

# Importance of Arts & Design in Liberal Education based STEAM model of Higher Education

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## Abstract

Liberal education concept in higher education provides an opportunity for students to choose the areas of study that enhances general knowledge, human values, and develops the intellectual ability for creative thinking and innovations. This kind of education can prepare students to work confidently in a variety of job situations and different working environments. In present modern civilization, it is argued that the students need an education system which can prepare them both specialized, super specialized and humans. Accordingly, a new higher education model at the higher secondary level and college level is suggested with a liberal education concept which involves equal importance to Science, Technology, Engineering, Arts & design, and Mathematics called the STEAM model. In this chapter, the importance, implementation, and expected outcome of such a liberal education system are discussed with emphasis on Arts& design. The advantages, benefits, constraints, and disadvantages of the STEAM model are studies using ABCD analysis from different stakeholders' perspectives.

**Keywords:** Higher education, Liberal education, STEAM, Arts & Design, ICCT, Confidence building, Creativity & innovation, Human values, Technology on arts & design.

## 1. INTRODUCTION

Liberal education is a system of education developed suitably to cultivate free and independent human beings. It is an educational concept based on liberal arts or more specifically, liberalization of the age of enlightenment by involving the learning of creative skills. As per many definitions, liberal arts & design education in higher education areas that focus on unleashing human creativity to provide high level general knowledge, human values, and develops the intellectual ability of students<sup>[1]</sup>. This kind of education can prepare students to work in a variety of challenging jobs in different working environments. Liberal arts & design concept related to creativity and imagination of human beings and hence systematic training of students in arts & design as a part of higher education contributes the creativity, innovation and hence the happiness of the people in the society. Liberal arts education at the college level prepares the students to become all-rounders based on their enhanced multi-tasking ability in different fields of human development and contribution. Liberal arts & design education at the college level are expected to expose various traditional humanities subjects to improve competency in each of them. It is believed that the objective of higher education is confidence building through a list of activities to enhance knowledge, skills, discipline, and experience in a given subject or area specialization or super-specialization<sup>[2]</sup>. However, arts and design education add further confidence by making them all-rounders. Thus, it is argued that blending different life skills and creative areas along with systematic science-based education add values to human prosperity and happiness. This also enhances human productivity and hence contribution to society.

As per Wikipedia, liberal arts education is a part of higher education consisting of traditional programs of education in four areas including natural sciences, social sciences, arts,

and humanities. Its objective involves creating innovative all-rounders by exposing the in variety of subjects in college life also (like primary & secondary education) including physical science, biological science, logic, linguistics, literature, history, political science, psychology, and even mathematics. The liberal arts study model contrasts with other study models like vocational, professional, engineering, etc.

The study of the liberal arts provides an exemplary arena for students to become active learners. The complexity of modern society requires a broader understanding of societal problems rather than a specialized one. Real problems are multifaceted and demand multifaceted solutions. Engaging students in the study of the liberal arts can provide a basis for lifelong learning and civic involvement<sup>[3]</sup>.

In this chapter, the importance, implementation, and expected outcome of such a liberal education system are discussed with emphasis on Arts & design. Starting from the concept and importance of liberal education, importance and details of arts & design subjects, an overview of the STEAM model and its effect on improving the employability of graduates are carried out. The advantages, benefits, constraints, and disadvantages of the STEAM model are studies using ABCD analysis from different stakeholders' perspectives.

## **2. OVERVIEW OF STEAM MODEL**

Even though the human education starts from childhood with play experiences and family environment, every child while growing engagement with the world that can promote learning various activities related to science, technology, engineering, and mathematics (STEM) subjects. As they grow in primary and secondary school education, they learn hands-on multisensory, creative and innovative experiences in STEM areas. Such education enhances the children's curiosity,

inquisitiveness, critical thinking, and problem-solving abilities throughout their primary and secondary school learnings. STEM subjects are integrated as a single subject in school education and are becoming popular in many countries and now spreading its roots to the higher education system. The STEM education model got importance in most developed countries and some of developing countries at the end of the 20<sup>th</sup> century. Apart from school education, if college level curriculum is planned with STEM subjects, the scientific thinking and innovative ability of students can be improved to make them smart graduates who can adopt technology in decision making and problem solving<sup>[4],[5]</sup>.

In the STEM curriculum model at the college level, a student has to study science, technology, engineering, and mathematics subjects in each year (preferable in semester) to be competitive in order to get further opportunities. Identifying such subjects in a systematic combination to make effective STEM interconnected model is the challenge for educators. But based on analysing the graduates of various professional education, who have been trained for STEM based education, it is found that additional skills apart from STEM may increase their creativity and design thinking abilities. New suggestions based on intensive research by many educators pointed out the addition of a component along with STEM constituents is desired to improve the quality, efficiency, and productivity of college graduates. This missing component to offer comprehensive education to everyone is identified as Arts & design to be a part of the liberal education system. Accordingly, a new higher education model at the higher secondary level and college level is suggested with a liberal education concept which involves equal importance to Science, Technology, Engineering, Arts & design, and Mathematics called the STEAM model. This improvement in STEM is argued by many researchers in education to make students as all-rounders. As per this argument, apart from learning for knowledge, skills,

and experience which are specific for a given industry, students should also enhance their creative thinking and design abilities by involving in art and design related training. Hence the above new model which integrates STEM with Arts & Design subjects is proposed. Based on studies it is realized that such a transdisciplinary STEAM model is the current requirement to enhance the creative thinking abilities among any professional courses' graduates [6]. The constituent disciplines of STEAM and their importance as knowledge and skills are summarized in table 1.

**Table 1:** The constituent discipline of STEAM and their importance

Sl. No.	Constituent Disciplines	Importance
1	Science	Allows the learner to develop an interest in and understanding in living and non-living bodies, materials, and the entire physical world and supports to develop the collaborative skills, explore new knowledge through research, critical inquiry, and experimentation.
2	Technology	Supports to extends human capabilities by covering a range of fields that involve the application of knowledge, skills, and computational thinking and enables us to satisfy human needs, wants, and desires operating at the interface of science and society.
3	Engineering	Allows the learner to design and create products and processes, using various scientific methods to use the skills and knowledge to real world problems.
4	Arts & design	Allows us to focus on unleashing human creativity and innovation ability to provide high level general knowledge, human values and develop the intellectual ability of students.
5	Mathematics	Provides the skills required to analyse and interpret information, supports to simplify and solve problems, identify risk, supports optimum decisions and helps to understand the world around by means of abstract and concrete modelling the problems.

STEAM model of higher education not only consists of teaching these constituent subjects individually but also integrates them based on a cross-disciplinary approach. It is also argued that the STEAM education model provides learners with exciting experience of deep learning that enables them to be resourceful and confident in identifying and solving everyday problems in society. Through STEAM, the learner engages in many activities which include : (1) Applying their knowledge to solve problems related to creativity and innovation, (2) Imaging the situations and solutions, questioning and exploring solutions, (3) collaborating with others for problem solving and enhancing efficiency, (4) Engaging inquiry, and analysis with patience, (5) Involving in design thinking and developing, (6) Implementing, testing, and modifying solutions of complex problems, etc based on enhanced creativity, innovation, challenge seeking ability, patience, enhanced competency, and confidence to address sustainability challenges<sup>[7]</sup>.

This “STEAM” approach will support the development of versatile professionals for the evolving workplace. To develop this program, a team of STEAM faculty members examined existing literature on the development of creativity as well as multidisciplinary models in the industry, business, and education. Through the academic restructuring of traditional educational models, this curriculum will be at the forefront of engaging learners in team-based multidisciplinary problem solving through mentoring, learning communities, research projects, and partnerships with outside agencies. The program is a model for the education of scientists who will be able to create innovations in modern science and technology necessary to address the complex problems facing human society<sup>[8]</sup>.

### **3. RELATED WORK**

According to our understanding of liberal education which focuses on the liberalization of professional and technical

education in order to empower individuals and prepare them to deal with complexity, diversity and change through added learning opportunities of arts and design. There are many studies in liberal education consisting of incorporated arts and design concepts and subjects in general, professional, and technical education. Liberal education has the potential to include liberal arts with design thinking, creative computing, and radical innovation maintaining critical thinking associated with humanist inquiry<sup>[9]</sup>. Table 2 lists some of the important papers related to liberal arts and design education including the objectives or focus of study and Table 3 reviews some of the papers published related to STEAM education model.

**Table 2:** Liberal arts & design education

Sl. No.	Focus	Reference
1	To describe the rationale of the test of Thematic Analysis, and ability for complex concept formation.	Winter, D.G. <i>et al.</i> (1978). <sup>[10]</sup>
2	How to design the classroom environment for experimental learning to diagnose and understand both learners and learning environments.	Fry, R. <i>et al.</i> (1979). <sup>[11]</sup>
3	Focussed on liberal arts education to enhance skills, leadership, and diversity.	Urcioli, B. (2003). <sup>[12]</sup>
4	Focussed on liberal arts education to identify learning outcomes associated with wisdom and quality citizenship.	King, P.M., (2007). <sup>[13]</sup>
5	Focussed on how professional marketing degree curriculum should complement and enhance the outcome of the liberal arts education.	Petkus Jr, E. (2007). <sup>[14]</sup>
6	Focussed on how liberal arts education experience and outcome supported to inquire and lifelong learning, personal well-being and quality of leadership.	Seifert, T.A. (2008). <sup>[15]</sup>
7	Focussed on the tradition, goal, and teaching-learning methodologies of liberal arts education and its relevance to a Muslim higher education.	Rostron, M. (2009). <sup>[16]</sup>

8	Focussed on how STEM education supports economic growth and development of the society.	Bevins, S. (2011). <sup>[17]</sup>
9	Examined whether dual enrolment of students in courses which train both cognitive and non-cognitive areas of higher education.	An, B.P. (2015). <sup>[18]</sup>
10	Brings the views and experience of graduates of social science and arts programs as they enter the professional job market.	Cameron, J. <i>et al.</i> (2019). <sup>[19]</sup>
11	Methods & strategies to solve wicked problems with design thinking.	Allan, S. <i>et al.</i> (2019). <sup>[20]</sup>
12	Suggests that Liberal Arts is only not sufficient unless a methodology is established to provide convergence of knowledge.	Melnick, P. (2018). <sup>[21]</sup>

**Table 3:** Published papers related to STEAM education<sup>[6]</sup>

Sl. No.	STEAM Curriculum	Focus	Reference
1	STEAM education	Development of a theoretical model	Kim, Sung-Won, <i>et al.</i> (2012). <sup>[18]</sup>
2	Development and application of STEAM teaching model	Based on the Rube Goldberg's invention	Kim, Y. (2012). <sup>[19]</sup>
3	A study of teaching-learning methods for the IT-based STEAM education model	With regards to developing people of interdisciplinary abilities	Kim, J.A. (2011). <sup>[20]</sup>
4	Rethinking STEM education	An interdisciplinary STEAM curriculum	Madden, M.E. (2013). <sup>[21]</sup>
5	Transitioning STEM to STEAM	Reformation of engineering education	Watson, A.D., (2013). <sup>[22]</sup>
6	From STEM to STEAM	Toward a human-centred education	Boy, G.A. (2013). <sup>[23]</sup>
7	An analysis on STEAM education teaching and learning program	On technology and engineering areas	Ahn, J. (2013). <sup>[24]</sup>
8	STEAM teaching practices	Developing a conceptual model	Quigley, C.F. (2017). <sup>[25]</sup>



9	From interdisciplinary to transdisciplinary	An arts-integrated approach to STEAM education	Liao, C. (2016). <sup>[26]</sup>
10	STEAM Education	Study on the current status	Park, H., (2016) <sup>[27]</sup>
11	STEAM as social practice	Cultivating creativity in transdisciplinary spaces	Guyotte, K.W. (2014) <sup>[28]</sup>
12	STEAM Education through Case Studies	Examination of the Practical Model	KIM, J. W. (2015) <sup>[29]</sup>
13	From STEM to STEAM	Students' beliefs about the use of their creativity	Oner, A. T., (2016) <sup>[30]</sup>

#### 4. OBJECTIVES AND METHOD

The objective of this chapter is to study the importance of Arts and design subjects in the liberal education concept on STEAM a new model of higher professional and technical education to enhance the skills through stimulating and enhancing creativity. The objectives involve :

1. To learn the evolving concepts of Liberal education and its importance.
2. To discuss the importance of Arts and design subjects in liberal education and their expected benefits.
3. To know and summarize the new knowledge developed in this field through a systematic review.
4. To learn the branches of Arts and design subjects which can add skills and values to the learners and identify career opportunities.
5. To make an overview of the STEAM model and its effect on improving the employability of graduates are carried out.

6. To discuss the importance of Arts & design areas in Science & Engineering education.
7. To analyze the advantages, benefits, constraints, and disadvantages of the STEAM model using ABCD analysis technique from different stakeholders' perspectives.

## **5. CONCEPT OF LIBERAL EDUCATION**

Unlike general education model, technical education model, and professional education model, in liberal education model, students have liberty in choosing varied subjects within the limitations from any subjects which are life skills, traditional skills, cultural skills, environmental skills, social skills, management skills which involve creativity, design thinking, creative computing, and radical innovation associated with a humanist inquiry for societal progress. Further, it helps students in providing a broad knowledge of the wider world such as science, culture, and society as well as in-depth study in a specific area of interest.

Integrating liberal arts & design in the STEM model makes it STEAM and it leads to a more efficient education model called progressive education model in higher education. Technical and professional educations have objectives in preparation of graduates for occupations or jobs above the skilled crafts but below the specific (Scientific, engineering, medical, or other) professions. Such a progressive education system using the STEAM model offers more value to experience than formal learning.

The liberal arts underlying subjects allow the students to learn about various subjects of interest based on their strengths and potential career paths. This also helps the students to discover their personal interests to carryout self-employment by finding new ideas of interest, allowing them to explore new philosophies, cultures, and social experiences to contribute to society to a greater extent.

## **6. IMPORTANCE & BENEFITS OF ARTS & DESIGN IN LIBERAL EDUCATION**

Art and design part of liberal education in STEAM focus on the certain interest of students like the art of being human in all professional and specialized areas of creative imagination and find ideal solutions to basic problems (needs), advanced problems (wants), and desires (dreams). Our research group recently proposed innovation in B.Tech. curriculum and named it as B.Tech. (Hons) by integrating Science, Technology, Engineering, Arts & Design and Mathematics (STEAM), Employability Skills Enhancement Program (ESEP) & Intellectual Property Right (IPR) features<sup>[6]</sup>. Some of the key benefits of liberal arts and design education at the college level include :

### **(1) An opportunity to explore the human experience**

Liberal arts and design education will provide an opportunity to the students to explore a variety of academic areas from science to literature, from the environment to astrology, from music to computer graphics, and to develop interdisciplinary and transdisciplinary insights into human skills from many frames of references.

### **(2) An option to search new solutions to existing problems which never thought off**

Creative imagination which is the output of liberal arts and design education empowers the students to search for new solutions using technology and human experience to solve existing and future problems in the area of basic need, advanced wants, and dreamy desires in such a way which never thought off in the history.

### **(3) An avenue to identify and follow new career opportunities**

The areas, approaches, and topics covered by liberal arts and

design curriculum uncover traditional, fundamentally flexible, futuristic, and interdisciplinary, which are environmentally adaptable to any circumstances. This empowers students to identify and follow new career opportunities with many options open due to inherently developed variety of transferable skills, rather than one specific skill set.

#### **(4) Opportunity to develop new ideas by sparking creative thinking**

When students are exposed to free, open ended liberal education without boundaries, they encash opportunities to pursue their interests to fulfil their curiosity by involving in solving complex situations by stimulating or sparking creative thinking. Liberal arts subjects particularly designed to provide in-depth knowledge and skills on a particular subject for individuals as well as collectively to various professions they take across fields in future endeavours.

#### **(5) Opportunity to gain multidisciplinary experience**

When a student learns a variety of subjects, his capability, and imagination power grows to provide solutions to complex problems through crazy ideas which helps him to identify his strengths, limitations, challenges, and opportunities and on the way becomes eligible to explore different philosophies, traditions, cultures, and multidisciplinary experiences to explore global opportunities.

#### **(6) Learning skills for lateral thinking and alternative solutions**

The important benefit of liberal arts and design education based on multidisciplinary studies and experiences is the ability to think beyond the obvious into many different areas. Liberal arts will develop critical thinking, lateral thinking, perspective thinking, research thinking along with a strong foundation in communication skills. This provides common sense and

ability to innovate and implement the most appropriate called optimum solutions as well as alternative solutions through lateral thinking. Such real-world skills make human beings as futuristic. This incorporating arts and design curriculum as blended with science, technology, engineering, and mathematics has added advantage to make man all-rounder.

### **(7) Liberalization means freedom, happiness, satisfaction in deciding in the subjects of interest**

The students get mental happiness and satisfaction when they feel that they have liberty in choosing subjects in higher education level irrespective of their chosen specialization of professional area. Along with core subjects of the field of specialization, the student gets opportunity to learn other area subjects in the STEAM model based on their individual interest so that they can be multi-disciplinary experts. Such freedom, happiness, and satisfaction in deciding the subjects stimulates the intellectual ability of the students for better contribution to the society.

## **7. Branches of Arts & Design & Career Opportunities**

The fundamental concept of introducing arts and design papers in pure science, engineering, or any other professional courses is to enhance the abilities of students in creative work and design thinking. These skills will certainly improve the ability to adapt, contribute, and help to solve complex problems so that such students get added advantage in employment due to the fact that every employer needs creative team members to do innovations and impacts in their business products or services. Thus, when it comes to employment, liberal arts and design part of the STEAM model gives at least one advantage over the STEM model of higher education due to the fact that the job market evolves and new skills and ways are always required to meet the challenges of the new market.

Many universities which offer professional degree programs at the undergraduate level have incorporated arts and design subjects as part of their curriculum along with core professional subjects. Such programs may incorporate elements of literature, music, philosophy, Yoga & meditation, environmental studies, and social science in their STEAM model for engaging academic experience interested in students. This supports to develop new ways of thinking, leading to creative problem-solving ability and effective communication skills in working place.

### **8. Arts & Design as a Part of Engineering Education**

Present model of engineering education needs radical change due to the quality of engineering graduates and their inability to cope with industry challenges. It is commented that major parts of engineering graduates are not employable which is due to the fact that they established low level skills while solving current industry problems. This is due to the fact that engineering education until recently followed the traditional model of teaching only core engineering papers and focused more time on fundamentals instead of enhancing their multitasking abilities by means of an innovative integrated all-round student development model. Accordingly, recently, a new variant of STEAM called Integrated Student development Framework for effective engineering education is proposed<sup>[6]</sup>. This new integrated model not only focuses on enhancing knowledge and subject specific skills but supports all-round skills like communication, creation of new ideas, proficiency in writing, computer based design, enhancing and stimulating competitiveness, attitude towards life, continuous improvement in life, preserving a vision of growth, skill of managing time and identifying and encashing opportunities, self-control and other qualities inculcate competency and confidence including leadership behaviour among the students to become a winner in the competitive industry and society.

This integrated student development model founded by STEAM keeps engineering students in pace with adaptation of newly emerging areas of technology and makes them to compulsory contribute to intellectual property (IPR) of the organization in particular and of the country in general. The student integrated development model for engineering program makes use of adopting newly emerging areas of technology in the program curriculum with an emphasis on basic science subjects, emerging technology subjects, engineering as core subjects, arts and design based subjects in each semester to provide creative skills and imaginative outlook, and of course, mathematics as quantitative technical support as STEAM part and the second part contains employment skill enhancement subjects as ESEP part and finally through systematic project based internship students are made to create new ideas in the form of product or process to create patent or copyright based IPR as a top-up. The student integrated model proposes six innovations in the undergraduate engineering curriculum suggesting a student focussed integrated development (SFID) framework to improve the depth, breadth, and vigorousness of the higher education by incorporating experimental learning concepts. The objective of involving the arts and design part in engineering education is to enhance competency, confidence, creativity, and employability of graduates to get a better job<sup>[6]</sup>.

## **9. ABCD Qualitative Analysis of STEAM Model**

A model is a simplified representation of a system, an operation, or a process in which the basic aspects and most important features of a problem under investigation are considered. Many frameworks are used to analyze a given model including SWOT (Strengths, Weakness, Opportunities, and Treats)<sup>[22][23]</sup>, SLEPT (social, legal, economic, political, technical)<sup>[24]</sup>, BSC (Balanced Score Card) analysis,<sup>[25]</sup> Value Chain Analysis (VCA)<sup>[26]</sup>, ABCD (advantages, benefits, constraints, and disadvantages)<sup>[27][28]</sup>, etc. ABCD analysis

framework is more effective and appropriate while analysing a system, idea, concept, innovation (technological, educational, product, process or social), strategy, etc. In the case of STEAM as a model of educational innovation, we have used the ABCD analysis framework to list advantages, benefits, constraints, and disadvantages under various issues<sup>[28]</sup>. The affecting factors and critical constituent elements of the analysis framework are out of the scope of this objective.

In this analysis, we have used focus group method<sup>[29-30]</sup> to identify advantages, benefits, constraints, and disadvantages of STEAM Engineering education model at under graduation level by considering six determinant issues which include Organizational point of view, Program based point of view, Faculty based point of view, Student based point of view, Industry based point of view, Societal based point of view<sup>[31-43]</sup> and are listed in tables 1 to 4.

### **(A) Advantages of STEAM :**

**Table 1:** Advantages of STEAM based on various determinant issues

Sl. No.	Determinant Issues	Advantages
1	Organizational Issue	<ol style="list-style-type: none"> <li>1. Organization adopts innovative curriculum model to improve the quality of education relevant to the industry</li> <li>2. Organization creates all-rounders who can solve multidisciplinary problems.</li> </ol>
2	Program based Issues	<ol style="list-style-type: none"> <li>1. The program offers STEAM subjects to the learners and stimulate their creativity and innovation with the freedom to choose the subjects under the core area and elective areas.</li> <li>2. The program is relooked as multi-disciplinary as unity with diversity.</li> </ol>



3	Faculty based Issues	<ol style="list-style-type: none"> <li>1. Experimental and research-oriented learning to create a competitive academic and research environment.</li> <li>2. Faculty members with diverse backgrounds get the opportunity to teach a variety of subjects and concepts – lateral thinking.</li> <li>3. Improved research infrastructure to provide an experimental learning experience to the students.</li> </ol>
4	Student based Issues	<ol style="list-style-type: none"> <li>1. Liberal education concept-based model provides an opportunity to learn and excel both core subjects and elective subjects spread on diverse areas of interest.</li> <li>2. Opportunity to become a smart innovator to excel in a career.</li> <li>3. Integrated student development model implementation.</li> <li>4. Experimental learning and patent analysis opportunity due to changed focus on curriculum.</li> <li>5. The curriculum is more wider and more deep.</li> </ol>
5	Industry based Issues	<ol style="list-style-type: none"> <li>1. Industry gets challenge seekers who can identify new challenges and convert them into opportunities</li> <li>2. Collaboration between institutes and industries enhances due to experimental learning concepts and focus on industrial research for the patent.</li> </ol>
6	Societal based Issues	<ol style="list-style-type: none"> <li>1. Contribution of all-rounders and creative innovators to the society to handle social problems.</li> <li>2. Society can expect qualified professional graduates who can handle need-based, want-based, and desire-based problems effectively through their smartness.</li> </ol>

## (B) Benefits of STEAM

**Table 2:** Benefits of STEAM based on various determinant issues

Sl. No.	Determinant Issues	Benefits
1	Organizational Issue	<ol style="list-style-type: none"> <li>1. Name, fame, and brand due to STEAM based advanced education model.</li> <li>2. More admissions at higher annual fees through increasing value of the Engineering Course.</li> </ol>
2	Program based Issues	<ol style="list-style-type: none"> <li>1. Popular &amp; hence high demand</li> <li>2. Value addition to the department due to highly satisfied students.</li> <li>3. Experimental learning focuses on the development of program infrastructure.</li> </ol>
3	Faculty based Issues	<ol style="list-style-type: none"> <li>1. More faculty members with more subjects.</li> <li>2. Faculty contribution to varied fields leads to enhanced job satisfaction.</li> <li>3. More IPR (Patents/Copyrights) in Faculty members names.</li> </ol>
4	Student based Issues	<ol style="list-style-type: none"> <li>1. Studying arts and design topics in the curriculum allows students to think creatively for effective design and implementation of optimum engineering solutions in the industry.</li> <li>2. Increased employment opportunity with lucrative earnings through enhanced personal value.</li> <li>3. Better graduates output due to the implementation of the Integrated student development model.</li> <li>4. Experimental learning leads hands-on experience to students.</li> <li>5. More knowledge and more skills due to the wider and deep curriculum.</li> </ol>

5	Industry based Issues	<ol style="list-style-type: none"> <li>1. Due to smart all-rounded employee availability, improved performance, and productivity.</li> <li>2. Increased profit due to sustainable and flourishable business due to innovative, high performing employees &amp; executives.</li> <li>3. Industries get the benefit due to readily available technically and creatively empowered human resources.</li> </ol>
6	Societal based Issues	<ol style="list-style-type: none"> <li>1. High quality educated innovators to contribute substantially to society.</li> <li>2. Improved economic and social performance of the country.</li> </ol>

### (C) Constraints of STEAM

**Table 3 :** Constraints of STEAM based on various determinant issues

Sl. No.	Determinant Issues	Constraints
1	Organizational Issue	<ol style="list-style-type: none"> <li>1. More resources like varied background teaching staff, state of the art equipped laboratories is required.</li> <li>2. Autonomy to implement STEAM based curriculum</li> </ol>
2	Program based Issues	<ol style="list-style-type: none"> <li>1. Equipment and collaborations between inter departments</li> <li>2. More credits per semesters due to more subjects to be studied</li> </ol>
3	Faculty based Issues	<ol style="list-style-type: none"> <li>1. Learning new things through Faculty development programs</li> <li>2. Continuous motivation and guiding students to involve in creative and innovative projects throughout the course.</li> </ol>
4	Student based Issues	<ol style="list-style-type: none"> <li>1. Though interesting, have to spend more time in studies.</li> <li>2. Experimental learning needs more industry interactions and hard work.</li> </ol>
5	Industry based Issues	<ol style="list-style-type: none"> <li>1. Industry has to spare its employees with institutes for training as industry experts.</li> </ol>
6	Societal based Issues	<ol style="list-style-type: none"> <li>1. Society should accept changes and innovations in the Engineering education model.</li> </ol>

## (D) Disadvantages of STEAM

**Table 4:** Disadvantages of STEAM based on various determinant issues

Sl. No.	Determinant Issues	Disadvantages
1	Organizational Issue	1. Traditional and Government organizations with a mindset of saturation and not ready for change will find difficulty.
2	Program based Issues	1. Programs affiliated to Govt. universities cannot implement without Autonomy.
3	Faculty based Issues	1. Updating themselves and coming out from the comfort zone.
4	Student based Issues	1. Increased program cost and hence student fees.
5	Industry based Issues	1. Graduates may translate themselves as entrepreneurs than employees.
6	Societal based Issues	1. Technological and Process innovations can happen on large scale and which leads to social changes (positive).

## 10. CONCLUSION

Many futuristic and innovative educationists recently highlighted the importance of Liberal education in building a solid foundation for creative, skilled, and employable youths for building a sustainable and progressive society. The recently proposed national higher education policy of India 2020 is also stressed the importance and inevitability of liberal education both at secondary and higher education level to build an equitable and progressive country. Based on the conceptual studies and analysis it is argued that the Arts and design subjects are considered to be equally important along with core subjects in any professional education programs and contribute equally to build all-rounder who can be an asset of organizations in any industry. The higher education engineering model builds on the basis of STEAM which includes arts and design subjects as a part of a combined

curriculum for integrated development of students. The important contribution of arts and design subjects in value creation of Integrated Student development Framework for effective engineering education proposed in earlier work [6] is also described and advantages, benefits, constraints, and disadvantages of the STEAM model are analysed using ABCD framework under six determinant issues to showcase the importance of the newly proposed STEAM model of higher engineering education. It is obvious that the advantages and benefits override constraints and disadvantages.

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