativity. It is an expression of original and unique ideas or explanations/solution, which were not available till now. Schools should make use of pedagogies that encourage the development of the cognitive skills inherent to the creative process.

- **Achievement and Progress:** Schools are arenas in which students' manifestations of creative thinking, either as individuals or as part of a group, can be observed and measured. Their achievement and progress in the form of creative expression, problem solving and knowledge creation is manifestation of creative thinking.

Process of turning creativity into insights, ideas, opportunities and action:

The creative process is a set of mental processes that regulate the creation of ideas that are both new and valuable. Research on stages of creativity began with **Graham Wallas (1926),** who suggested the following four successive steps of creative thinking:

- **Stage of preparation**
- **Stage of incubation**
- **Stage of illumination**
- **Stage of verification**

Joy P. Guilford and other psychologists have also tried to explain the creative thinking process from different dimensions. Some common steps of creative process are given below:

- **Preparation**
- **Incubation**
- **Insight**
- **Evaluation**
- **Elaboration**

(for more details refer back to Unit 1)

Once the creative thinking is promoted in our educational institutions in an organised manner then we can convert the creative ideas of students into new opportunities and novel and useful action plans useful for society. For this purpose, the following points can help us.

Start Thinking in a Creative Way

- Our teachers should use different techniques for promoting creativity in different tasks/subjects. SCAMPER, brainstorming etc. are some of the examples.
- Students should be given opportunities to explore different concepts available in context of situation in hand to develop new and useful ideas.
- Students should be motivated to work on identified ideas, try to elaborate, analyse from different perspectives, refine the idea, evaluate the ideas before its wider implementation

Work Creatively with Others

- Students can participate in collaborative work/ group work to promote generation of ideas to the development of idea, its implementation. Involve others in the process of creative ideas to its implementation.
- Students and teachers always need to be open to diverse ideas.
- Useful inputs from the others can enhance the level of creative work.
- At the time of adopting ideas, one must be aware about the limits, and practical implementation.
- In creative work every failure is new creative lesson for each and everyone involve in this process.

Implement Innovations

- Implementation of novel and useful ideas for solving a problem or making useful contribution in the society

As generation of creative idea to its implementation is influenced from many factors. Educational institutions are one of the key factors in this whole process. Educational institutions should integrate creative thinking work in day-to-day work in schools through the following activities:

- Use a variety of techniques to promote creativity in classroom.
- Improve communication and social skills of students for effective participation of all.

- Class environment should be democratic.
- Provide opportunities for children to learn outside the class.
- Group work need to be promoted.
- All students should be encouraged to ask questions, generate diverse ideas.
- Group interactions in classroom should be promoted.
- Students should be made aware to use multiple approaches to find a solution of a problem.
- Provide opportunities and support them to implement the creative ideas to improve existing practices.
- Efforts of students for converting creative ideas into actions and useful practices must be recognised and given due importance in their overall evaluation.
- Removing the different barriers to creativity in educational institutes

3.7 Summing Up

Creativity is the most mysterious aspect of the human mind. Sternberg has defined creativity as "the capacity to create a solution that is both novel and appropriate". Concepts like insight, imagination and intuition are directly or indirectly related to related to creativity. The process of turning creativity into insights, ideas, opportunities and actionismuch needed in the 21st century. Our educational institutions can play significant role by preparing our young generations for creative work.

3.8 Questions for Practice

(i) Explain the meaning of Insight.
(ii) Briefly explain imagination and its role in Creativity.
(iii) Discuss characteristics of Intuition.
(iv) What is the difference between Insight and Intuition.
(V) Elaborate the process of turning creativity into insights, ideas, opportunities and action.

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CERTIFICATE COURSE IN CREATIVITY AND INNOVATION IN SCHOOL EDUCATION

COURSE: CREATIVITY AND INNOVATION IN SCHOOLS: THEORETICAL FRAMEWORK (CISE-1)

UNIT 4: CREATIVITY ENHANCEMENT AND CREATIVE PROBLEM SOLVING

(STRUCTURE)

4.0 Learning Objectives

After completing this unit, you will be able to:

- Discuss ways of enhancing one's creativity
- Describe Creative Problem Solving
- Enlist Stages of Problem Solving
- Explain Strategies of Creative Problem Solving
- Explore the contributions of world-famous creative personalities

4.1 Introduction

Creativity is not limited to only a few, we all are creative. You may have small ideas or big ideas. We also call it little-c (or common) creativity and Big C (or special) creativity. Your ideas can be simple or complex. So, we all humans are blessed by Almighty with higher order thinking skills like creativity and problem solving etc. These skills can be enhanced by using different techniques. Creativity is an unusual goal directed thinking which is novel and useful. In recent years, all countries are focusing to nurture and teach creativity among school students. Newell, Shaw and Simon (1963) have explained the nature of creativity on the basis of following four criteria:

- Novelty and usefulness
- Rejects previously accepted ideas
- Requires intense motivation and persistence
- Results from organizing the unclear situation in a coherent, clear and new way

Creativity is a natural trait in humans. Its amount, dimension & manifestation may vary from one individual to another.

The details about the way of enhancing one's creativity and different aspects of problem solving will be covered in this unit. You will be able to know the nuances of these by going through the content.

4.2 Enhancing One's Creativity

Creativity can be improved/learned or enhanced among students with conducive environment by using suitable techniques and material. James (2015, p. 1032) claimed that it is possible to establish creativity-enhancing learning environment. Some of the techniques for enhancing creativity are given below:

Curricular and extra-curricular activities: Different kind of activities are organised in a classroom. Broadly we divide these activities as curricular and co-curricular activities. There is also overlapping in these activities. An activity can either be curricular or co-curricular, depending on situation where and how it is used. To develop creativity among students, teacher can plan a number of activities in the classroom. The list of techniques and material used for enhancing creativity is very comprehensive. Moreover, it is in process of updating with new techniques and material created and adopted by researchers and practitioners.

Broadly we can divide these into techniques & instructional material. Techniques are specific and differ from person to person. Like brain storming developed by Osborn, instructional materials with manual and instructions developed by researchers and psychologists can also be used on groups of students. In abroad and in India some people worked to develop instructional material.

4.2.1 Techniques for Enhancing Creativity

Gordon Technique: This technique was developed by William J. J. Gordon. He reported that people would incrementalize when they are asked to come up with a creative idea, i.e. they take an available alternative and improve it bit by bit. Although this may lead to better alternatives, but not the real breakthroughs. To avoid this problem, Gordon decided that he would be not tell people what they were inventing. So, the Gordon technique focuses on function initially. For example, rather than being told to build a better mousetrap, might be told to focus on capturing only. In this way, a number of creative ideas come for a problem which are original and novel.

Synectics: Synectics is a problem-solving technique which seeks to promote creative thinking, typically among small groups of people of diverse expertise. In Synectics, groups of people from different perspectives are added to bring diversity. This method was developed by George M. Prince and William J.J. Gordon. Synectics strategies provide a structure through which individuals and a group can free themselves to develop imagination and insight into everyday activities.This technique relies deeply on the use of similarities/analogies. These techniques have been used in many educational institutions. Gordon listed three Synectic's tools:

- **Direct Analogy:** Finding parallel facts, information, or knowledge in a different domain.
- **Personal Analogy:** Students identify themselves psychologically with key parts of the problem. It requires students to empathize with each idea or objects to be compared from personal point of view too. The identification may be with a plant, person, animal or with a non-living thing.
- **Fantasy Analogy:** Students are asked to tell their wildest imaginative ideas to complete a task.

Synectics is not just the use of analogy. The technique follows a structured problem-solving sequence to reach a creative solution.

Idea Checklists: Idea checklists have been developed by different persons to enhance creativity. Idea checklists contain a series of questions asking to tell the number of ways in which we can use a thing that we already have. For example, SCAMPER (Substitute, Combine, Adapt, Modify or magnify, Put to other uses, Eliminate or reduce, Reverse or rearrange) where idea-spurring questions is main focus.

Checkerboard Method:it is also called morphological analysis. It is an extension of attribute modifying. One axis of a matrix is showing specific ideas for one attribute or problem dimension and the other axis showing ideas for a second attribute.

Puzzle solving: Puzzle solving is another technique to keep the mind creatively open to many problems and ideas. Edison, according to his son Charles, was very fond of solving puzzles. Most of the puzzles have a clue, which will help you in solving the puzzle.

Riddle solving and construction: From times immemorial, we have the culture of riddle solving which is also evident in our rich literature. Our elders used to involve young generations to solve the riddles. Each state of India might have riddles in their regional languages. In riddle construction, creative expression is channelised through the half-finished riddle. Most of the riddles are developed using analogies - direct, simple, symbolic or fantasy. Riddle solving and riddle construction are the indigenous techniques similar to 'Synectic' to enhance creativity.

Attribute Listing: Robert Crawford developed this technique and he said, "Each time we take a step we do it by changing an attribute or a quality of something, or else by applying that same quality or attribute to some other things."

Two forms of attribute listing are there:

- attribute modifying
- attribute transferring

With attribute modifying, the main attribute(s) of a problem are listed and ways to improve each attribute are listed then. For example, the technique can be used to find ways to improve the attributes of running shoes like- weight, stability, cushioning, and durability. On the other hand, attribute transferring is similar to direct analogy. Attributes from one thing are directly transferred to another.

Creative Writings: Poem writing and Story writing are the best ways for a creative expression. It is always enjoyable to write novel titles for the given stories by students. They

complete the half-finished story or write a full story for a given title. Students can write creative poems too.

Mystery plots: In this technique, students are accosted with a plot of a situation. The students have to think like a detective. Students enjoy solving such mystery plots by using their creativity.

Divergent thinking questions: More than one response is asked for in these questions. Students give a variety of responses and the teachers ensure and motivate divergent thinking. We also need reforms in our examination system where the students' divergent thinking should be motivated. Allow yourself to be different, be different from what is considered "normal". Try not to be hesitant to ask questions and share your thoughts.

Face Challenges, Take Risks: When it comes to improving your creative skills, you should face challenges in order to advance your abilities. While your efforts may not lead to success every time, you will still be boosting your creative abilities and building skills that will work well in the future.

Word Completion: Each student is asked to complete words for which 3-4 letters are given. Developing a word for each letter is done in such a way, that a meaningful sentence emerges.

Imaginative Stories: Each culture has bed time stories, which develop imagination. Sanskrit, Hindi, English and other languages have many such fairy tales, and even the science fictions are of much importance here.

Crossword Puzzles: The students have to solve the crossword puzzles from various magazines and newspapers.

Alliteration: Students Children are asked to enlist words starting with the same letter and make sentences from these. For example - Central, College, Coffee, Club.

Imaginary story telling: Students can be asked to imagine a man-animal-bird combination (like Ganesha, Sphinx, etc.), develop its picture and write a story of its existence.

Invention: Students are asked to think about a new dish (say), and asked to enlist the materials required, process of preparation, and approximate tell the taste, as well as the new name for it.

Jyoti (2012) compiled some research evidence to indicate that parents and teachers can help children increase their creativity in the following ways:

• Encouraging spontaneous expression and accepting novel ideas without hesitation.
• Relying less on memory activities and asking provocative questions instead.
• Reducing anxiety and rewarding non-conformity.
• Emphasizing the importance of working alone and discouraging group activities.
• Providing a non-threatening stimulating environment.
• Encouraging controversy and disagreement on any topic in a free manner.
• Ignoring petty mistakes and never insisting on the child becoming a high graded person.
• Granting responsibilities and independence.
• Accepting imaginative activities, fantasies and even day dreaming ideas.
• Encouraging the tendency of disagreeing and freely discussing controversial ideas.
•Providing suitable opportunities for free exploring, making original hypothesis and performing experiments.
•Accepting different types of judgement and evaluation of the ideas and works of adolescents.
• Helping the youngster to be confident to trust his/her own senses and intuition.
• Showing due respect for emotions, imperfections and ambiguity of the youngster.
• Supplying such books, games and literature profusely which demand creative responses and playfulness.
• Encouraging self-assertion of the creative child to recognize his own self as a creative talent of competent nature.

4.3 Key Points for Enhancing Creativity and Problem Solving for You:

Enjoy Failure: failure or mistake is your first attempt toward creativity and problem solving. Mistakes may occasionally create hurdles on your road to creativity, but ultimately you will reach the destination. Always enjoy failures as stepping stone of success.

Find a creative solution of a problem: You need to try as many solutions as possible to a particular problem to find a creative solution. Think on all alternative approaches to reach to the solution of the problem in hand.

Use of Mind Maps: A mind map is a great way to connect ideas and look for innovative answers to questions. Make a mind map by writing down a central topic or word. A flow chart can also help you to anticipate the final product, eliminate potential problems and create unique solutions.

Be Confident: Always appreciate your small efforts in any work. Enjoy your creative ideas. Always find ways to admire your creativity.

Try the Six Hats Technique: The "six hats" technique involves looking at a problem from six differing contexts.

- Black Hat: Use a negative perspective. Which aspect of the solution won't work?
- Blue Hat: Think broadly. What is the best overall solution?
- Green Hat: Think creatively. What are some alternative ideas?
- Red Hat: Look at the situation emotionally. What do your feelings tell you?
- White Hat: Look at the situation objectively. What are the facts?
- Yellow Hat: Use a positive perspective. Which elements of the solution will work?

Try new sources of inspiration: Try to generate unique answers to questions. Read a novel, poem or a book, visit a hill station, museum, listen to your favouritesongetc. to get inspiration for you.

Reward yourself: Rewards and appreciations help in producing creative works. To motivate yourself, you can also reward yourself if no reward is received from outside factors.

Distance from the problem: Research Studies have shown that in some situations, making a psychological distance from the problem can help you to think in a different way. An idea can emerge to resolve the ongoing problem.

Inspirational thought and people: For enhancing creativity, you always try to be with inspirational ideas and people. The environment around you, really affect the creativity. As we know the group also influence the process of creativity, so company of inspirational and creative persons helps a lot.

Be Emotional: Researchers have long thought that positive emotions were strongly linked to creativity, but further research has found that both strong positive and negative emotional states were linked to creative thinking.

Wok as an Expert: One of the best ways to develop creativity is to become an expert in that area.

Self-Check Exercise

List some methods of enhancing Creativity

4.4 Creative Problem Solving

4.4.1 Concept of Problem solving

Problem solving is the ability of a person to follow a systematic process of removing obstacles from the path to complete a task or reach a goal. Problem solving ability is an integral part of critical thinking, decision making and in solving everyday problems. Psychological researches have listed many aspects of problem-solving behaviour as discussed below:

Goal or end state: The end product of the process of problem solving is the Goal state or the End state. The goal state has some well-defined properties which are defined by the person involved in the process of creative problem solving. The person in problem makes every effort to overcome all obstacles to move from the initial state of the problem to the goal.

Person / operator: Operator is the person who is facing the problem and strives to solve it. He/she uses various skills and techniques to overcome the obstacles in reaching the goal state. Operator identifies and manipulates the various elements involved in the problem with the help of some symbols or visual images.

Problem space: problem space comprises of the Initial state, goal state and operator. It includes a number of elements which are to be organised in a particular manner. The three things that would lead to a successful understanding of the problem space are: coherence, correspondence and relationship to background knowledge. Coherent refers to connecting the elements in a meaningful manner and correspondence means a close correspondence between the internal representation and the elements of the problem space. Proper matched connections should be made among all the elements and none of the elements should be left unmatched or mismatched.

Rules: Rules are the ways followed by the operator that govern the process for taking the problem from the initial state to the final or the goal state. For example- Problem Solving in Kohler's experiments with a chimpanzee: Kohler (1927) put a hungry chimpanzee (operator) in a closed cage and bananas hanging from the roof (goal state). In the same cage he put three boxes on the floor. The chimpanzee could reach the bananas only by putting all the three boxes together one upon the other (rule). After a number of irrelevant behaviours, the chimpanzee suddenly solved the problem and got hold of the bananas. The sudden solution resulted from internal representation and understanding of the problem. The whole process

was continuously going on in the chimpanzee's unconscious mind and is termed as insight by Kohler and other Gestalt psychologists.

4.4.2 Typologies of Problems

- **Well-defined and Ill-defined Problems**

Everything is well-defined in such problems: a definable initial state; a goal state; a definite number of operators; well identified, clear and explicit rules; sub-goals to convert the initial state into the goal state. A perfect example is the problem faced by the chimpanzee in the Kohler's experiment.

However, an ill-defined problem is one in which the various elements of the problem space are not clearly defined (initial state, goal state, operators and rules). A unique example is creation of a painting.

- **Problems of Inducing Structure:**

Determining relationship among different elements is required in these problems. For example, in the analogy, the operator has to find a structure in elements which clearly defines a rule - "bird is to sky as fish is to water". Three types of cognitive skills are required to solve the analogies:

i. attribute discovery
ii. encoding
iii. comparing encoded attributes and evaluating attribute-based structure among the elements.

- **Problems of Transformation:** A particular sequence of operations is required to transform the initial state into the goal state. For example- Tower of Hanoi.
- **Problems of Arrangement:** In these problems, rearrangement of the elements of problem according to some criterion is required. The arrangement criterion can be predefined, or can be discovered. For example- problem of Anagram. In an anagram the order of letters of a word is changed and the operator is asked to rearrange the sequence to form a meaningful word to solve an anagram, the cognitive skill needed is constructive search by which operator systematically examines the reasonable combinations of letters until the meaningful sequence is found.

4.4.3 Stages of Problem Solving

The Gestalt psychologists, suggest the same stages that are followed in creative thinking: preparation, incubation, illumination or insight and verification.

According to Polya , four stages are involved in the process of problem solving:

Stage 1: Define, understand and think about the problem: Identification of the actual problem, attributes of the problem, area of knowledge involved and collecting relevant information is done in this stage.

Stage 2: Devise a plan for solution: Alternate ways to solve the problem are suggested and a flowchart of solution is prepared in this stage.

Stage 3: Carry out the plan: Execution up to the solution of the problem is carried out in this stage.

Stage 4: Looking back: in this stage, problem solved is verified as the one originally defined, followed by checking reasonableness, criteria and constraints and at last the communication of results.

4.4.4 Strategies of Problem Solving

Successful problem solving needs an additional element of general strategy. A strategy is a procedure that can be used by the operator to arrive at a solution. The strategy helps the operator by guiding in efficiently extracting relevant data from the problem space and follow a planned approach to solve the problem.

Two major types of strategies are generally described by the Cognitive psychologists: Algorithms and Heuristics.

4.3.4.1 Algorithms

The well-defined set of rules which ensures the correct solution of the problem is called an algorithm. In an anagram, an algorithm would be to attempt all the possible letter sequences until the correct word is found. The four essential properties of an algorithm are:

1) Each step must be *exactly and precisely described*, to avoid any uncertainty.

2) An algorithm should have a finite number of steps and *must terminate* with the solution of the problem. The ultimate purpose of an algorithm is to solve a problem

3) An algorithm must *be effective* and provide the correct answer to the problem.

4) An algorithm must *be a general solution*. It must solve every instance of a certain type of problem. For example, if an algorithm is framed to compute the area of a rectangle, it should work on all possible dimensions of the rectangle.

Although an algorithm is a guarantee to reach the solution of a problem, yet the effort and time involved in using it forbade a human operator to use this strategy.

4.3.4.2 Heuristics

Heuristics are general suggestions that are useful in solving a number of problems. Although, Heuristics are powerful and general, but they don't always ensure a correct solution. As they are large in number, so one substitutes the other if it doesn't work and the second by yet another if needed. General heuristics are usually context free unlike algorithms and apply across different situations. On the other hand, specific heuristics are used in specialised areas, like application of different laws/principles to solve different problems in physics.

Means-end analysis

It is the most common and general heuristic. This heuristic suggests to do something to get closer to the goal. It helps to break down a problem into pieces. The ultimate goal is broken in short term goals which will have to be achieved. This helps the person to get closer to the main goal. It is important to self-monitor the sub goals, to check that the person has achieved it or not. The self-monitoring is called meta-cognition and is essential for problem solving, because it keeps the problem solver aware of the current activity; the ultimate goal; the strategies used to attain the goal and the effectiveness of the strategies.

Working Backward

As the name suggests, this strategy starts with the goal state (end). The operator moves backward from final towards the initial state (start). It can be used in solving paper-pencil maze problems.

This method can also be used in combination with the means end analysis. Working backward is useful only when the end state is uniquely well defined and the initial state is unclear. This strategy depends on discovery of common attributes among various problems solved earlier and the present problems.

4.4.5 Factors Affecting Problem Solving

A number of factors decide an effective solution of a problem. Effectiveness of a problem-solving strategy is measured on time taken to solve the problem and probability of getting the correct solution. These factors can be inherent in the problem or belong to the personal characteristics of the problem solver also.

Various factors affecting problem solving include-nature of the problem; degree of difference between the initial and the goal state; perceiver's set; and the functional fixedness.

i) **Nature** includes the magnitude, the difficulty level, etc. If the initial state of the problem is very much different from the goal state, the difficulty level increases which makes solving the problem somewhat difficult. The number of elements present in the problem space decide the size of a problem. An increase in the size of the problem makes it more difficult and time consuming. The best example to explain this condition is a typical Anagram, in which an increase in the number of letters enhances the difficulty level and makes it more time consuming to reach the goal.

ii) The **difference between the initial and the goal state** is inversely proportional to the solution of the problem with increase in first, the second decreases. In such a condition problem space is more disorganized and more steps are required to reach the solution. On the other hand, if the problem is common and is frequently encountered, the operator becomes familiar with the steps, the problem becomes less difficult and the operator is able to reach the solution in lesser time.

iii) The tendency to perceive and respond to a particular stimulus in a stereotypical manner is called the **perceiver's set**. When a person successively and systematically perceives and responds to a problem in a similar way, a set is formed. The following example shows that a set may prove to have facilitatory or even inhibitory impact on problem solving.

Read the words given below

MACDONALD, MACGREGOR, MACHINERY

What did you read Mac-Hinery? It means the effect of set has worked on you.

This effect can be minimized by

- increasing time interval between practice and trial,
- explicit instruction to not follow the previously learned rules
- introducing some exceptions in the practice.

iv) **Functional fixedness** refers to the tendency of an individual to perceive the objects with their common/routine and stereotypical use. We mostly categorize objects according to their use in our daily life and their functional features dominate our thought process whenever we think of those objects. In a broader sense, it is an example of a mental set, which hinders the probability to achieve a creative solution

4.4.1 Creative Problem-Solving

Creative problem-solving is the cognitive process of solving a problem independently, with an original solution to an issue which is previously not known. The creative problem-solving process was originally developed by Alex Osborn and Sid Parnes. Creative problem-solving is a process of breaking down a problem to smaller parts for a better understanding of the problem, generating ideas and assessing them to find the most effective solution to the problem.

4.4.2 Steps of Creative Problem solving

The process of Creative Problem Solving goes through the following steps:

Step 1: Clarify And Identify The Problem

It is the most significant step of creative problem solving. The problem must be clearly identified and defined with its initial state, expected outcomes and the various elements present therein. One must know real problem or goal and the obstacles in reaching that goal. The purpose is to completely understand the issues and breaking it down can help challenge the first interpretation of the problem, as things always don't look like the same as they are.

Step 2: Research the Problem

The next step in creative problem solving is to research the problem. The situation must be analysed well to get a better understanding of the problem, so that the probable strategies can be chalked out. The amount of research to be done depends on the nature of the problem.

Step 3: Formulate One or More Creative Challenges

A creative challenge is a simple question which is framed to get suggestions or ideas. These should be simple and concise, focussing on a single issue. One should be clear on the real issues behind the problem before framing the challenge(s).

Step 4: Generate Ideas

This is the main part associated with brainstorming and creative problem solving. Taking only one creative challenge at a time, try to generate at least 50 ideas (say) that may or may not solve the challenge. Give yourself some peaceful time to execute this step. You can do this step individually or you can invite someone to help you out. If other people are also involved, then it is to be ensured that no ideas are criticized in any way because even a small amount of criticism can demotivate the group members for sharing their creative ideas. You have to set a time limit of 15-20 minutes (say) if working in group, but don't stop until you've reached your target of 50 ideas if you are doing it alone. After enlisting the ideas, compare all the ideas and always take a second round to ask everyone if they have some new ideas. Most of the times people get motivated by others' ideas and add more to the existing list.

Step 5: Combine and Evaluate Ideas

After noting down all of your ideas, go through the thoughts and categorize them. Related ideas can be combined together to form bigger ideas. It is very important to choose all the diverse ideas that meet the criteria of the problem. If only the "best" or the favourite ideas are focused, then there is chance that you will choose the less creative ones. After enlisting all the ideas, you must go through each idea more carefully and give it a rating of 0 to 5 points to consider how well it meets each criterion of your problem.

Step 6: Draw Up an Action Plan

Now you have some great ideas, but mostly people loose energy up to this step and have trouble in motivating them to take the next step. So, don't let yourself feel exhausted till the goal is achieved. Take up the best selected idea and prepare the steps needed to execute it.

Step 7: Execution

Execution is the simplest step of taking up the action plan and implementing the best idea. Don't worry even if the situation is not as per your action plan steps. If needed, reframe the action plan and execute. Never stop until the goal is reached.

Self-Check Exercise

How can a Problem be solved creatively?

4.5 World Famous Creative Personalities

In the continuously evolving world, Creativity is one of the most highly valued qualities of human beings. Creative acts affect enormously all spheres of life. It is, thus, imperative to give due recognition to the phenomenon of creativity and its importance in life. Amabile's theory of intrinsic motivation is reflected in Howard Gardeners research on the lives of great creators. Howard Gardeners has written a book in 1993 titled as '*Creating Minds: An Anatomy of Creativity seen through the* lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi'. 2nd edition of the book was published in 2011. This book contains seven creators of late 19th and early 20th century. Creativity can occur in any field, not just in the field of arts. Some of great creative thinkers' list from the history is shared here as an examples for all of you. Dear learners, going through the details of life of these people can really help you in future. We can learn many things from these stalwarts. Their creative work has really made a mark in history.

- **M. Gandhi:** M.K. Gandhi was anti-colonial nationalist, an Indian lawyer and political ethicist, who employed non-violence policy to lead the effective movement for India's independence from British rule. He inspired some movements (civil rights and freedom) across the world. He showed creative ways to fight with mighty rulers with non violence.
- **Leonardo Da Vinci:** Leonardo da Vinci was an Italian polymath of the High Renaissance. He was a great inventor, famous painter and sculptor, architect, mathematician, scientist, writer and engineer. He was considered as one of the best creative painters. His work in different forms (sketches, scientific diagrams and notes) display his forward-thinking and creativity and inventions.
- **Thomas Edison:** Thomas Alva Edison was a great creative mind. He said, "Many of life's failures are people who did not realize how close they were to success when they gave up." He was an American inventor. He developed many devices in fields such as electric power generation, mass communication, sound recording, and motion pictures He had made more than 1000 innovations and had patent for many inventions. His beautiful words tell his life story: He said "I have not failed, I have just found 10,000 ways that won't work."
- **Isaac Newton:** Sir Isaac Newton was an English mathematician, astronomer, physicist, theologian and a great author who is extensively recognised as one of the

supreme mathematicians. He was a most influential scientist. His work was really a scientific revolution in the field of science and its application in society.

- **Walt Disney:** Walter Elias Disney was an American entrepreneur, voice actor, animator, writer and film producer. He was the innovator of the American animation business. He introduced numerous developments in the construction of cartoons. Walt Disney said, "It's kind of fun to do the impossible." He was rejected by a newspaper agency on the ground that he did not have creative ideas but he was persistent in his efforts and built an entertainment empire by turning his dreams and goals into reality.
- **Albert Einstein:** Albert Einstein said 'Logic will get you from A to B. Imagination will take you everywhere.' He was widely recognized as one of the greatest physicists. Theory of relativity is one of the best contributions to society along with the famous theory of quantum mechanics.
- **Steve Jobs:** Steve Jobs said that Creativity is just connecting things. He was an American visionary in technology, industrial designer, entrepreneur, investor, and media proprietor. He changed the way countries were using computers by introducing the personal computer. It was a great revolution to introduce ipod, iphone etc."
- **Marie Curie:** She was the first lady to win a Nobel Prize in history. Going one step ahead she is the only woman to win the prestigious Nobel Prize twice in two different areas. She created the path for all women in the field of science with her discoveries and revolutionary ideas. She was a very creative and dedicated woman.
- **Picasso**: Picasso was a Spanish painter, printmaker, sculptor and theatre designer. Picasso showed a great passion and a refine skill for drawing from his early age. Picasso proved astonishing artistic talent. His painting in a naturalistic manner was really creative.
- **Freud:** He was father of psychoanalysis, a theory which helps to explain human behavior. As a method it is used to treat mental illness.

The involvement and commitment to work were the most important characteristics that made these personalities successful. All of them had sacrificed a great deal on a personal level and were wholly and completely consumed by their work dedicating all their time, energy, effort and emotion to a problem, sometimes, non-stop for days or weeks on end.

4.6 Summing Up

All humans are blessed by almighty with higher order thinking skills like creativity and problem solving etc. Creativity is defined as a goal directed thinking. It is unusual, novel and

useful. Creative thought process rejects the previously accepted ideas and organizes the unclear situation in a new way. It can be enhanced by using different techniques. Imagination and creativity can be incorporated into every aspect of learning. Problem solving is another kind of goal directed thinking that begins with a difference between initial and the goal state. The operator is required to reorganize the problem situation in order to remove the obstacles and convert the problem from the initial state to the goal state. The factors affecting the success of problem-solving behavior include the size of the problem, generality of the problem, difference between problem state and goal state and set and functional fixedness of the problem solver. Our educational organization and other organization may face various problems in day-to-day activities. The nature of problem can be simple or complex. All the stakeholders need to use creative and innovative ways to resolve these problems in an effective manner.

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4.8 Questions for Practice

- Explain the Barriers to creativity in detail?
- How would you foster creativity among your students?
- What are the steps for creative problem solving?
- Write a note on famous creative personalities of the world?

- Match the Column:

Column A	**Column B**
Black Hat	Use a positive perspective.
Blue Hat	Look at the situation objectively.
Green Hat	Look at the situation emotionally.
White Hat	Think broadly
Red Hat	Think creatively
Yellow Hat	Use a negative perspective.

CERTIFICATE COURSE IN CREATIVITY AND INNOVATION IN SCHOOL EDUCATION

COURSE: CREATIVITY AND INNOVATION IN SCHOOLS: THEORETICAL FRAMEWORK (CISE-1)

UNIT 5: CREATIVE DIVERSITY

STRUCTURE

5.0 Learning Objectives

After completing this unit, you will be able to:

- Explain the concept of creativity and diversity in detail.
- Define the four creative diversity principles.
- Enlist various diversity aspects that are helpful to increase Creativity.
- Understand the meaning of Individual creativity.
- Understand the meaning of group creativity.

5.1 Introduction

We are living in a diverse country. Unity in diversity is the key characteristic of the democratic India. In your institution/classroom you can see a lot of diversity. Diversity is the main component of creativity. Creative thinking is one of the most important parts of diversity. Diverse teams give more creative results than teams with homogenous members. The principles of creative diversity help an individual to work with others more smoothly and efficiently and at the same time make sure your ideas are being perceived.

5.2 Concept of Creativity

Creative thinking is one of the important skills out of the 10 life skills defined by the World Health Institution. Creativity is defined in a number of ways by different psychologists, philosophers and educationists. According to Guilford, creativity includes divergent thinking, with respect to traits of fluency, flexibility and originality of thought process. Torrance defined creativity as a process of becoming sensitive to problems, deficiencies, gaps of knowledge, missing elements, disharmonies and so on. In Unit 1 you have learned the concept of creativity in details. (Please refer to Unit 1 - 1.2.2 ‘Meaning of Creativity’ for more details)

5.3 Concept of Diversity

Diversity means every individual is unique and known for her/his own individual differences. These individual differences can be gender, caste, race, age, physical appearances, religious aspects, socio-economic status, etc. Diversity is a reality formed by individuals and groups from a broad range of demographic and philosophical differences. It is important to support and protect diversity by respecting individuals and groups free from prejudice and by nurturing a climate where equity and mutual respect are inherent. Diversity means impartially accepting and/or bearing differences. It is a set of conscious practices that include:

- Accepting and appreciating interdependence of humanity, cultures, and the natural environment.
- Practicing mutual respect for those qualities and experiences which are different from our own personality.
- Accepting that diversity involves not only ways of existence, but also ways of knowing.
- Building associations across differences to eliminate all forms of discrimination.

5.3.1 Types of Diversity

The types of diversity are vast. They include characteristic that appears with variations among a group of people. Different types of diversity is explained below:

- **Cultural diversity**- This type of diversity is associated with every person's cultural background. It is basically based on the set of norms that students/people get from the society of which they are a part. North Indian culture may be different from South Indian culture. Punjabi culture may be different from Haryanvi culture.
- **Religious diversity**- This type of diversity refers to the manifestation of multiple religions and spiritual beliefs in the society.
- **Age diversity**- Age diversity means students of different ages in a classroom.
- **Gender diversity-** Gender can be defined as male and female in the traditional sense. It means that males, females and transgenders, all are equally important in our Indian society.
- **Disability -** There are various types of disabilities or chronic conditions that may include mental, physical, social, emotional, financial or any other conditions prevailing in our classrooms. The school/college needs to accommodate every individual along with their disabilities.
- **Race diversity**- Race means grouping of people based on physical traits that are not biological. For example: races of Africa, Asia, Europe, etc.
- **Language diversity-** In India we have 22 languages under eighth schedule of the Constitution. In our classroom too we are dealing with students of different languages and dialects.
- **Economic diversity-** Students may belong to different economic strata in your class they have large economic diversities.

So, diversity includes, qualities and conditions that are different from our own and outside the groups to which we belong, however these are present in other individuals and groups. These include age, ethnicity, class, gender, physical abilities/qualities, race, sexual orientation, as well as religious status, gender expression, educational background, geographical location, income, marital status, parental status, and work experiences etc. Finally, we accept that categories of difference are not always static but also can be movable, we always respect individual rights and responsibilities for self-identification, and we know that no one culture is superior to another.

5.3.2 Four Creative Diversity Principles

When an individual is looking for solutions to solve a problem, he/she tries to use different creative ideas. At such a time, the brain tends to work with information related to that problem. For example, if an individual wants to get more creative, he/she must be diversifying the thinking process. This style of creativity is more effective. Generally, creative diversity is understood in four principles which are given as under:

All people are creative- All people belonging to different age groups and different professions, have a different creative aspect. Every individual has a source of creativity whether they are studying, working alone or in a small group or in a large institution. Every individual has some ideas that may be innovative or evolutionary. The individuals who are not creative are dead.

Creativity is diverse- All individuals are creative to some extent, but they are not creative in the same way. There are many different styles of creativity. There is not only one aspect of idea or one method to solving problems, but a variety of possibilities across the human race to solve a problem. So, we can say that creativity is diverse.

Creative diversity is described by basic 4 variables - Creativity is different across individuals and to explain these differences, there are four aspects that explain about creative diversity. These are: Creative level which describe about knowledge, skill and experience; Creative style is focused on idea about change in approach; Motive means motivational aspects to solve problems and bring change in that problem if needed; Opportunity means the opportunities and interest areas that inspire an individual maximum. These are further explained as below: -

- **Creative level** – Creative level is related to mental capacity. Creative level is assessed using different concepts like intelligence, aptitude, knowledge, skill, and experience. So, an individual may have a special talent for art work, or may have a strong aptitude for science. An individual may be skilled in drawing, while someone has experience in computer programming. All these differences will measure creativity that tends to be creative in proportion to our creative level.
- **Creative style** – Creative style means the preferred way of managing and using all the creative level that an individual has acquired. It is individual way of particular preferences to solve a problem. An individual is born with a particular creative style that doesn't change over time, although sometimes individuals can do things in ways that don't match up with their style. Some individuals have a more structured creative style, while others prefer a less structured method. People with a more structured creative style are easy to deal with and have evolutionary ideas, whereas people with a less structured creative style are not so easy to deal with and have revolutionary ideas. All individuals are creative but they are creative in different ways.
- **Motive** – Motive means an individual channel of energy. An individual's creativity is affected by the motive behind it. Individuals are motivated by different things, like money, helping others, or achieving recognition. Depending upon the motives, an individual puts in more or less energy into the task, and that will affect their creative contributions.
- **Opportunity** – Lastly, opportunity means the availability of a problem to solve and the way an individual perceives that problem. Sometimes, an individual has access to an opportunity that others don't perceive it as an opportunity. In other words, an individual understands a situation as an opportunity and some other person might think that it is not thought-provoking. These observations also affect creativity and thinking about the environment around us.

There is no ideal kind of creativity. No specific creative level or creative style, or motive, or opportunity is enhanced than any other in general. The kind of creativity that is most appropriate or most effective depends on the situation and that also depends upon the current problem that is being trying to be solved.

5.3.3 Diversity Is Important For Creativity

Diversity enriches creativity. It motivates for the search of novel ideas and perceptions, promotes better decision making and problem-solving ability. Diversity can improve the level of institutions and promotes autonomous and advance innovations. Diversity can change the way you think and that leads to creativity. There are a number of ways that help to enhance creativity through diversity.

Diversification in personal creativity- The best thing to generate creative ideas is to diversify thinking. One technique to work on this idea is to randomly select a word from a dictionary or a book and try to generate ideas by using that word. This forces brain to diversify thinking and think out in more distant mental ways. One more modern technique is to google the word and work on that word with own thought processes. Similarly, going on a long walk or visiting an art gallery can also bring creative ideas in a diverse manner. For example- the banking sector, who always want to provide more streamlined services to customers can use the model of a fast-food restaurant. Just like a bank, a fast-food restaurant manages food, serves customers quickly and promotes new products. So, the fast-food restaurant can provide a wealth of inspiration to the banker.

Diversification in teams- To generate more creative ideas the teams must be familiar with use of personal creative diversity techniques. Team leaders and Team members jointly work for diversification and this is only possible through creative ideas of a heterogeneous team with all members from different educational and cultural backgrounds. Such a team provides a wider range of knowledge to extract information and build upon ideas. As the work environment can force people to think in a commercial way. So, taking the team to external locations can help to generate and develop ideas also inoculates diversity into group thinking.

Diversification in institutions – Diversification in institutions is a result of diversification in teams which comes from the team members, who are from diverse background, education, knowledge and experience. These people provide diverse networks of professional associates and use the knowledge to solve problems and accomplish tasks in an institution with a vast and diverse meta-network. Diversity should also include people of all genders at the employee as well as management level.

Diversity at home- Diversity can be as simple as to watch a new video on mobile, trying new foods, trying new recipe, taking an evening class on a new topic and reading books on new topics. Individuals are thankful to networking web sites like LinkedIn, Instagram and Facebook. These are the sites that give opportunity to many of us to create new networks that include people we have never met. It's a great way to learn and diversify.

5.3.4 Diversity Is Helpful To Increase Creativity

We have already discussed the concept that diverse teams work more with different creative ideas. In developing creativity at any place, two phenomena take place - generating ideas and implementing ideas. Although diverse team arrangement does deliberate an improvement by generating a wider range of original and useful ideas, but the creativity created by higher team diversity is disrupted by the intrinsic social conflict and decision-making shortfalls. So, it would therefore make sense for institutions to increase diversity in their teams by focusing on generation of new idea and use more-homogeneous teams to implement these generated ideas. The process of creative thinking involves divergent thinking, openness to experience, and mind involvement, which are required to unique ideas, but these unique ideas have to be followed by convergent thinking, expertise, and effective management to make them become an actual innovation. So, for creativity new and novel creations are very important. At many places, individuals have number of creative ideas which are never implemented due to insufficient steps taken for the implementation. There are number of ways that are helpful to increase creativity:

- Leadership helps to increase creativity - As we already know that leadership is the main resource for team work in the institutions. The problems arising from diversity are easily controlled if the leader of the team is handling it in a more effective way.
- More diversity is problematic situation: As we know diversity and creativity are in a linear relation but it is important that an adequate degree of diversity is more favorable than a higher amount.
- Deep-level diversity is key: Diversity focus on demographic variables such as age, caste, religion, race and gender etc. The most interesting and influential aspects of diversity are based on psychological aspects such as personality, values, attitude, abilities and aptitude and known as deep-level diversity.

- Sharing of Knowledge is important: Diversity will not improve creativity till there is a good platform for sharing of knowledge. Social networking of different peoples in the different institutions has more creative ideas as they are more interconnected. This networking connects people on diverse aspects and collectively they share knowledge and create a wonderful innovation in their respective fields.
- Other factors are much more salient: Other factors as positive support for innovations, wider vision, task orientation, and external communication are the strongest factor to foster creativity. Similarly, developing expertise in concerned field, assigning diverse people to tasks that are also meaningful and interesting is helpful to improving creative thinking abilities. Selecting individuals on the basis of their creativity instead of the cognitive abilities can also encourage creativity and diversity. So, we can say that creativity may lead to diversity and diversity leads to creativity.

In brief, creating a diverse team in a school than boosting creativity is a better way to enhance creativity. When the need is to enhance creativity, there are no simpler or more effective solutions than boosting diversity.

Self-Check Exercise

Define Creativity. How is Diversity important for Creativity?

5.4 Individual Creativity

Individual creativity is the use of individual's mind to generate original ideas. Creative behaviors are easy to recognize but hard to define. A creative work of art is that which is novel and useful for the individual or for the society. Creativity has a wider range from the ordinary to extraordinary. Creative persons create new ideas and thoughts that are unique. In the society, creative individuals are in different fields as painting, literature, acting, sports and many more. Brown (1989) and other researchers have identified four P components of creativity. These are:

- Personal characteristics
- Processes, such as thought processes
- Products, services, and outcomes produced
- The presence of contextual environment

5.4.1 Components of Individual Creativity

Creativity differentiates human beings from other creatures on the Earth. Every individual is born with some intrinsic characteristics that lead to creativity. These intrinsic characteristics vary from individual to individual. In general, there are some basic aspects of a creative individual and that are as given below:

Cognitive abilities including general intelligence- Every creative individual needs to perform extraordinary task in the society and performance of these task determines their creative level. Creative individual has skills as listed below:

- High tolerance for ambiguity,
- Self-dependence or independence,
- Lack of concern for social approval,
- Persistence to accept a challenge,
- Risk-taking
- An exploratory cognitive style to seek new perspectives on a problem.

Cognitive abilities are directly associated with individual creativity. Learning and experience can improve an individual's creative levels. A capacity to generate a variety of ideas helps to create new thoughts as we know creative problem solving also demands generation of new knowledge. Every problem involves an individual's cognitive capacity to reframe or redefine it in a creative manner.

Mastery of a discipline- Mastery of a discipline is a measure of creativity in the individual. An individual become creative only within discipline with the long periods of research in that field. Cognitive ability helps to solve problems within disciplines creatively.

Subjectivity of Creative Output and Courage- There is subjectivity in the actual creative output of individuals, such as performance on creativity tests involving puzzle-solving ability. Creative results are often perceived as subjective and situational and perception of creativity varies from person to person. So, it becomes necessary for a creative individual to stand-up for self and claim to be different.

5.4.2 Influences of leaders on individuals' creativity: Everyone is influenced by others and many other individuals influence each one in their life. Everyone, even most introvert person also influences a number of individuals during their life span. A mother is always an inspiration

for her growing children, a teacher can be an inspiration for the students. A school going child also influence other schoolmates in the school.

5.5 Group Creativity: A Social Process

Group creativity is used to generate ideas within a group of people. There are number of activities that can be organized to identify ideas or the activities to meet the requirements of the group. Creativity in a group is successful only with a carefully managed creative process. This process involves various number of steps to complete the activity. In the creative process, firstly we need a proper preparation which involves carefully selecting members for a team so that each member involved has potential for creativity to get maximum benefits. After that, main aspect is to identify a problem that leads to creativity. This step is known as innovation opportunity. When problem is identified then each team member think with divergent thinking to generate possible ideas. These ideas are then carefully evaluated and at last the group tries to arrive at the best idea out of all possible ideas.

5.5.1 Abilities of a Creative Team

Following are the abilities that must be involved to enhance creativity in the group members:

- **Always try for new Innovation-** An innovation is the product of a number of ideas contributed by number of persons. These ideas go through the process of improvement and ultimately it converts into an innovation.
- **Importance of Deep listening-** All Members of a team always focus on the ideas of others in order to work out with effective feedback or proposals for improvement. An individual will first listen all the ideas or inputs from the group and after that he/she will contribute according to his/her creative potential.
- **Diverse Ideas-** Every individual has unique ideas as great idea never belongs to a single individual. It is the better to go for a process that follows in the right direction. Therefore, efforts from multiple individuals through diverse ideas come together to generate the ultimate new idea.
- **Group can help to clarify ideas**- Ideas when first come into mind are just thoughts of individuals but when they are reinterpreted, interrogated or applied by other individuals, they acquire their full meaning.

- **New and unexpected issues emerge from groups-** A creative group works for creatively collaborating new problems and new directions to the existing problem. The ability of creative groups is not restricted to solving existing problems only, but also finding new questions that require answers.

These are the abilities that any creative group must have to work on common problems and solve that problem in the effective manner with more creative ideas.

Creativity is multiplied when people work together on a project. Creativity, as a social process, involves communication with others to develop alternative ideas and solutions to problems. Creativity involves "thinking outside the box" and considering viewpoints that are not ordinarily considered.

In inventive creativity, group members offer unique solutions to a problem and in Innovative creativity, group members examine an issue from an alternative viewpoint. Both of these clearly involve teamwork and collaboration.

5.5.2 Methods for Effective Group Creativity

The methods used for enhancing group creativity are as given:

- Brainstorming is a group creativity method in which members are allowed to generate as many as ideas in a possible manner without any criticism. In this method, the individuals are free to present their creative ideas. The brainstorming method does not sequence the ideas. During the whole process, all the generated ideas are recorded without any evaluation. It's a productive session where numbers of ideas are generated from one idea as well as encourage group members to make connections between these generated ideas.
- Nominal group method - This method is suitable for small group discussion. In these group discussions ideas are ranked and group prepares a list of ideas that are generated by all group members. It is a form of brainstorming with a voting process. In this method ideas are arranged in an order and process is guided by session coordinator. The coordinator should ask the team to rate each idea under a particular heading for providing a better result. All the ideas that are generated/chosen should be testable and measurable.
- Mind mapping- It is used for individual sessions with each group member. The coordinator then combines all the ideas into a single map to prepare a common level of understanding. This is a method that is started with one idea in the middle that is known

as central idea and then needs to branch out more ideas from the central idea. This method provides the holistic view about the ideas and is helpful to prepare proper plan for work.

- Affinity diagram- It's like a diagram that requires various ideas and group these ideas into different categories with similar ideas. This method arranges all the ideas with similar nature. This method is useful to classify a large number of ideas for analysis. These diagrams can be used alone and also with brainstorming and the nominal group techniques as well.
- Multi-criteria decision analysis: When it is needed to determine the best idea out of several ideas on the basis of certain criteria. Multi-criteria decision analysis recognizes the various measures that the leader will use to evaluate the ideas and then assigns a high-level value to each criterion like risk levels, uncertainty, and valuation, to assess these ideas.
- **Delphi Technique** – In this method 15-20 experts on a certain aspect are referred. A structured questionnaire is sent to each participant without any direct interaction between them. After that a response is prepared and this summary is sent to each expert. Multiple rounds of the questionnaire may be sent and, in each round, a summary is prepared. In this way, a number of rounds are taken until proper idea is generated.
- **Fish bowling –** In this method all the individuals sit together in a circle and one person sits in the centre of the circle. The person in the centre gives suggestions to a problem and other ask questions to him about the problem. All the views are collected and a common report is prepared at the end of the session. There are different types of fish bowl techniques. In one method participants split into two as inner fish bowl and outer fish bowl. The participants in the inner bowl engage in a structured conversation in which each member speaks in turn and others listen.

5.5.3 Blocks to the Group Creativity

- **Pressure to conform to group norms:** Without some conformity to group norms, groups would not be able to function. However, a preoccupation with group member conformity stifles creativity and encourages group think. When group members are overly concerned with following rules, then innovation becomes difficult to achieve.

- **Inability or unwillingness to collaborate**: Competition among group members seldom leads to creative ideas as competitive individuals would like to keep information to themselves rather than sharing it. Competition also encourages self-centredness in group members and they focus on themselves and their own agendas rather than the goals of the group.
- **Lack of group work skills:** It is common that creative group members lack the skills necessary to foster collaboration. By focusing on cooperation, group members would bring their ideas together and create something innovative. Sometimes, due to lack of cooperation in a team, a potentially useful idea is lost.
- **Group Dominance by few:** Some individuals are more outspoken, extroverted and vocal in their opinions, while others are more introverted, reserved to express their ideas. This trend results in wastage of many good ideas. The outspoken members often dominate group meetings and so only their ideas are heard.
- **Cultural norms:** Creativity and innovation are a result of a different perception of the world around in unique ways, but the deep rooted cultural norms, values, and beliefs cause hindrance in this process. Thus, innovators' ideas are often ignored. To facilitate creativity, a balance must be maintained in respect of cultural norms with appreciation for innovation and freedom of expression.

5.5.4 Steps to Enhance Creativity In Groups

- **Embrace diversity:** Group members should be open to seek diverse perspectives and listen to different views and approaches to problems.
- **Facilitate a supportive communication climate:** a supportive communication climate must include description, spontaneity, problem orientation, empathy and equality.
- **Reward inventive and innovative creativity:** Encouragement must be given to students who offer exceptional ideas and different viewpoints.
- **Foster collaboration:** Collaboration results in innovative solutions to complex problems, although it can be time consuming and frustrating.
- **Practice active listening:** The active listening time is used to ponder, interpret, and contemplate what others have said, before formulating any response.

5.5.5 Individual Vs Group Creativity

Individuals and groups always behave in a different way. A group must be efficient and predictable, but individuals can behave in any way they like.

People are the backbone of Innovation- An innovation must be good if there are many innovations behind it. This statement is true for both, individual and group creativity. This means that various institutions need creative individuals to create innovative ideas for the team. Individual creativity is extremely based on the disposition and efficiency of the individual. The individuals in group of individuals can be motivated to create new creations for the institutions. So, group creativity can frequently be maximized with motivation to individual creativity. This motivation can be of financial or any other beneficial aspects for an individual. This aspect cannot work on all individuals but group of individuals get benefited from it.

Environment plays an important role- By providing better environment for the individuals we can enhance creativity. To foster creativity among individuals, we always need to create certain psychological and physical atmosphere. Therefore, individual creativity has a vast advantage on group creativity in respects to the environment. Individuals are always free to work on various ideas according to their interest and abilities. So, create congenial environment in the institutions so that group work can be done with more motivation and energy.

Successful Idea Execution- A good idea execution process always helps to increase individual and group creativity. An individual creativity always works on different ideas and give proper shape as per the individual's view point. In group creativity the biggest problem is that all individuals do not easily cope up with the situation to create new ideas.

Own Strengths and weaknesses - Group and individual creativity have their own strengths and weaknesses. But group creativity needs to understand the individual creativity to succeed in all sphere of creativity. So, for this it is necessary to motivate the right person in the right direction and nourish their creativity in a positive manner.

5.6 Let's Sum Up

We are living in a diverse country India. Unity in diversity is the key characteristic of Democratic India. Diversity means every individual is unique and known for her/his own

individual differences. Creativity is a purposeful activity. Creative thinking is one of the most important parts of diversity. Individual creativity and group creativity both have their advantages and disadvantages. Creativity is affected from the behaviors/environment conditions of individual and groups. A group must be efficient and predictable, but individuals can behave in any way they like. The methods used for enhancing group creativity are brainstorming, nominal group method, mind mapping, affinity diagram, Delphi technique and fish bowling techniques. Some of the blocks to group creativity are group norms pressure, unwillingness to collaborate, group dominance by few and cultural norms.

5.7 Questions for Practice:

- What is the concept of Diversity? Explain how Diversity is important for enhancing Creativity.
- Elaborate the Creative Diversity principles in detail.
- What are the creative thinking ideas that are used in Diversity?
- Explain Individual creativity with key components of individual creativity.
- What is meaning of Group Creativity**?** Explain various methods for effective group creativity.
- Differentiate between Individual Creativity and Group Creativity.

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CERTIFICATE COURSE IN CREATIVITY AND INNOVATION IN SCHOOL EDUCATION

COURSE: CREATIVITY AND INNOVATION IN SCHOOLS: THEORETICAL FRAMEWORK (CISE-1)

UNIT 6: MANAGING CREATIVITY AND INNOVATIONS

STRUCTURE:

6.0 Learning Objectives

After completing this unit, you will be able to:

a. Enlist the emerging trends in innovations
b. Enlist various types of Innovations
c. Explain various levels of Innovations
d. Describe various emerged ideas of Innovation
e. Create a culture of innovation in schools
f. Explain the ways of empowerment of teachers for innovation
g. Explain Strategies to manage creativity and innovation

6.1 Introduction

Innovation and creativity are key skills in all disciplines and institutions. Both have been highlighted as important skills for the present century. These skills can promote our student's talent. In different contexts we see the value of these skills. Creativity is related to generating novel and useful ideas in some context. Innovation is both generating and applying creative ideas in a context. Creativity is an important component in innovation. In an educational institution, the term innovation is mainly used for a complete process which includes idea generation, converting them into product which is novel, viable and useful. In this unit we will learn about emerging trends in Innovations, creating a culture of Innovation in schools, Managing Creativity and Innovation in detail and how creativity plays a positive and effective role for innovations. In this unit we will try to understand the concept of innovation, innovation related trends in our educational institutions, creating a culture of innovation in school and different strategies related to creativity and innovation.

6.2 Innovation

As we have learned in previous units that Creativity means creating something with one's own ideas that are novel and useful in one or another context. Innovation is the application of creativity in the development of something novel and innovative which never existed before. Broadly Innovation can be defined as a novel way to see things, new thoughts, new procedures or things that have value. Innovation mainly contains the idea of some output it means doing or producing something differently. It is always a product of continuous hard work. It needs persistence and perseverance, otherwise many good ideas are bound to perish. Creativity is important component of any innovative work. The words 'creative process' and 'innovation' used interchangeably at many places.

6.2.1 Emerging Trends in innovation

Innovation in education is a new step to promote education, challenging our methods and strategies in order to support the success of all students as well as teachers. This transformation may be small or a complete renovation, but it is done with determination and support from all students. Innovation means to update education level with new trends and technology in the related field. Innovation in education is always looking for knowledge that will help and support new and unique ideas in instructional techniques for the purpose of

outreach to the students in more effective and exciting ways. Efficiency basically depends upon the amount of time, money, and resources that are used to get some results. In the field of education, efficiency of learning mainly depends upon the utilization of time and cost. In the field of education, learning can become more efficient with introduction of some innovations and we can achieve the same results in less time and less cost. Efficiency is based on estimating the outcomes acquired as compared to the endowed effort in order to achieve the result. Hence, innovations in education should increase both efficiency of learning and learning productivity.

Innovations in education arise in various areas and in different forms. Innovations can be seen in teaching learning process, curriculum planning, institutional administration, curricular and co-curricular activities and in many more ways in the classroom. It can be in the teacher recruitment procedures, internal assessment. At learner's aspect, it involves identifying and developing abilities, skills and competencies. These abilities, skills and competencies include improving attitudes, dispositions, behaviours, motivation, self-assessment, self-efficacy, autonomy, as well as communication, collaboration, engagement and learning output. Similarly, to improve the quality of teaching, enhancement is needed in teacher education, professional development and life-long learning which also includes attitudes, dispositions, teaching style, motivation, skills, competencies, self-assessment, self-efficacy, creativity, responsibility, self-government to teach, capacity to innovate, autonomy from administrative pressure, best conditions of work and public sustenance. So, educational institutions provide an ideal academic environment, materials and circumstances for achieving excellence in the learning outcomes for each student. Educational innovations are concerned with the stakeholders of education like learner, parents, teacher, educational administrators, researchers, and policy makers. These stakeholders are an integral part of educational institution. Institution needs their active involvement and support. A national education system is the product of a unique set of historical, political, social, cultural and economic effects. This is a system that involves different areas that are not only interrelated and interdependent but act together. So, if any change occurs in one aspect, it may create a change in other aspects also. Given below are some examples of innovations in different areas that made a strong influence on the educational system:

- Social (Equal Opportunities Act, affirmative action policy);
- Philosophical (constructivism, objectivism);
- Political (No Child Left Behind Act, Race to the Top);

- Cultural (moral education, multiculturalism, bilingual education);
- Pedagogical (competence-based education, curriculum choices in school: Science, Technology, English, and Mathematics);
- Psychological (cognitive theory, multiple intelligences theory, Maslow's hierarchy of needs, learning style theory);
- Technological (computer-based learning, e-learning, computer assisted learning).

These innovations are helpful to improve the productivity and quality of learning process in educational system.

6.2.2 Types of Innovations

- **Evolutionary or revolutionary** -Evolutionary innovations lead to incremental improvement but require continuity; revolutionary innovations lead to complete change, totally overhauling and/or replacing the old with the new, often in a short time period.
- **Sustaining or disruptive**- Sustaining innovation perpetuates the current dimensions of performance (e.g., continuous improvement of the curriculum), while disrupting innovation, such as a national reform, radically changes the whole field.
- **Tangible or intangible-** Innovations can also be tangible as technology tools and intangible as methods, strategies, and techniques.

Along with types of innovation, the degree of impact can be identified on the following three levels:

- **Adjustment or improvement in the process**: Innovations are a part of our day-to-day performance and these are helpful to make our job easier, more effective and less stressful. These innovations should be considered as an improvement rather than innovation as it does not produce a new method. Educators use the term innovative to all the aspects that are used for improvement in classroom practices.
- **Modification of the process**: Innovation plays an important role in the modification of process, performance or quality of an existing product.
- **Transformation of the system**- The innovations are significantly helpful in transformation of learning through one system to another as fully automated educational systems vs autonomous or self-directed learning.

6.2.3 Levels of Innovations

- **First-level innovations-** These make reasonable improvements and are important ingredients of everyday life and work. They should be clearly enriched, reinforced and used.
- **Second-level innovations-** These lead to a system that involve evolutionary change or are a part of that change so, it can make a considerable contribution to educational quality.
- **Third-level innovations-** We are more concerned with innovations of the third level which are both breakthrough and disruptive and can potentially make a revolutionary and systematic change in the whole educational system.

Innovations are directly related to qualitative and quantitative factors of learning outcomes:

- **Qualitative Factors:** better knowledge, more effective skills, important competencies, character development, ethics, temperaments, job placement and job performance
- **Quantitative Factors**: improved learning parameters such as test results, volume of information learned, amount of skills or competencies developed, college enrolment numbers, measured student performance, retention, graduation rate, and number of students in class, cost, and time efficacy.

Innovation can be evaluated by its novelty, originality and potential effects on the system in which it is incorporated. As it is a time-consuming and cost-effective experience, innovations are critical to calculate on the basis of short-term as well as long-term expenses and results of an invention. In the field of education, we can do appraisal of the effect of innovation with the help of learning outcomes or end term examination results, teachers' formative and summative evaluation, formal and informal assessments and students' self-assessment. Innovation can also be assessed on the basis of factors as productivity, time efficiency or cost efficiency data as well as it also includes the school academic data, college admissions and employment rate of school students, their work productivity and career growth.

6.2.4 Various emerging ideas of Innovation

For schools, various new and innovative trends that are being positively used in classroom environment are as under:

- **Classroom Environment:** School and classroom environment plays a key role in creativity and innovation. Stimulating environment provides many opportunities to enhance the talent of students in classroom.
- **Change in teacher's role –** 21st Century students are interacting with diverse environment around them. Change in environment has influenced the learning and teaching styles. Technological intervention has made a significant effect on the learning of students. Teachers can play a key role in integrating technological advancement judiciously in the teaching learning process to make it more effective. Our teachers must be aware about the ongoing innovations in the field of teaching and learning. They must have adequate training to use new methods of teaching to bring innovations. They should update their pedagogical skills continuously and apply these in the classroom. They should create opportunities in classroom where they can think of alternative ways, express their ideas and motivate students to convert ideas into action.
- **Smart campus-** Smart campus can be created by integrating technology in teaching learning process and use of student centered pedagogies. Creative expression and innovative home work are the characteristics of a smart campus. Smart campus is always ready to implement path-breaking modes of teaching and learning.
- **Unusual learning materials:** From many years lesson plans and teaching learning material are the key components of teachers' toolkit. Now a days, unconventional teaching learning materials are used in classroom to ensure more engagement and creative thinking. Ted talks, Podcasts, creative lesson plans and virtual labs are used as learning material for students to promote innovations.
- **Gamification –** This technique is used in many learning environments for progressive learning. It makes learner more engaged and active. Gamification is becoming increasingly used in educational settings. It makes "the hard stuff more fun," helping to motivate students and make them more engaged with the subject matter.
- **The Internet of things (IoT)-** IoT is new innovation in schools. It means a connected and more cooperative future for education. IoT devices provide students improved access to tp a vast resource from teaching learning materials to communication modes. It also gives teachers opportunity to assess their student progress in learning in real-time.
- **Artificial intelligence-** The future classrooms will be loaded with artificial intelligence. Robots or computer program will assist teachers in the near future for multiple

function Personalized ways of learning. AI is already playing a big role by helping educators know the pulse of learners and then designing a customized learning experience for different learning needs.

- **Virtual Reality (VR)** – It is helping learners to interact with a 3D world. Teachers can take benefit of 3D technology for exploring science concepts, processes, travel across the world for a class of geography, explore ancient civilizations or even have the provisions for a trip to go to outer space and enjoy science subject in the class.
- **Augmented Reality (AR)**- Use of 3D replicas of reality and animated content makes classroom learning very attractive. It catches the attention of students. Teachers can explore variety of subject specific content and use it on a smart board. 3D images can be added in teaching learning presentations to make the environment more fascinating & entertaining for students. It also helps to grasp and understand the content.
- **Block chain technology-** To solves problems related to network hacking and fraud of important data of schools, block chain technologies are used in schools. These technologies help to secure data within their network or available on websites.
- **Revolution in examination system –** To assess creative thinking, critical thinking or problem solving among our students, we need to transform our traditional system of examination. Alternative modes of examinations are becoming popular now a days. Concept maps, portfolio, podcast, vlogs etc. are becoming an integral part of assessment. Artificial Intelligence and related technology are also making their entry for assessment and timely feedback in a more personalized way.
- **Digitalised library-** Digital libraries are helpful to preserve and distribute our precious knowledge with masses. As the availability of ICT infrastructure is at any places, student can access the resources from their mobile phone or computer/laptop with ease. N-list, NDL and many such initiatives have really helped the students and teachers in the field of education.
- **OLabs:** The OLabs is an innovation in school education funded by Ministry of Electronics & Information Technology. It is based on the premises that lab experiments can also be taught using the Internet. This is more efficient and less expensive. OLabs can be used by those students, who have no access to physical labs or quality of equipment are not available in labs. It helps to remove geographical distances and digital divide.

Self-Check Exercise

Define Innovations, give the types of Innovations

6.3 Creating a Culture of Innovations In Schools

Everyone is born with some creative potentials on this earth. Many instances of children's creativity can be seen in different activities in school. These activities can be from scholastic or co-scholastic areas. As children grow, we have seen that their creativity is snubbed with over structured classroom and school activities. Students are even hesitating to ask questions in classes as they enter secondary or higher secondary stage of schooling. We need to think on this critical issue very seriously. The aims of schooling are not only filling the information in the minds of students and making them machines or robots. The real purpose of education is exploring the talent available in each student. By providing stimulating environment, their creative expression can be enhanced and they might be tomorrow's scientist, inventor, poet, writer etc.

To bring qualitative changes in our schools, our teachers are the most powerful agent of this change. School need to create a culture in which every teacher believes that they need to improve for their betterment as there is no limit that an individual wants to achieve in their life. One key to change is developing a culture of saying "yes I can do it". Educators need to understand the value of change in the system, only then the changes can be easily implemented in that system. They would be always ready to support and promote it, if they believe they can do it. This is a very successful aspect of change in leadership. When people understand the value of change, they are more essentially motivated to embrace it, which results in sustainability and ultimately leads to transformation. Effective leaders always have a shared vision with positive input from all stakeholders, including students. So, they plan and implement that plan of action for the purpose of change. The connection that holds the entire process together is a leader's passion for how the change will positively affect students and staff. Educational Institutes need to adopt following practices to promote creativity and innovation and developing an innovative culture in the organisation:

- **Celebration of each one's contribution:** Each student's and teacher's creative and innovative contributions need to be valued and celebrated. It is advised that when we succeed then it is very important to celebrate with staff and students. Always give appreciation for the hard work of the people and assists in motivating others to embrace the change.

- **Effective Curriculum:** Curriculum should not be loaded with facts and it must be simple and meaningful. It should focus on depth as well as breadth. Balanced curriculum for students should have a range of experiences.
- **Group and Individual work:** There is a debate over the importance of group or individual work for creating innovative and creative work. Group or individual work have their own positive and negative points, so an institution should transact the curriculum in such a way that activities in group as well as individual level must be well designed.
- **Time management**: Proper time management must be done to provide opportunities for students to explore. Some creative work can take some extra time. A creative or innovative assignment by a student may need some flexibility in time.
- **Promote reflections among students:** Students should be motivated to reflect intensely on the given material. Find out or make some connections between subjects and topics. Extend hours for reflection, discussion and review on each content material.
- **Promote Problem solving:** It requires students to think on alternative and new ways by using their existing knowledge to find a solution to the problem in an effective manner. Project-based learning needs to be promoted.
- **Brainstorming Session**: Each classroom must use some brainstorming sessions. It gives a starting point with a lot of alternative ideas to any creative or innovative work.
- **Participation in creative activities:** Students should be encouraged to take participation in creative activities of co-curricular/co scholastic programme.
- **Code of conduct:** Develop code of conduct for students and teacher's behaviour that promote creativity and innovations.
- **Small and sensible risk:** Teachers can encourage students to take small and sensible risk by demonstrating it through trying something new in their teaching learning process in classrooms.
- **Strategic Thinking:** School head should share the vision followed by a plan of action. The plan identifies the purpose and focus for the change, and it provides methods to monitor successful implementation and sustainability. The best school leaders model the expectations they set for others.
- **Communication:** The effective and democratic style of communication help to accomplish a task. The circulation of important information, acquiring new information, reaching a decision through consensus, building relationships, and motivating and empowering all connected people through good communication embrace change.

- **Involve all the stakeholders:** Successful change initiatives ultimately depend on moving the masses, but this can best be accomplished by building positive relationships at the individual level. Empower staff to embrace change by putting them in a position to experience the value for them. Provide autonomy to those who are already on board while focusing more time and effort on supporting staff that are not yet willing to change.

There are certain key points on nourishing change that will enable to develop a clear focus during the planning process:

- Fosters learning, not merely change that alters schooling.
- Always supported by available as well as obtainable resources.
- Promotes ecological diversity and capacity throughout the educational and community environment.
- Culture with a positive spirit is always helpful to improve the teaching-learning process.

6.3.1 Empowering teachers in institutions

The following ways can be used in educational institutions to empower teachers:

- **Focus on vision.** A clear vision provides proper guidance to achieve the goals of an institution. Leaders work with various stakeholders to develop a shared vision and their action plan that keeps everyone focused on a goal for improved student learning.
- **Enjoy the work.** When an individual enjoys the work, it provides the resolve to persevere when challenges arise. Most of the successful school leaders have fun while working and ensure that others have fun as well.
- **Appreciation.** Success is not isolated to one person in an organization, it is a collective effort wherein everyone plays an important role. All teacher need to be appreciated at each step of creativity and innovation.
- **Eliminate excuses.** Challenges and obstacles are always prevalent in any organization, especially schools. School Leaders need to provide the way for their staff by removing obstacles and challenges through empowerment and autonomy. To overcome any obstacle in any creative work, we need to move ahead with positive attitude. And always enjoy & learn from every failure.
- **Ideal expectations-** Great leaders always motivate the individuals to do the tasks that are in accordance with the interest level of those individuals. A leader never asks

anyone to do what someone is not willing to do. Setting an example by putting ourselves in others' shoes, provides the motivation for staff to embrace change.

- **Start with small efforts-** Always prefer to start any work with small efforts to achieve great results. They should be motivated that success is the conclusion of various small wins that shape path for innovation.
- **Provide effective feedback-** There is a big difference between proper feedback and criticism. There is need of communication of feedback in a proper manner who excel in various fields and highlight specific areas of growth. Proper feedback is like a fuel for improvement in innovative culture of an organisation.
- **Communicate effectively-** Teachers must have adequate skill in listening, facilitating, dialogue, asking questions, creating an open environment, and clearly getting to the point. They also must have the knowledge about the importance of a multifaceted approach to increase stakeholder engagement.
- **Flexibility-** School leaders should be well versed with their leadership style. Work with different personalities and situations require flexibility and a willingness to make changes in the working conditions.

6.3.2 Change as an agent to build new relationships: a key to culture

Change is a word that is most frequently used in the field of education. As we know that the world is changing continually and that too at a faster pace. In this era of technological changes, education has to change dramatically. The best leaders not just talk about these changes as well as work on as per the demands of the changing society. In today's world, most of the school structure and function are unable to meet the needs of today's learners. So, educators as well as students need to adjust according to the changes around them. Leaders need to decide the right path that provides students with the education and learning experiences they deserve.

Significant change has always begun at an individual level. At this level, change is sustained to the point that it becomes an implanted component of the school culture. The hardest, but the most acceptable work in which a leader must engage, is empowering colleagues to change. School leaders need to remove the barriers in the process of change, eliminate the fear of failure, provide autonomy and empower teachers to drive change up to the classroom level. Dynamic relationships push this change to happen in education system.

Consider trying the following strategies to help your colleagues begin the process of changing their professional practices:

- Always follow by example- the changes have good motivation for one another.
- Always focus on recent research and practices that authenticate the change.
- Encourage colleagues who might be resilient to change for attending professional learning opportunities.
- Always share experiences during a faculty meeting or in personal conversations.
- Always try to tackle fears.
- Help others see the value of the change on their own.
- Articulate the change that improve professional practice and result in improved student learning and achievement outcomes.
- Be patient.
- Always treat your colleagues with respect
- Always involve students in the task.
- Always try to build better relationships.

So, in this way successes can be promoted within the school, to serve as a facilitator for cultural transformation. School campus should be designed in such a way that must meet the needs of all types of students. So, with these certain changes, teachers as well as students create new innovations with their novel ideas and promote a healthy and congenial environment in the school campus and this will help to implement change in the entire education system in a better way.

6.3.3 Shift the paradigm

In a world, where people use technology in almost every aspect of their lives, it is important for leaders, irrespective of their position, to replace the conventional view of school with a more meaningful and modern way. In this century of technological advancements, this is the right time to introduce the concept of digital leadership in the education system. School administrators, teacher educators and school teachers must try to make the necessary paradigm shifts to replace existing practices or make addition in ongoing practices with more effective and relevant innovative practices in school system. The following are some specific ideas for bringing digital leadership:

- **Student Engagement through Learning and Achievement-** It is important to select numerous ideas that are new and novel and try to integrate technology with those ideas and involve students to learn through this process. As we know that achievements of the students depend upon sound instructional design, high-quality

assessment and an improved feedback structure. In school system, when these tools are implemented correctly, these digital tools can transform education system.

- **Provide Learning Environments:** An old-fashioned classroom with uncomfortable furniture, poor lighting facilities and inflexible arrangements is not acceptable in the present system. In order to motivate students to think and solve problems in the real world and beyond, they need to learn in proper learning environments that imitate today's reality of the system. The present-day classrooms have to be smart, decked up with beautiful walls and furniture, bright lights, smart boards and projectors to take the students to a tour to reality.
- **Professional Growth:** Technology enables professional learning to take place anytime, anywhere and with anyone around the world. Technology breaks the constraints of time and location that exist as barriers to growth. These are helpful to improve the professional learning experiences.
- **Communications:** Most schools still heavily rely on traditional means of communication, for example email, newsletters, phone calls etc. They need to shift from this approach and engage in two-way, real-time communication. This blended approach helps to create more transparency, exposure and amplification of the vision.
- **Branding:**

  Communications + Public Relations = Branding

  This is not a business-oriented concept that focuses on selling. This is a greater support and appreciation system for the whole concept of change approach that many schools are now focusing on this approach to enhance students outreach and learning. Branding is now used in every field.
- **Opportunity:** As the saying goes- “If opportunity doesn't knock, then build a door.” The digital world allows us to build and open doors like never before. The paradigm shift here will naturally result with a sustained focus on the other six pillars.

It is evident that a paradigm shift in learning, teaching and leadership is needed to improve our education system. To deliberately design schools, and ultimately transform learning, it is imperative to have holistic improvement in the system.

6.4 Strategies to Manage Creativity and Innovation

Goal setting- Goals should be clear enough to bring into line the team members, and also movable enough that team members have self-government in how to achieve those goals. It is that autonomy, and the ability it allows for combining ideas and bringing in new perspectives, that allows real creativity to happen.

Assign work as per the individual's interests and provide positive challenge- Every person searches for work that is meaningful, as well as motivating. Motivated team members are more persistent and give more feedback to the system, contributing to innovation in a more effective way. These are always good for individual also. The key concept of leadership task is to pair the work that needs to be done with people who have both the skill *and* the interest to complete it.

Free environment for communication - The practice for enabling innovation needs the creation of a free environment for communication that always facilitates exchange of ideas, coordination and collaboration of work. This certainly becomes a culture over a period of time. This kind of environment is helpful in collaboration and building up of new channels of communication and creativity and ultimately lead to innovations.

Effective Feedback - Feedback must be frequent, constructive and supportive to the creative culture so the best approach for feedback is to prepare a list of small observations, recombination of ideas, and small experiments. These ideas give us fast feedback, allowing us to adapt to the situation in an effective manner. This process of feedback and adaptation is one of 'four steps process'. These four steps are: Design, Build, Work and Analyse.

Rewards and recognition- For creating a culture of innovations, the organisation needs to provide appropriate reward and appreciation for any creative and innovative behaviour. Teachers will be motivated to use their free time for innovative projects. Link promotions for contributing innovative ideas. Celebrate innovation verbally during staff meetings.

Avoid bureaucracy- Bureaucracy stifles innovation in two ways. It creates long lag times and institutional churn that slow innovation down to the point of irrelevance, and it demotivates innovators by putting road blocks in their way. Eliminate bureaucracy and encourage continuous and rapid experimentation.

Collaborative efforts- For fostering innovation, supportive collaboration efforts play an effective role. For example, when the two schools were more collaborative, it led to greater innovation as measured by the number of parents' and participant ratings.

Mind mapping- Mind maps is diagrammatical organisation and representation of information. Mind maps are multipurpose and a manageable style to understand a particular material. Practising these techniques can help to think on alternative ways to organise. It can give birth to creative an innovative way.

6.5 Summing Up

Creativity and Innovation are becoming an integral component of any organisation. Education sector also needs it for making school/ college education relevant to the needs of the society. Creativity is an important component in innovation. Innovations in education arise in various areas and in different forms. Innovations can be seen in teaching learning process, curriculum planning, institutional administration, curricular and cocurricular activities and in many more ways in the classroom. Innovations are of different types and levels. We have also discussed emerging innovations in education and how to create a culture of innovation in our schools. We also discussed how we can empower our teachers for this transformation. Innovation in education can promote education, innovate our methods and strategies in order to support the success of all students as well as teachers.

6.6 For Practice Questions

a. Write down the emerging trends in Innovations.
b. What are the various types of Innovations?
c. How will you create a culture of innovation in schools?
d. Elaborate the ways of empowerment of teachers for innovation.
e. Briefly explain the paradigm shift in the education system

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(vi)https://www.cambridgeinternational.org/Images/426483-chapter-4-innovation-and-creativity.pdf

CERTIFICATE COURSE IN CREATIVITY AND INNOVATION IN SCHOOL EDUCATION

COURSE: CREATIVITY AND INNOVATION IN SCHOOLS: THEORETICAL FRAMEWORK (CISE-1)

UNIT 7: CREATIVITY CONSCIOUSNESS AND ATTITUDES

STRUCTURE

7.0 Objectives

After completing this unit, you will be able to:

- Explain the need of 21st Century Skills
- Describe Creative thinking skills as critical 21st century skill
- Explain the concept of creativity consciousness and attitudes through 4Ps
- Discuss ways to facilitate student creativity in an educational institution

7.1 Introduction

From the starting of the 21st century, the whole world is witnessing intense changes in every field (Science, Technology, Education, Economy, Society etc). In these rapid changes

everyone needs different skills to adjust effectively. These abrupt changes in entire world are creating new and complex problems before us. To find the solutions of these problems, we need matching skills related to 21st Century. 21st Century Skills are those skills which are essential for holistic development of child. Identification of these 21st century skills and developing these among students is Herculean task before the world. Different documents and reports have already been published in the context of 21st century skills. These skills are much more than literacy and numeracy. These 21st Century skills will be: Critical Thinking, Creativity, Collaboration, Curiosity, Communication,". The main role of our education system is to prepare students with the required competences they need to adjust in society effectively. Our Prime Minister Narender Modi also said that we will have to take our students forward with 21st-century skills. He said National Education Policy (NEP)-2020 will ensure the holistic development of students. In this unit we will try to explore the concept of Creative thinking as 21st Century Skills, its need and role of 4P's in context of creativity.

7.2 Concept of Creative Thinking as 21st Century Skills

Creative thinking is much required competence for today's children/adolescents to develop. Never before in the history of humans, have the tools for information access and management made such an impact on the way we live. New technologies and tools multiply daily and the new technologies of today are out-dated almost as soon as they reach the market. Numerous studies and reports have emerged over the past decade that seek to identify the life, career, and learning skills that define the skills needed for success in the 21st century world. Although there are differences in how the various skills of this era are categorized or interpreted, there are many commonalities also. Creative thinking is one such common skill under 21st century skills in different reports and documents.

7.2.1 Need of 21st Century Skills

In past years, we have witnessed that world is changing at a fast rate and recently covid-19 pandemic has created challenging and novel situation before all of us. All these abrupt changes is society demands different skills from each individual to adjust in the society. The solution of the new problems and situations cannot be made with common numeracy and literacy skills. Any society, any country or an institution that ignores these realities is bound to face enormous problems in near future; the survival in this competitive era is itself in question. All need to act quickly to empower its young generation in context of a different set of 21st century skills. These skills are necessary for each individual for the all-round

development. We need competencies related to these skills among our future citizens. A competent individual can only contribute towards the development of society. The countries that are seeing opportunities in these challenging changes are going to be in a much better position in the coming years. The growth and development of a nation is not measured in terms of number of physical assets, it depends upon the development of human resources. The training of these skills needs to be started from home and school in initial years of a child. It is a challenging task before our educational system. Some of the school boards in India have already started work in this direction but to get fruitful results, each and every stakeholder has to play its key role in this whole process of skill development. We need to reduce the cultural lag (between need of the present society and what is offered by schools/educational institutes) as much as possible to be successful in future. Development of all these 21st century skills is very important for addressing the vast demands and new challenges of day-to-day life. One important point to be remembered that many skills come under umbrella term of 21st century skills are interconnected with each other directly or indirectly.

7.2.2 Meaning of 21st Century Skills

In simple terms, 21st Century Skills refer to the skills that are required to enable an individual to face the challenges of the 21st century world that is globally-active, digitally transforming, collaboratively moving forward, creatively progressing, seeking competent human-resource and quick in adopting changes. The Glossary of Education defines 21st Century Skills as: "The term 21st century skills refer to a broad set of knowledge, skills, work habits, and character traits that are believed— by educators, school reformers, college professors, employers, and others—to be critically important to success in today's world."

Different institutions at national and global level have proposed various frameworks to address 21st century challenges in last decades. Some of the key developments in this direction listed in 21st_Century_Skill_Handbook published by CBSE are given below:

The Delors Report

- Learning to Know
- Learning to Do
- Learning to Live Together
- Learning to Be

WHO Life Skills

- Decision-Making and Problem-Solving

- Creative Thinking and Critical Thinking
- Communication and Interpersonal Skills
- Self-Awareness and Empathy
- Coping with Emotions and Coping with Stress.

OECD

- Communication
- Information
- Ethics and Social Impact

Partnership for 21st Century Skills (P21)

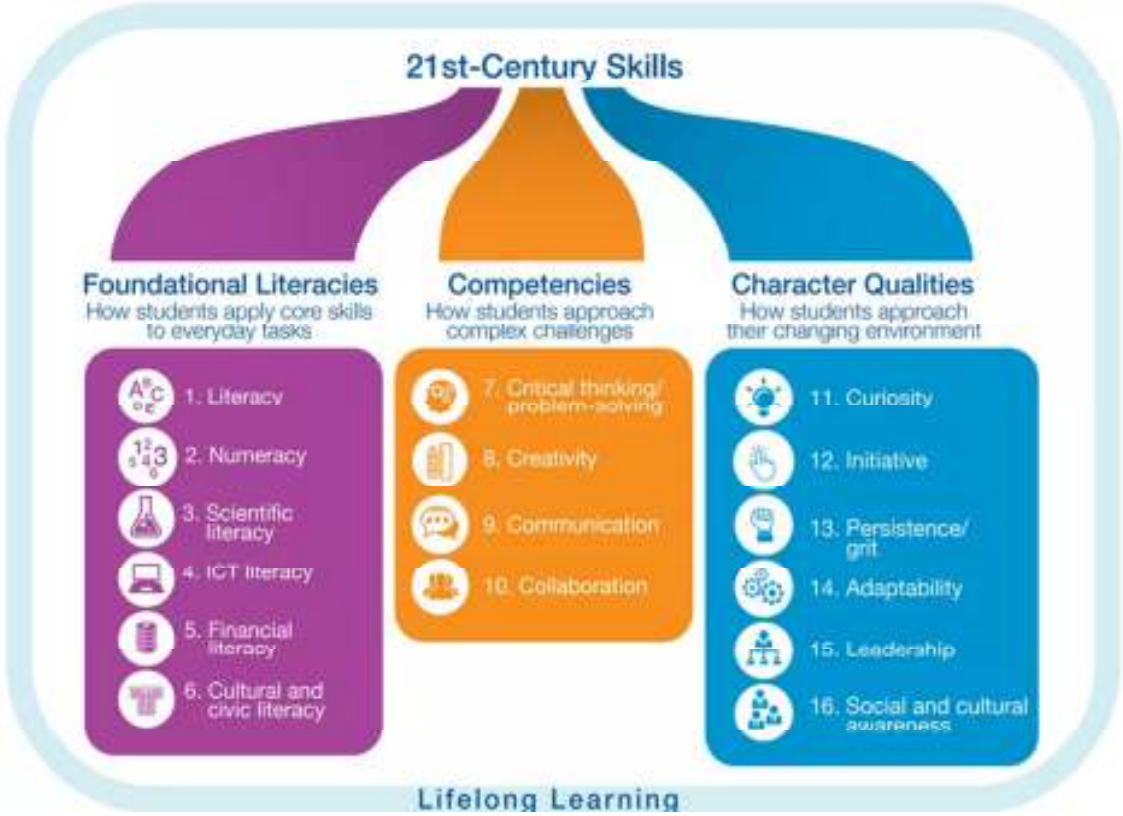
- Learning and Innovation Skills
- Information, Media and Technological
- Life and Career Skills

Assessment and Teaching of 21st Century Skills (ATCS)

- Ways of Thinking
- Ways of Working
- Tools for Working and
- Living in ATCS the World.

ATC21S		21st C skills reviewed by ATC21S			
21st Century skill category	21st century skills	Partnership for 21st C skills (2013)	Lisbon Council (2007)	ISTE NETS (2013)	ETS Skill (2013)
Ways of thinking	Creativity & innovation	Creativity & innovation		Creativity & innovation	Creativity & innovation
	Critical thinking, Problem solving Decision making	Critical thinking Problem solving Decision making	Problem solving	Critical thinking Problem solving Decision making	Critical thinking Problem solving
	Learning to learn metacognition				
Ways of working	Communication	Communication		Communication	Communication
	Collaboration	Collaboration	Collaboration		Collaboration
Tools for working	Information literacy	Information literacy Media literacy	Information literacy	Information literacy	Information literacy
ICT literacy	ICT operation and concepts	ICT operation and concepts	ICT operation and concepts	ICT operation and concepts	ICT operation and concepts
Living in the world	Citizenship				
	Life and career	Initiative Flexibility Leadership	Flexibility Adaptability		Initiative Self-direction
	Personal and Social Responsibility				

Source: Categorisation of 21st Century Skills: Various Frameworks from 21st_Century_Skill_Handbook published by CBSE



Source: World Economic Forum

Above cited sources give us a clear picture of 21st Century skills. We can see across the globe that these are key skills of holistic development of citizens.

7.2.3 21st Century Skills Development Program

Education system should start with a vision. In light of the vision, we need to develop and implement plan for development of 21st Century skills. For this purpose the following points should be kept in mind:

- Need Assessment of students in context of 21st century skills
- Development of staff capacities by organising capacity development programs.
- Providing support to the teachers for implementation of program of 21st century skills
- Use of variety of methods and strategies in teaching
- Assessment of progress of students in planned program of 21st century skills development.
- Analysis of progress of students in program of 21st century skills development

- Remedial Strategies
- Reflection on the program to modify it for future use.

7.2.4 Creative Thinking Skills as Critical 21st Century Skills

Creativity is the main goal of education. It is also an essential part of 21st century skill. All nations have focused on the importance of all round development of students to deal with creative problem solving of complex and new problem by using creative thinking. We have learned in previous units/modules that creativity is not limited to the field of arts (great painter), dance (performer), music (musician), literature, etc. It is something that we all can nurture. Creativity can be promoted by creating conducive learning environment. The background of 21st century skills shows that creative thinking was a key part of the 21st century skills in different reports and documents. The focus is on creativity as it is offering solutions to the global problems. One report published by World Economic Forum in 2016 shows that creativity had moved from a tenth-place ranking in 2015 to the third most important work-related skill for 2020 (Gray, 2016). It shows the growing need of creativity across the globe. Each country is trying to make creative thinking an integral part of the education system of the country.

Creativity is the core life skill that the children of 21st century must develop from an early age. It enhances academic performance and helps to uncover children's talents in various areas. It is a crucial life skill which is a necessary and constructive element of the innovative thinking processes. Creativity is a multidimensional construct which includes cognition, education, personality characteristics, family along with both social and cultural elements. These dimensions interact with each other as per the individual thinking and creative styles to produce ideas that are expressed is many different ways. Fleith (2000) in his report explained that teachers really boost creativity by "giving choices, providing opportunities to become aware of their creativity, and accepting students as they are."

Self-Check Exercise

Define 21st Century skills. What is the need for such skills?

7.3: Creativity Consciousness and Attitudes Through 4ps

Natarajan (2013) explained that Consciousness is self-aware energy. When his consciousness is taken into routine, it becomes very efficient and when it breaks new ground, it becomes creative. When a man acts creatively, the public takes note and when a public speaker

delivers a creatively inspired speech, he can hold the audience spellbound or send them into raptures. Creativity Consciousness can be developed through a sound system of education. Education is society's most important institution for conscious social evolution. Values form the essence of society's knowledge for highest accomplishment and Education, by imparting values, becomes an evolutionary social organization that can hasten the emergence of that creative consciousness. In this unit we will discuss about 4Ps Creativity Model for developing Creativity Consciousness and Attitudes.

7.3.1 The 4Ps Creativity Model

An American educationist and creativity researcher Rhodes has elaborated the concept of 4Ps of Creativity. Rhodes was having the view that Creativity has clear composition of 4 components or important factors. These are influencing Creativity.

The following questions are very important to know about Creativity:

- What is (a) Creative (product)?
- How Creativity is achieved (the process)?
- Who is creative (the person)?
- What type of environment/conditions is conducive to Creativity (the press) ?

Each of these questions highlights different aspect of Creativity: - the 4Ps — Person, Process, Product and Press. The creative framework (4Ps) elaborated by (Rhodes, 1961) explains these terms as:

- "The term **person**, as used here, covers information about personality, intellect, temperament, physique, traits, habits, attitudes, self-concept, value systems, defense mechanisms, and behaviour." (p. 307).
- "The term **process** applies to motivation, perception, learning, thinking, and communication." (p. 308).
- "The term **press** refers to the relationship between human beings and their environment." (p. 308). This notion and the word "press" are rather common in the field of education.
- "The term **product** refers to a thought which has been communicated to other people in the form of words, paint, clay, metal, stone, fabric, or other material. When an idea becomes embodied into tangible form it is called a product." (p. 309).

Person

The person is at the focus of any creative effort/work. Person uses the creative process and the available press (environment) to create the creative product. Creative abilities of an individual cannot be easily measured, but they can be observed. Divergent Thinking (DT) model uses open-ended exercises and automated scoring to measure creativity.

A genius person must have the following characteristics:

- Ability (intelligence, divergent thinking)
- Self-control, hard work
- Grit, drive to succeed/ create
- Right mindset (growth/ creativity/ openness to experience)

Process

It is the thinking process, procedure adopted or used by the Person to create the creative Product. Methodology is the secondary part and thought process is an important component of process. Process is dealing with whole thinking process involved to find a creative solution of a problem. For instance, the process can include the following: -

1. **Improve**: means to imitate and master the existing forms and do incremental improvements or changes in them. This is related to recombination of already existing things.
2. **Innovate**: The person takes time to incubate and based on chance and a prepared mind, creates something novel/original. This is related to transformations of the already existing or totally new things.
3. **Insight**: means looking at things from new perspectives e.g. overcoming the functional fixedness of things. This is related to re-conceptualization of things.
4. **Imagination**: means to use your rich and fertile imagination to ask questions. This is related to expanding one's conceptual spaces.

Product

Creative process followed by the person results into the Product. It can be in the form of an innovation. In the field of creativity, Product is perhaps the least studied. Product is commonly seen as the outcome of the earlier two components i.e. Process and the Person. There is lack of consensus in defining the creative product. Generally, it is defined as: a novel and useful contribution in the society. Product can be surprizing, new, useful, creative, innovative etc.

Press

The environment in which the 'Person' works and functions to create a 'Product' is called 'Press'. Every product is created by a person in a particular environment. The environment plays a key role in the creative process and product. Conducive environment can enhance creativity and vice versa. So, in this context the word 'Press' includes culture of the organisation, available resources and adopted best practices etc. This list may include other components too.

- **Organizational culture**: Every institute has its own organizational culture. Some organizations try different things, take risks, promote creativity, take failure as learning, gives motivation, encouragement and rewards for efforts for creativity and innovation. Promotions are given to encourage people in an organization. On the other side some organizations avoid risks and try to sperate in safe zone only.
- **Organizational (resource) pool**: In every organization, there is need of resources to promote creativity activities. There must be availability of domain/subject experts, trainers, mentors and role-models for helping others in acquiring skills and knowledge and creating opportunities for creative work. They must provide adequate time and resources (including monetary) to promote creativity in organization.
- **Organizational (Best) Practices**:
    a. **Autonomy**: Adequate freedom in organization to its staff
    b. **Mastery**: Challenging work is given, but it is interesting and matching to the skills.
    c. **Relatedness**: Promoting cooperative learning i.e. members working with each other in teams. In each team, there is diversity. Members with diversity helps in providing different points of view, all members are committed toward the team and are supportive to each other. There is always a constructive challenge before members. Trust, Cooperation and open communication is promoted.
    d. **Purpose**: Organization has well defined goals for future. All goals and objectives are properly communicated to each and every one. These goals are moving toward the big picture, the aim of organization. There is a procedure of assessment/knowing the progress made towards achieving goals. Based on the results feedback is given.

7.4 Ways to Facilitate Student Creativity in an Educational Institution (Classroom and School)

No doubt that in last few decades people are trying to automate almost every task related to our life. Machines, computers, robots, artificial intelligence is taking the place of human work. In this changing scenario, we must remember that every new invention is based on a creative idea related to it. Creativity is the base of our development. Every machine and even robot still depend upon humans to program it. These gadgets and use of Artificial Intelligence have replaced humans in many tasks, but creativity is still a key component which humans have authority or the upper hand. Creative citizens can only play a significant role in the development of any nation. So, our education system needs to nurture creativity among students. It should create conducive environment to facilitate creative work. A classroom that promotes Creativity places students at the centre of learning. In such a classroom students' inquiry/questions are promoted. It can help to engage and promote student's passion for learning. Students are provided learning opportunities that promote problem solving that is often initiated by the students. In a Creative classroom culture, students are stimulated to think outside the box. They are motivated to apply their creative skills to find creative solutions to the actual world situations. For creating conducive environment in classroom or in educational institution, the teacher must have understanding of creative thinking concept, process and assessment procedures. A competent teacher can only guide the students for creative work and make them competent citizens or productive citizens. Teachers can create situations for student exploration by playing the role of stage setter. Teachers need to focus on achieving higher order objectives in blooms taxonomy. To bring this change teachers need to be proactive to make transformational changes in the pedagogy. They should promote problem-based learning, creative education. Classroom activities should include brainstorming, discussion, debate, question answering, cooperative work and many more student centred activities. Gorman (2002) has explained some ways to develop creativity in schools on a blog. Along with these given points, some other ways and means to promote Creativity in the Classroom and School are given below:

- Classroom teaching should not be limited to remembering and understanding only.
- Promoting student's intrinsic motivation

- Allow and motivate students in schools to try different things and take risks. Support them in out of the box thinking.
- Self-assessment can be promoted.
- Paste a Creative Thinking poster in the room.
- Make Creativity a part of your formative and summative assessment.
- Develop a culture in educational institutions through curricular and co-curricular activities that promote creativity
- New methods of teaching in classroom.
- Motivate students to find various connections in different content, concepts and life problems.
- Support their journey from surface learning to deep learning in every activity.
- Encourage student autonomy.
- Clarification of misconceptions in the minds of students related to creativity
- Use of Creativity Thinking rubric and other learner centred flexible assessment techniques for students
- Make assessment of Creativity an ongoing effort.
- Cooperation and collaboration should be promoted among learners. It will really help in variety of ideas, understanding each other's point of view, empathy, active listening, discussions etc.
- Appropriate use of technology advancements to support learning
- Promote cooperative work among students, motivate to work in teams.
- Creating different opportunity for students for exceptional, thoughtful, and influential communication.

7.5 Summing Up

Creativity drives innovation. With creativity, we can solve complex problems. We can develop novel and useful solutions and bring innovations to meet the different dynamic demands of uncertain future. Creativity is recognised as an important skill among 21st century skills. Creativity is multidimensional concept. Research studies have reported that creativity can be nurtured through a well planned education system of a country. Different ways and means can be adopted at institution level to promote creativity. 4Ps model of creativity is also very useful in the context of creativity. It includes 'Person', 'Process', 'Press' and Product'. It

is always said that the future of any country depends upon its citizen but considering the dynamic demands of 21st century we can say that future will depend upon creative citizens of a nation who can use creative problem-solving skills, having creative consciousness and attitude. In this long journey our education system and our teachers can play a vital role in making significant changes in the life of students through creative education. No doubt that COVID-19 has already made some major changes in the way education is given to students, but more radical changes are expected to match with the pace of dynamic 21st century in near future. All stakeholders of education need to focus on development of 21st century skills specially creativity in our educational institutions.

7.6 Questions for Practice

a) Explain the concept of Creative Thinking as 21st Century Skills.

b) How Creative thinking skill is an important component of 21st century skill ?

c) Discuss in detail the 4Ps model in the context of Creativity.

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CERTIFICATE COURSE IN CREATIVITY AND INNOVATION IN SCHOOL EDUCATION

COURSE: CREATIVITY AND INNOVATION IN SCHOOLS: THEORETICAL FRAMEWORK (CISE-1)

UNIT 8:- CREATIVE PROBLEM SOLVING TOOLS AND DEVELOPING RESOURCES TO PROMOTE INNOVATIONS

STRUCTURE: -

8.0 Objectives

After completing this unit, you will be able to:

- Explain the concept of problem solving
- Describe Creative Problem-Solving Tools in the Classroom
- Use Creative Problem-Solving Process
- Explain developing Tangible Materials/Resources to promote innovations
- Explain Creative Problem-Solving Model

8.1 Introduction

Since the past few decades, different countries are focusing on nurturing and teaching creativity in schools. A Child at an early age can be taught in such a way that in promotes creativity and problem solving. Some of the subjects like arts and music/drama are thought to be better channels of creativity. Now we have to admit that creativity is not limited to a few subjects, it can also be in science, mathematics, engineering etc. (Khalid et. Al. 2020). Creativity and problem solving` are interrelated concepts. Problem-solving is a process that centers on a problem. Problem solving is an integral part of our day-to day life. To solve any problem, out thinking, creativity plays its key role. Solving Problems in a creative manner defined as creative problem solving. In this unit we will learn about the concept of creative problem solving and its process. Various tool related to Creative Problem-solving which can be used in the classroom and the tangible materials/resources to promote innovations and their development will also be examined.

8.2.1 What Is Problem Solving: -

All of our children must develop their life skills for adjustment in the society. Life skills are very important skills for dealing with rapid pace changes across the globe. Problem Solving is one of the key life skills which need to be learned by students during their school years. Problem Solving skill includes:

- identifying most relevant part of information from a vast pool of information available on the problem
- selecting useful information for solution and discarding the irrelevant
- from previous experiences, trying different combinations of relevant old and new information in context of new problems to find solution.

For problem solving, we can use different techniques:

- Abstraction: solving the problem in a model of the system before applying it to the real system
- Analogy: using a solution that solved an analogous problem
- Brainstorming: (especially by using groups of people) suggesting a large number of solutions or ideas and combining and developing them until an optimum solution is found
- Lateral thinking: approaching solutions indirectly and creatively

- Fractionalization / Divide and conquer: breaking down a large, complex problem into smaller, solvable problems
- Hypothesis testing: assuming a possible explanation to the problem and trying to prove (or, in some contexts, disprove) the assumption
- Means-ends analysis: choosing an action at each step to move closer to the goal
- Morphological analysis: assessing the output and interactions of an entire system
- Reduction: transforming the problem into another problem for which solutions exist
- Research: employing existing ideas or adapting existing solutions to similar problems
- Root cause analysis: eliminating the cause of the problem
- Trial-and-error: testing possible solutions until the right one is found
- Proof: try to prove that the problem cannot be solved and wherever the proof fails, becomes the starting point for solving the problem.

8.2.2 History of Creative Problem Solving

Creative Problem Solving (CPS) is not a new concept, but it takes into account the role of creativity in problem solving. There is a solid link between human thinking and the context of life, in which knowledge and skills in solving a problem can be developed and channelled through the application in our routine life. Every individual has his or her own skills, either real or hidden and mastery of these skills will open up opportunities for students to acquire new knowledge and skills. This will strengthen their existing knowledge and enhance their problem-solving skills.

The idea of creative problem solving (CPS) began in 1963, when Osborn proposed seven stages in creativity: 1) Orientation, 2) Preparation, 3) Analysis, 4) Ideation 5) Incubation, 6) Synthesis and 7) Evaluation. With changing times, the environment opened up opportunities for scholars to discuss the role of creative skills in problem solving and 1995 Osborn integrated this process of creative skills into solving problems involving five stages, namely

1) Facts-Finding
2) Problem-Finding
3) Ideal-Finding
4) Solution-Finding
5) Acceptance-Finding

The five stages in the creative problem-solving process are an attempt to connect the divergent and convergent thought process. Many researchers have worked upon the principles of CPS from Osborn (1963) and Isaksen et al. (1993).

8.2.3 Meaning of Creative Problem Solving

An individual faces many problems at workplace, home & in society. The nature of problems may be from simple to complex. Individual must be knowing the ways and means to solve these problems in a carefully planned manner to make adjustment. So, problem solving is an essential skill for all individuals in the 21st century. Problem solving normally applies logic/skill/experience for finding solution by applying existing ways, further investigations and by improving existing skills. The path adopted for problem solving is more or less on the pattern of previous one or slightly improved or expanded. Now think about a situation, where the whole process of problem solving is applied but the problem is still pending for solution? The you need to apply something different, to think out of box the to find an appropriate creative way to solve a particular problem. So, the concept of creative problem solving is helpful here. Creative Problem Solving is a method for approaching a problem or a challenge in an imaginative and innovative way. The solution to a problem is created independently rather than learned with assistance. Creative problem solving always involves creativity. CPS is the ability to find creative solution of the problems by creating thoughtful & creative ideas. Creative Problem Solving (CPS) is use of creativity to find new and innovative solutions to the problems. It is the mental process and a structured way of generating novel and useful solutions to problems. It is flexible process and is a part of overall problem solving. CPS teaching is a form of training conforming to solving complicated problems, to deal with problems in real life, and a teaching method to simultaneously enhance students' group education. Literature related to creativity and problem-solving shows that there is overlapping between the literature on creativity and problem solving. Posamentier, Smith, and Stepelman (2009, p. 121), claimed that "solving a problem is like inventing something new". So, we can say that creativity and problem solving are helping each other. Creative problem solving always involves creativity, but the vice versa is not true always. Creativity often does not involve creative problem solving, especially in fields such as music, poetry, and art. Creativity requires newness or novelty as a characteristic of what is created, but it does not necessarily imply that the product has some value or is appreciated by other people. To qualify as creative problem solving the solution must either have value, clearly solve the stated problem, or be appreciated by someone for whom the situation improves (Fobes, 1993). Creative problem solving particularly stressed on various possible flexible measures before selecting or executing solutions and solving problems and solving problems with systematic thinking (Mostafa & Esmaeel, 2012). Creative problem-Solving Skills (CPS) process emphasized the principle that each individual has a creativity that is inherited and can

be expressed by each student on different levels of thinking and age (Abraham Carmeli et al., 2013). Creativity is reflected in interest, thinking and personal choice. It can be enhanced at every level of individual development. Thus, creative problem-solving thinking affects the ability to make decisions, constantly enhancing ideas and self-efficacy and increasing productivity (Adam et al., 2009). Emphasis on these skills is very crucial in producing high quality graduates who are competitive and have high potential in innovation.

Noted CPS educator and practitioner, Ruth Noller, PhD, described CPS as the sum of its parts:

Creative specifies elements of newness, innovation, and novelty.

Problem refers to any situation that presents a challenge, offers an opportunity, or represents a troubling concern.

Solving means devising ways to answer, to meet, or to satisfy a situation by changing self or situation.

Ruth Noller also created a symbolic equation for Creative Problem Solving

C = fa (K,I,E)

Creativity is the Function of combining **Knowledge, Imagination, and Evaluation,** all of which are tempered by "attitude." Fostering a positive belief that each person is creative is the key to engaging knowledge, imagination, and evaluation.

Self-Check Exercise

Define creative Problem Solving. How is it different from ordinary Problem Solving?

8.3 Creative Problem-Solving Tools in The Classroom

Creativity can be nurtured through school by designing such a school/class environment where students will play with problems to find out their own innovative solutions. The creative Problem-Solving process uses divergent as well as convergent thinking skills. In this process, brainstorming and group discussions are promoted, wild ideas are encouraged and judgement on ideas is avoided at the initial stage. At first stage, quantity of ideas only are considered, quality parameter comes later on. CPS teaches the students the ways to solve problems in a creative and critical manner, and use of creativity to find out of box solutions to those problems where already learned procedure of problem solving doesn't work. CPS makes the process more innovative and imaginative. Creative problem-solving is a skill that students need in addition to the academic field to be more successful and excellent (Hu et al., 2017; Leisian Sa & Tatiana, 2015). The process of CPS is helpful to improve students' skills

related to problem-solving and enhance their creativity. Our teaching methodologies in schools must include opportunities for students to question, discuss and participate in each and every activity across the disciplines. Given below are some of the formalized and well-known methods and processes which combine various creativity and creative-problem-solving techniques:

- **Mind mapping:** A mind map is a diagrammatic presentation to organize information in an easy visual way. It is a hierarchical and explain relationships among different parts of a concept and its interrelated concepts as a whole. It is useful to foster creativity and improve creative problem solving.
- **Brainstorming:** It is a group activity designed to increase the quantity of fresh ideas. The process of brainstorming is related to the Torrance creativity model component 'fluency'. Getting other people involved can help increase knowledge and understanding of the problem and help participants reframe the problem.
- **Edward de Bono Six Thinking Hats Activities:** It is a wonderful way to promote creativity. He has also published different type of material to promote creative problem solving.
- **Use of innovative teaching methods:** Use of variety of instructional/teaching methods in the classroom can promote use of out of box creative ideas to solve problems. It can also motivate students to like and enjoy problems. Doig et al. (2011) indicated that, for successful creative teaching, teachers had to make proper decisions, realize the roles of problem diagnosticians and analysers, know how to plan teaching environments, and understand students' interests, aptitudes, abilities, and willingness to creation so as to induce students searching for problems, knowing problems, and solving problems as well as to develop the creative potential.
- **Creativity-enhancing learning environment:** Positive attitude, participatory environment, reflective practice is required to create learning environment that enhance creativity successfully
- **Take a break:** One simple and popular technique related to creative problem solving is to take a break from routine problem-solving process and be relax. Enjoy music or sleep or any pleasing activity to fresh your mind for creative ideas.
- **Cooperative Learning Pedagogy:** Two minds are always better than one. One and one can be eleven. So, for creative problem solving various cooperative learning methods like Jigsaw, STAD, Think and Pair etc. can be used in classroom.

Cooperative learning in classroom will help to work in a cooperative manner and more useful and new ideas can emerge through group discussions. Studies conducted on high school students reported that cooperative learning methods promotes interaction and in result stimulates student's ability to be more creative (Sternberg & Lubart, 2004).

- **Open-ended and dynamic Questions**: Teacher should always motivate the class for participation in each activity. For promoting participation, he or she need to present open ended and dynamic questions before the students to think out of box and bring new creative ideas to find creative solutions of the problem. Teachers need to start routine teaching with good questions from the daily syllabus in a creative manner for students' active participation. Reasoning should be promoted in classrooms.

  Reframe the problem: It means students can reconsider their goals. Some problems need to be reversed to know the different perspective. There is need of thinking from opposite direction
- Try to reframe the problem from different perspective to explore new and useful ways to resolve it.
- **Division of problem into parts:** This technique used Analysis technique to solve the problem. Problem can be dismantled into parts to make it simple for the understanding. By analysing each part of the problem, more comprehensive and creative ideas can be applied to find its solution.
- **Academic challenges.** It is a student work, structured as a problem directly from an area of study. It is used primarily to promote understanding of a selected subject matter. The academic challenge is crafted by transforming existing curricular material into a problem.
- **Scenario challenges.** Scenario challenges cast students in real-life roles and they are asked to perform these roles in the context of a reality-based or fictional scenario.
- **Aryabhata Ganit Challenge:** It is an online test organised by CBSE to make learning mathematics joyful. In this competition, questions are based on analytical skills in which children think and relate mathematical problems to real life problems, leading to development of problem solving and critical thinking skills.
- **Reading Challenge:** To encourage quality of reading among students, CBSE has organised reading challenge in which students read different text and graphics and comprehend their meaning. Children will develop critical thinking when they are able

to read as they will understand better. Their problem-solving skills will be developed because they can understand better and their creativity will also improve as they can comprehend graphics also.

- **Real-life problems.** The actual problems in our life need real solutions. These involve students directly and deeply in the exploration of the problem. The solutions must have the potential for actual implementation in the classroom, school, community, regional, national, or global level.
- **Web-Based Tools:** Many technology-enhanced lessons and tools are available on the web. Teachers must adapt these tools to fit their own teaching styles, student needs, goals, resources, and contextual variables. Teachers must learn to modify these resources to make them suit their own teaching and help them to work effectively in their unique teaching situation.

  Six-step method developed by Alex Osborn: The Creative Problem-Solving Process (CPS) is a six-step method developed by Alex Osborn and Sid Parnes that alternates
- convergent and divergent thinking phases. It can also be understood as Creative Problem-Solving Process.

8.4 Creative Problem-Solving Process

The Creative Problem-Solving Process (CPS), also known as the Osborn-Parnes CPS process, was developed by Alex Osborn and Dr. Sidney J. Parnes in the 1950s. CPS is a well-structured method for generating new and useful solutions to problems. CPS follows three process stages, which match a person's natural creative process, and three stages are further categorised into six explicit steps. CPS syntax consist of six stages (mess finding, fact finding, problem finding, idea finding, solution finding, and acceptance finding) to empower students' problem-solving skills in the form of

- Identification of each phenomenon, which need to be filtered into problems for follow-up
- Collecting basic information and required data about the causes of the problems
- Identifying each problem and the procedure for its solution
- Looking for alternative ideas, available options, methodologies as possible solutions or ideas

- Exploring ideas in new and different ways and from different points of view to be developed into activity plans
- Finding ways to make ideas or solutions more effective and useful in genetic mutation material (Doak et al., 2013).

Details of these steps are given below:

Stages of Creative Problem Solving

1. Explore the Challenge

- **Objective Finding (identify the goal, wish or challenge):** In CPS, the first step is to find a situation which caused the problem. It is the process to identify a particular situation which is related to the problem or presenting a challenge, having an opportunity. So, it gives you direction to work, activate to do something or gives you a sight of objective to achieve.
- **Fact Finding (gather the relevant data):** After identification of your objective or goal, you need to make a list of all the important facts associated with objective/goal or the situation. This process will help to collect the facts related to the problem. You can use these facts to know the nature of problem and situation. For this purpose, you need to ask yourself:
    - Who is involved in this problem?
    - What are different examples?
    - What are the causes behind the problem?
    - When and where will it happen?
    - How does it will happen?
    - Any other question related to the problem and related situation

  Apart from these questions, you can ask other questions which can provide additional facts related to the situation or raw problem in your hands.
- **Problem Finding (clarify the problems that need to be solved in order to achieve the goal):** Till now you were working on raw ideas about the problem, its associated facts and situation. Now, considering the data, in your hands about the situation during fact finding, try to clarify the problem, define it. It will narrow down the problem to a defined statement. This will help to achieve it in more precise terms. You can ask yourself the questions given below:
    - What is the real nature of problem?
    - What is my objective?

- What are my worries, hesitations, fears and concerns?
- What is my opportunity and challenge?

2. Generate Ideas

- **Idea Finding (generate ideas to solve the identified problem):** After defining your problem, you need to make efforts to find probable answer of your problem with variety of ideas. Brain storming technique is one example at this stage to explore many ideas. Avoid judgement and promote divergent thinking as we want maximum ideas.

3. Prepare for Action

- **Solution Finding (move from idea to implementable solution):** Now you must be ready with criteria to be used for selection of best ideas(s) for solution of the problem. You have to make decision regarding various ideas, which seems to be helpful for finding solution of a problem. A suitable criterion should be used to find the best solution(s) related to the problem. A suitable criterion may be on the base of its cost, reliability, validity, quality, time, legality, safety, feasibility, timeliness, morale and ease of implementation. All these components or some of these may be part of final criteria.
- **Acceptance Finding (plan for action):** You are now prepared to make your action plan. To ensure successful implementation of idea(s), it is necessary to gain maximum acceptance. An idea has a little value until it is put to use. You have to plan how to alter or modify your idea so it will be as acceptable as possible.

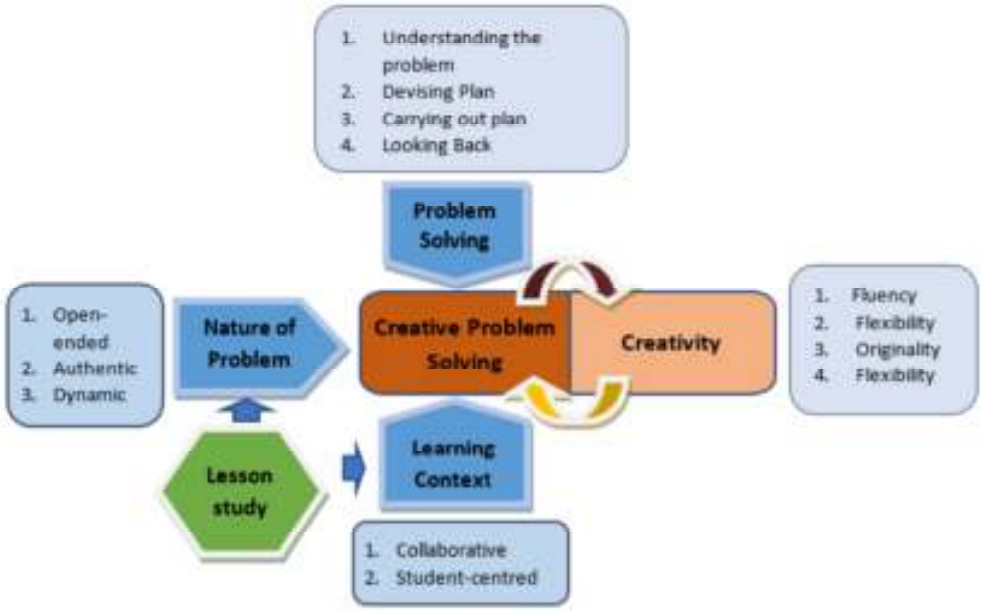
8.5 Developing Tangible Materials/Resources to Promote Innovations

As we have learned about the creativity and innovation in previous units. Now it's time to implement learning from previous units. For promoting innovation in educational institutions, we need two types of resources i.e. tangible and intangible resources. **Tangible resources** are mainly physical things. It includes education institute's Land, building, ICT tools, laboratories, playgrounds, equipment's, incubation centre and financial resources– all these comes under the category of tangible resources. Most of these resources can be made available to the teachers and students for effective use of pedagogies to promote innovation and creativity in educational institutes. Different techniques of creativity and innovation may

require physical things in order for effective output. So, the learning environment must be supporting the efforts of students and teachers for innovation in educational institutions.

8.6 Creative Problem-Solving Model

This model is given by Khalid et. al. (2020). It explains the whole process of creative problem solving and sums it up in an organised way. For solving any problem, you must understand it, devise a plan, carry out your plan and then check feedback to review it. To apply creative problem solving, we must have open ended, authentic and dynamic nature of problems. Creative problem solving is also affected by the learning context in which it is used. Collaborative and student-centred context is more suitable for creative problem solving. So, for a creative problem-solving thorough understanding of problem and use of creative ideas are essential requirements.



Source: Khalid et. al. (2020). Creative Problem-Solving Model

Importance of Creative Problem Solving (CPS) in educational institutions

- Creating an environment in schools where creativity and innovation will flourish
- Lifelong benefits to the person, organization and to the society
- More and more use of divergent and convergent thinking in day-to-day activities
- Becoming a good and productive citizen of the country
- Enjoying the CPS and love to engage with problems and finding creative solutions.

- Creativity becomes an integral part of an individual's work and life.
- Use of CPS process in different settings.

8.7 Suming Up

21st century skills or life skills are integral part of every country's education system across the globe. Inter-connectedness of all these skills at different age-levels is also an important point to be considered by our educational institutions. All these skills are attached, interlinked and to be developed in cohesion with each other. One of the important skills is creative problem solving. CPS is a cognitive process. CPS is an organized method for creating new and valuable explanations to problems. It is a flexible process. The process is influenced by various factors. It is the ability to use creative and new ideas which are useful to find a solution of a problem in an innovative way. Creative problem-solving knowledge is an important element for each student to make adjustment in the dynamic society where every day new problems are emerging. In this module various methods and techniques are discussed which can promote CPS in classroom. Six-step method developed by Alex Osborn and Sid Parnes is very useful in creative problem-solving Process. Individuals and group activities are providing stimulating environment for creative problem solving. Well planned teaching resources, material and student-centred pedagogies can stimulate thinking among students in classroom to promote creativity. CPS is connection of problem-solving skills and creativity. The connection between creativity and problem-solving skills requires a supportive and encouraging environment. An unfavourable environment can lead to negative perceptions (Sternberg & Lubart, 2004).

8.8 Unit End Questions for Practice

1) Discuss the concept of creative problem solving.
2) Describe Creative Problem-solving Tools in the Classroom
3) What is Creative Problem-Solving Process? How will you use this to solve a problem?
4) What are the different components of Creative Problem-Solving Model?

8.9 Suggested Readings and References

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