

# Applied Learning as a Key Factor to Innovative Manufacturing

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## Abstract:

The world of manufacturing has changed drastically and tremendously during the last few decades due to the advancement of technology. In 2017, PwC global network of firm's base in the USA did a global study on 1200 companies and executives. Their result showed that 54% of the surveyed respondents struggled to align innovation strategies with their business strategies, and 72% of them said that they were not out innovating their competitors. On the other hand, 61% of the surveyed respondents embraced open innovation to generate new ideas.

The current needs for well-structured applied learning across the board is becoming a necessity to meet the ever-changing demand for creative design solutions to satisfy innovative manufacturing and improve human lives. Therefore, the upcoming new work forces must be well educated and appropriately trained from an early age. This requires a continues reviewing and upgrading of applied learning and applied design programs and curriculums. This paper focuses on 1) defining applied learning, applied education, applied design, and innovative manufacturing; 2) identifying the vital relationship between applied learning, applied education, applied design, and innovative manufacturing; 3) exploring existing programs that uses applied learning.

## Introduction

The world of manufacturing has changed drastically and tremendously during the last few decades due to the advancement of technology. In 2017, PwC global network of firm's base in the USA did a global study on 1200 companies and executives. Their result showed that 54% of the surveyed respondents struggled to align innovation strategies with their business strategies, and 72% of them said that they were not out innovating their competitors. On the other hand, 61% of the surveyed respondents embraced open innovation to generate new ideas. (1)

In the Mckinsley Global Innovation Survey for 500 companies, results indicated that although 84% of surveyed executives agreed that innovation is important to growth strategies, only 6% of them were satisfied with innovation performance. Moreover, 80% or the participants in that survey believed that current business models are at risk. (2)

As reported in the 2018 Digital Transformation Index, 50.4% of companies reported that technology disruption had a positive impact on their business for the last three years, while 30.7% reported that the impact of technology disruption had a negative impact on their business, and 18.9% reported no noticeable change.(3) Statistics show that current and future needs for well-structured applied learning is becoming more of a necessity to meet the ever-changing demand for creative design solutions to satisfy innovative manufacturing and improve human lives. Therefore, the upcoming new work forces must be well educated and appropriately trained from an early age to be innovative. This requires a continues reviewing and upgrading of applied learning and applied design programs and curriculums.

## Research Problem

The less usage of applied learning and applied education in innovative manufacturing and the reliance of traditional methods of educations resulted in many cases in the drop of the quality and innovation of newly manufactured products. Many of the current manufactured products fail in their designs and application due to low understanding of customers' needs and wants, and the fears marketing competition. Other products fail because their lack of using proper materials in manufacturing such products. These problems and more can be addressed solved when proper, knowledgeable, and well-trained designer, researchers, and marketers are involved in the creation of innovative

manufacturing.

## Signification of the Study

This study is designed to focus of the current needs for well-structured applied learning programs across the board from Kindergarten to grade 12, undergraduate, and graduate studies. Such need is becoming essential to be adapted to meet the ever-changing demand for creative design solutions to satisfy innovative manufacturing and improve human lives.

## Objectives

This paper focuses on 1) defining applied learning, applied education, applied design, and innovative manufacturing; 2) identifying the vital relationship between applied education, applied design, and innovative manufacturing; 3) exploring existing programs that use applied education.

## Research Limitations

This paper focuses on studying applied learning and applied education and clarifying their impact on innovative manufacturing.

## Research Methodology

To fulfill the objectives of this study, both the descriptive and analytical methods are used in this research paper.

## Definitions

To address the topic of this paper properly, it is important to define applied education, applied learning, applied design, and innovative manufacturing. Such understanding will pave the way to clear explanation to why applied learning, applied education, and applied design rather than academic education are quite vital to creative and innovative manufacturing.

## Education:

It is defined as "the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and generally of preparing oneself or others intellectually for mature life, and the act or process of imparting or acquiring particular knowledge or skills, as for a profession." (6)

## Academic Education:

Academic education and academic courses are focused on abstract reasoning to teach subjects. It is "generally defined as education which has learning as its primary purpose. This differs from Vocational education which

has a primary focus on “preparing to perform in a workplace”; or “life education” which may have a purpose of preparing to live better”. (7)

#### Applied Education:

It is defined as “an educational system that focuses on hand-on-experience that starts from Kindergarten to grade 12.” Teachers are often the leaders in this educational system and students are the followers. Applied education is often structured in a specific way and students’ contribution in it is directed. In fact, applied education and applied learning are used alternately and lead to the same meaning because students are guided by the educators and learn by doing things themselves. (8)

#### Learning:

It is “the process of acquiring new understanding, knowledge, behaviors, skills, values, attitudes, and preferences. The nature and processes involved in learning are studied in many fields, including educational psychology, neuropsychology, experimental psychology, and pedagogy” (4)

#### Applied Learning:

“Applied learning refers to an educational approach whereby students learn by engaging in direct application of skills, theories, and models. The applied learning activity can occur outside of the traditional classroom experience and/or be embedded as part of a course.” (5) Applied learning does not have to be limited to the school environment. On the contrary, it is better to be practiced in the real places of the studied matters and subjects. For example, it is better for students to learn about furniture mass production by going to a furniture manufacture and observe their line of mass production. Moreover, it is better for student to learning about building a chair by trying to build a real one. In a short term, it is “learning by doing.” This approach expect student to be engaged more in the creation of the programs and activities. That process get student at an early age to be active learners. Furthermore, it prepares them to move to the next level which is applied design. Next, they will be ready to enter the work force and be creative and innovative thinkers, problem solvers, and creative designers.

#### Applied Design:

“Applied Design, or traditionally known as “dec-

orative design” is an umbrella term used to define fields of industrial design, graphic design, fashion design, in which these days and age are evolved to the use of technology in creating design.” (9)

#### Manufacturing:

“It is the processing of raw materials or parts into finished goods through the use of tools, human labor, machinery, and chemical processing. Large-scale manufacturing allows for the mass production of goods using assembly line processes and advanced technologies as core assets. Efficient manufacturing techniques enable manufacturers to take advantage of economies of scale, producing more units at a lower cost.” Also, “Manufacturing is a value-adding process that allow businesses to sell finished products at a higher cost over the value of the raw materials used. It is often reported on by the conference board, and well examined by economists.” (10)

#### Innovative Manufacturing:

“Innovative manufacturing is the creation of cutting-edge technologies at a fast pace and for a reasonable price. Many of the companies that are in this business require precision and high tolerance parts that could go beyond the everyday run of the mill manufacturing that has been going on for ages.” (11)

**Types of Innovative Manufacturing:** there are four types of innovations when it comes to manufacturing: 1) incremental innovations, 2) disruptive innovations, 3) architectural innovations, and 4) radical innovations (Image 1). (12)

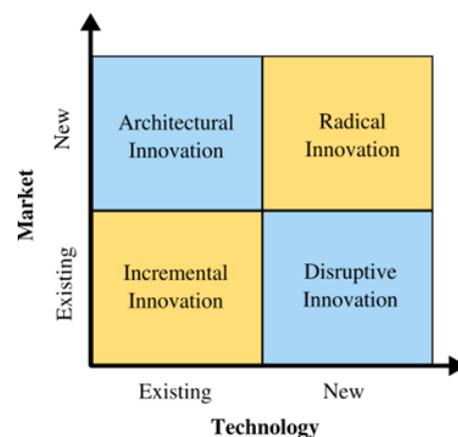


Image (1): The four types of manufacturing innovations. (1)

1. Incremental Innovations: This term refers to “a series of small improvements made to a company’s existing products or services. Generally, these low-cost improvements help further to differentiate a company from the competition while building on current offerings.” (13)
2. Disruptive Innovations: “It refers to a technology whose application significantly affects the way a market or industry functions. An example of modern disruptive innovation is the Internet, which significantly altered the way companies did business and which negatively impacted companies that were unwilling to adapt to it.” (14)
3. Architectural Innovations: “It refers to the innovation of an architecture of any product that changes or modifies the way various components of the systems link or relate to each other. The different components of the system can be changed within the improved architecture (lighter weight, the smaller form factor, etc.); however, the main technologies at a component level remain unmodified.” (15)
4. Radical Innovation: “It is an invention that destroys or supplants an existing business model. Radical innovation changes both the components and how the components interact and puts them together in a new way to create a unique solution.” (16)

### The Importance of Applied Learning in Practice

Applied learning is essential to future education. It prepares students to meet future challenges, satisfy employers need, and meet market demands and requirements. Furthermore, it advances students’ knowledge and sharpen their skills in many fields and in different ways (Image 2).



Image (2): Applied Learning in Practice. (2)

1. Applied learning encourages collaboration between teachers, students, and parents; as well as, collaboration among students themselves. This process is important for teamwork and for expanding students’ understanding and feedback regarding the studied issues or matters.
2. Applied learning gives students real opportunities to reflect on their learning subjects, exercises, and results. With a two-way communication between the students and their educators and among themselves, students reap the real benefits of the applied learning approach.
3. Applied learning promotes students with real opportunities to articulate their real understanding of the studied subjects and share their thoughts and contributions in that regard. This skill nourishes students’ self-confidence and self-respect.
4. Applied learning allows teachers to coach their students in multi different ways to open their minds and expand their knowledge. Furthermore, experienced students lead the less experienced one when working in groups. This healthy behavior allows for healthy social growth and smooth flow and exchange of information and experiences.
5. Applied learning exposes students to real life situations. They often learn in real places with real objects and practice real operations and experiments. Thus, the gap between what they learn and what is outside in the real world gets smaller. That gets them in every learning stage closer to their future world and prepare them greatly to their future tasks and careers.
6. Applied learning is structured around activities and tasks more than plain and dry knowledge. Learning activities and task motivate students to explore and to “think out of the box”. Moreover, it encourages them to be adventures in their journey seeking knowledge.
7. Applied knowledge promotes and encourage multiple roles and perspectives. In real life, successful people often have multiple roles at the same time and have to be open to different perspectives to expand their knowledge and experiences and reap the benefits of listening, sharing, and exchanging knowledge and expertise with other.
8. Applied learning provides tremendously useful opportunities for co-producing useful knowledge. When more than one head and brain are put

together, they often challenge each other, think wider, and dig deeper in their thought. They often reach solutions to problems or discover new things in ways that they couldn't accomplish if they were working as individuals.

9. Applied learning lead to expert performance. That is way people often say: "one cannot talk the talk until he walks the walk." This means that expert performance is a result of the compilation of the combination of knowledge and practices. Therefore, as students move from one learning level to another, they accumulate knowledge and skills that allow them in the future to be successful in their careers.
10. Applied learning provides excellence ways and methods for integrated assessment. As students advance in their studies, they are evaluated in more than one method of assessment. They are assessed based on their written, verbal, and practical performances. These three methods of assessment provide good, clear, and comprehensive evaluation of the learner's total performance.

### Teaching and Learning Tools

In order to practice successful applied learning

Grade	Design	Skills	Technologies
K-3	Design grows of natural curiosity.	Skills can be developed through play.	Technologies are tools that extend human capabilities.
4-5	Design can be improved with prototype and testing.	Skills are developed through practice, effort, and education.	The choice of technology and tools depends on the task.
6-8	Design can be responsive to identify needs	Complex tasks require the acquisition of additional skills.	Complex tasks may require multiple tools and technologies.
9	Social, ethical, and sustainability considerations impact design.	Complex tasks require the sequencing of skills.	Complex tasks require different technologies at different stages.

Table (1): Applied design, skills, and technologies for K-9 at the British Columbia's New Curriculum

As for grade 10-12 students, there are three main core competencies: 1) communication, 2) thinking, and 3) personal and social.

"The **Communication competency** encompasses the knowledge, skills, processes and dispositions associate with interactions with others. Through their communication, students acquire, develop, and transform ideas and information, and make connections with others to share their ideas, ex-

and applied teaching, it is important to have a variety of effective and practical teaching and learning tools. Such tools may include but not limited to the following: cards, charts, grids, pictures, drawing, photos, magazines, worksheets, mind-mapping, technology, video, digital material, data show, CDs, electronic program, gaming, dictionary, websites, the computer, the internet, e-books, intelligent board, blackboard, libraries, different kind of laboratories, workshops, studios, actual fields, real situations, online dictionaries, virtual tours of their latest exhibits, the real daily environmental things ... etc.(17) These tools will provide both the educators and learners a variety of educational opportunities to invest in for a better educational future, which is a key factor in in paving the path for innovative manufacturing.

### Examples of Existing Applied Design Programs

One of the comprehensive and successful learning programs is provided by the British Columbia New Curriculum. It is structured to provide solid applied design, skills, and technologies. It is designed based on specific competencies to fulfil students' needs from Kindergarten to grade 9 (Table 1) and from 10-12.

press their individuality, further their learning, and get things done. The communication competency is fundamental to finding satisfaction, purpose, and joy". (18)

"The **Thinking competency** encompasses the knowledge, skills and processes associate with intellectual development. It is through their competency as thinkers that students take subject-specific

concepts and content and transform them into a new understanding. The thinking competence includes specific thinking skills as well as habits of mind, and metacognitive awareness. These are used to process information from a variety of sources, including thoughts and feelings that arise from the subconscious and unconscious mind and from embodied cognition, to create new understandings.” (17)

“The **Personal and Social competencies** is the set of abilities that relate to students’ identity in the world, both as individuals and as members of their community and society. Personal and social competency encompasses what students need to thrive as individuals, to understand and care about themselves and others, and to find and achieve their purposes in the world.” (17)

At SUNY – The State University of New York at the USA is an example for undergraduate and graduate applied learning. At SUNY “applied learning refers to an educational approach whereby students learn by engaging in direct application of skills, theories, and models. Students apply knowledge and skills gained from traditional classroom learning to hands-on and/or real-world settings, creative projects or independent or directed research, and in turn apply what is gained from the applied experience to academic learning. The applied learning activity can occur outside of the traditional classroom experience and/or be embedded as part of a course.” (19)

### Research Results

It is important to highlight some of the research result which include:

1. Global needs for applied learning and applied education are increasing rapidly due to the rising demand for innovative manufacturing.
2. Innovative manufacturing is a product of well-structured applied learning and applied education.
3. Applied learning and applied educations processes and philosophies should be practiced in all field of science and knowledge because of their fruitful outcomes in satisfying human needs and wants.

### Research Recommendations

1. Current traditional educational programs and curriculums need to be revised and updated to meet the requirement of comprehensive applied

learning and applied educational programs and curriculums.

2. More in-depth research is needed to improve the relationship between applied learning as well as applied education with innovative manufacturing.
3. Specialists in education and manufacturing must be linked together and communicated with each other to improve both learning and educational along with manufacturing capabilities in this new age of technology.
4. New policies are recommended to secure successful applied learning and applied education due to their direct impact on innovative manufacturing in specific and on national and international economies in general.
5. Educator at all educational levels are encouraged to enhance their students’ educational experiences by implementing applied learning more in the teaching methods.

### Conclusion

Innovation is a combination of a system and a process. It starts with applied learning programs that grow in width, depth, and intensity from Kindergarten to grade 12. Next, it escalates to undergraduate and graduate programs. In every learning level, students are challenged to learn as individuals and as groups through self and group explorations. They are actively involved in developing their curriculums to advance their knowledge and enhance their skills. That all together create an accumulated body of knowledge and wealth of experiences to help students be as innovative in their thinking as possible. As a result, when grown student enter the different markets and work for various manufacturing industries, they enter as experienced adult with innovating minds.

### References

1. <https://www.pwc.com/us/en/services/consulting/innovation-benchmark-findings.html> Retrieved on 11/11/2020
2. <https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/how-we-help-clients/growth-and-innovation> Retrieved on 11/11/2020
3. <https://innovationcloud.com/blog/20-innovation-related-statistics-that-we-can-learn-from-in-2020.html> Retrieved on 11/11/2020

4. [https://www.google.com.kw/search?ei=puuuX\\_2tPKXRxgP0jbKABQ&q=definition+of+applied+education&oq=diffinition+of+applied+education&gs\\_lcp=CgZwc3ktYWIQA-RgAMgYIABANEB46BAGAEec6DQguE-McBEKMCEAOQkwI6BggAEAcQHjoE-CAAQDToKCC4QxwEQrweQDToICAAQC-BAHEB46CAGAEAgQDR AeULm2Avi25w-FgxvsBaAFwAngAgAGuAogB8h2SAQY-yLTE1LjGYAQCgAQGqAQdnd3Mtd2l6y-AEIwAEB&scient=psy-ab](https://www.google.com.kw/search?ei=puuuX_2tPKXRxgP0jbKABQ&q=definition+of+applied+education&oq=diffinition+of+applied+education&gs_lcp=CgZwc3ktYWIQA-RgAMgYIABANEB46BAGAEec6DQguE-McBEKMCEAOQkwI6BggAEAcQHjoE-CAAQDToKCC4QxwEQrweQDToICAAQC-BAHEB46CAGAEAgQDR AeULm2Avi25w-FgxvsBaAFwAngAgAGuAogB8h2SAQY-yLTE1LjGYAQCgAQGqAQdnd3Mtd2l6y-AEIwAEB&scient=psy-ab) Retrieved on 10/11/2020
5. <https://www.suny.edu/applied-learning/about/definitions/#:~:text=Applied%20learning%20refers%20to%20an,of%20skills%2C%20theories%20and%20models.&text=The%20applied%20learning%20activity%20can,as%20part%20of%20a%20course.> Retrieved on 10/11/2020
6. <https://www.dictionary.com/browse/education> 10/11/2020
7. <https://www.acs.edu.au/info/education/trends-opinions/academic-education-explained.aspx#:~:text=%22Academic%22%20Education%20is%20generally%20defined,learning%20as%20it's%20primary%20purpose.&text=This%20differs%20from%20Vocational%20education,of%20preparing%20to%20live%20better.> Retrieved on 10/11/2020
8. [https://www.google.com.kw/search?ei=faiVX-8eQC\\_PuxgP\\_5ojQBA&q=applied+education+define&oq=applied+education+define&gs\\_lcp=CgZwc3ktYWIQAzIGCAAQF-hAeOgQIABBHOGQIABATOGYIABAKEB-M6CAGAEByQHhATOGgIABAIEA-0QHICNuQRY2MQEYKfRBGgAcAJ4AIABngKIAZUNkgEDMi03mAEAoAEBqgE-HZ3dzLXdpegBCMABAQ&scient=psy-ab&ved=0ahUKEwiHw8C14YHtAh-VzqnEKHX8zAkoQ4dUDCA0&uact=5](https://www.google.com.kw/search?ei=faiVX-8eQC_PuxgP_5ojQBA&q=applied+education+define&oq=applied+education+define&gs_lcp=CgZwc3ktYWIQAzIGCAAQF-hAeOgQIABBHOGQIABATOGYIABAKEB-M6CAGAEByQHhATOGgIABAIEA-0QHICNuQRY2MQEYKfRBGgAcAJ4AIABngKIAZUNkgEDMi03mAEAoAEBqgE-HZ3dzLXdpegBCMABAQ&scient=psy-ab&ved=0ahUKEwiHw8C14YHtAh-VzqnEKHX8zAkoQ4dUDCA0&uact=5) Retrieved on 10/11/2020
9. <https://samudrathepuma.wordpress.com/2012/01/27/4/#:~:text=Applied%20Design%2C%20or%20traditionally%20%E2%80%9Cdecorative,of%20technology%20in%20creating%20design.> Retrieved on 10/11/2020
10. <https://www.investopedia.com/terms/m/manufacturing.asp> Retrieved on 10/11/2020
11. <https://www.usimn.com/what-is-innovative-manufacturing/> Retrieved on 10/11/2020
12. <https://www.northeastern.edu/graduate/blog/what-is-incremental-innovation/> Retrieved 11/11/2020
13. <https://www.northeastern.edu/graduate/blog/what-is-incremental-innovation/> Retrieved on 11/11/2020
14. <https://www.investopedia.com/terms/d/disruptive-innovation.asp> Retrieved on 11/11/2020
15. <https://www.procto.biz/architectural-innovation> Retrieved on 11/11/2020
16. <https://searchcio.techtarget.com/definition/radical-innovation> Retrieved on 11/11/2020
17. <http://www.bchmsg.yolasite.com/teaching-tools.php> Retrieved on 10/12/2020
18. <https://curriculum.gov.bc.ca/competencies> Retrieved on 12/11/2020
19. <https://www.suny.edu/applied-learning/about/> Retrieved on 12/11/2020

#### Images

1. <https://techblog.constantcontact.com/software-development/types-of-innovation/> Retrieved on 11/11/2020
2. [https://blogs.shu.ac.uk/graduatecapabilities/2017/01/18/welcome-2/?doing\\_wp\\_cron=1605369431.7352728843688964843750](https://blogs.shu.ac.uk/graduatecapabilities/2017/01/18/welcome-2/?doing_wp_cron=1605369431.7352728843688964843750) Retrieved on 11/11/2020

#### Tables

1. <https://curriculum.gov.bc.ca/curriculum/adst> Retrieved on 11/11/2020