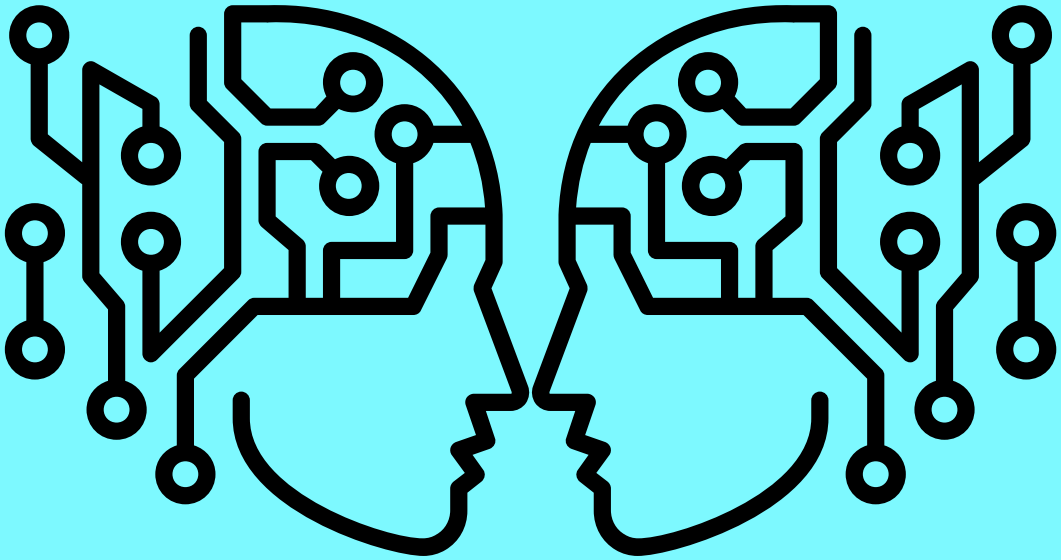
The *Myth* of TVET & RnD



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TVET and R&D

Technical and Vocational Education and Training (TVET)

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Preface

This can be written with Allah's (SWT) blessing. This book was inspired by "The Myths of TVET and RnD". Technical and Vocational Education and Training (TVET) is a system of education and training that prepares scholars for particular jobs by emphasising hands-on experience. In contrast, Research and Development (R&D) create new information and concepts. Innovation creates new things or improves existing ones. This book gives writers at polytechnic and community colleges a forum to publish their work.

Contrary to popular belief, The Myth of TVET and RnD doesn't focus solely on TVET. The book's nine chapters offer various viewpoints. As the Chapter 1 suggests, the author emphasises knowledge intake and processing for future application. Chapter 2 teaches how packaging affects a buyer's decision to buy. In the Chapter 3, the argument shows a link between a well-presented product and happy customers. In Chapter 4, we learn the importance of customising designs. The Chapter 5 explains how the proper method can make something from cheap sources and discusses the value of credentials in today's market. The Chapter 6 describes making environmentally friendly aircraft fuel from inexpensive and plentiful natural resources.

In the meantime, the Chapter 7 covers online education and training. In the Chapter 8, you'll find modern presentation features to improve traditional methods. So, a product's legacy can continue to serve consumers in the future. The final chapter explains why evolution is necessary to survive and thrive over time. It is hoped that the book's chapters will provide new insights and dispel common myths about TVET and R&D. We hope it helps those in vocational and technical education.

Chief editor,

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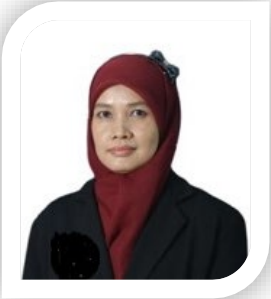

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CHAPTER 1: Master The Art Of TVET With The Effect Of Using Screencast On Different Learning Styles

Muhammad Razuan Abdul Razak, Mohd Saharudin Abuludin

Introduction

Using multimedia tools in the classroom can create a more engaging and effective learning environment for students. A meaningful transfer of knowledge is possible through efficient instruction and study. If correct and appropriate instructional materials are provided, the process of passing on knowledge from teacher to student is simplified.

This chapter delves into the possibilities of using screencasts in the classroom. Screencasts are videos that capture all or part of a computer's display. Voices or narrations can be added to the video to provide more context for the events on screen. Screencasts are pretty helpful when training someone to utilise the application programme independently.

Different students in the same course may end up using this screencast in different ways. Other people have different perspectives when picking out the relevant data for the study. Learning preferences, typically established at a young age, play a significant role in the selection process. Consequently, this book chapter will discuss how the presentation principles of various multimedia elements in the screencast affect the real-world skills of people with different learning preferences.

Screencast and Software Applications

In 2005, Jon Udell popularised the screencast under his name. In this case, we're talking about a digital video in which segments or entire screenshots of a computer's interface are displayed. Include a voiceover or written description of the scene's events to complement this digital video presentation. Its popularity as a teaching tool means that people with a wide range of educational backgrounds use screencasts. Because of

this, screen casting is a valuable tool for demonstrating the operation of computer applications.

Compared to traditional text, Screencasts allow for more efficient information transmission and processing in the brain's working memory. Let's examine the steps involved in decoding printed text. We find that the information must first be received through the visual channel. Also competing with these visual channels are any accompanying illustrations or visuals found in the printed text. Indirectly, this procedure burdens working memory, particularly the visual channel. Consequently, a screencast can reduce the cognitive load on visual and verbal channels, allowing for more efficient information processing.

One issue that needs to be addressed is whether or not all students in a given class will gain knowledge from the screencast creation. Even from a purely aesthetic perspective, no screencast stands out from others. This is because human working memory has a finite capacity. Everyone, indeed, has their own unique set of memory limitations and strengths. As the cognitive load on an individual rise, the latter's working memory capacity rises until it is exhausted; as a result, the individual's learning is impeded. Therefore, for individuals to effectively process that information, instructional material designers must create materials that can lessen the burden on working memory. It can be done by decreasing the amount of external processing required.

Obstacles To The Learning Process

What we mean by "external processing" is incorporating data from sources outside the classroom that complements core course concepts. The external processing load can be minimised in the design of instructional materials by adhering to five principles: coherence, signalling, redundancy, spatial contiguity, and temporal contiguity. Suppose people spend less time processing irrelevant external information. In that case, they'll have more mental bandwidth for the message they're

trying to convey. We want to know if the screencast presentation's goals can be met with or without the verbal assist factor, whether narrative and text serve as external information or essential information.

Despite the widespread belief that using screencasts with different presentations improves retention, research has shown that this is not always the case. Working memory will be heavily taxed by its use because of the wide variety of information that must be processed simultaneously. Students can focus on more critical material with less to keep track of in their working memory. Therefore, it is essential to consider personal acceptance for learning when designing a screencast with multiple approaches.

In the research on the efficacy of instructional materials, consideration of design and individual differences in learning styles is crucial. Research in psychology and education has revealed that people vary significantly in their capacity for processing new information. This means that the person must be able to locate, file, and retrieve the information they have been given. Therefore, it is essential to consider different learning styles when creating instructional materials like screencasts.

The Theory Of Multimedia Learning Cognitive

The central premise of Multimedia Learning Cognitive Theory (MLCT) is that people always strive to establish connections between various forms of media. The three assumptions upon which MLCT is founded are the dual-channel assumption, the limited capacity assumption, and the active processing assumption. Regarding working memory, the principle of the dual-channel assumption refers to both the auditory and visual channels. In turn, the concept of working memory's finite size is what is meant by the principle of the assumption of limited capacity. Concurrently, the principle of active processing assumes that meaningful knowledge can be constructed when one pays close enough attention to relevant materials. Creating a

well-organized set of mental models and incorporating previously gained knowledge are essential steps in this procedure.

Sensorial, working, and long-term memory are the three types of storage used by MLCT. This short-term memory retains information only about 0.25 seconds after it has been presented. As opposed to this, working memory will pick and choose which bits of data from sensory memory to process and incorporate. Information processing and delivery take less than 30 seconds, but it can handle only small chunks of data simultaneously. Finally, information is stored as a schema in long-term memory for an indefinite time. Memory operation according to MLCT is illustrated in Figure 1.

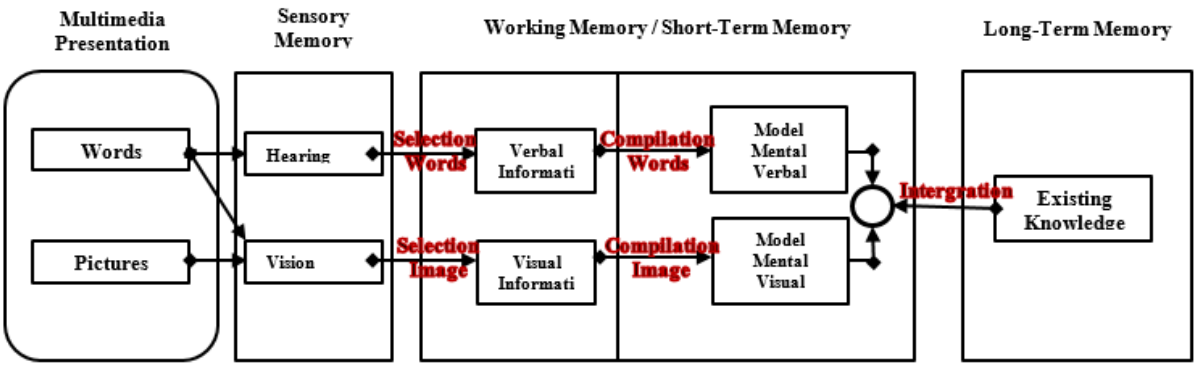

Figure 1: Cognitive Theory of Multimedia Learning Mayer

This book chapter discusses the five principles—coherent, signalling, redundancy, spatial touch, and temporal touch—that comprise the framework for Reducing External Processing. Consequently, it is believed that minimising non-essential processes comes first, followed by promoting essential processes and, finally, the development of generative processes. This is so because sensory memory undergoes this transformation before it is stored in working and long-term memory. Table 1 summarises these five guiding principles.

Table 1: Five principles of Reducing External Processing

Principles of Instruction	Description
Coherence Principles	Students will learn better if the external elements are removed. Example: Issuing interesting but irrelevant statements or graphics is used.
Signalling Principles	Students will learn better if a signal for processing information is given. Example: Place a signal, sign, or affirmation of an essential piece of information to the student to indicate what needs to be done and how to organize it.
Redundancy Principles	Students will learn better if the information is not provided in the same sensory channels. Example: **Redundancy**, print text, and narration are presented simultaneously with the screen display. **No Redundancy**. The narration is presented simultaneously with the screen display.
The principle of spatial contact	Students will learn better if the text prints are close to the corresponding graphics section to reduce the need for visual scanning. Example: Text is placed near the same important part of the illustration (on paper) or animation (on the screen).
Temporal Relationship Principles	Students will learn better if narrative and animation are displayed simultaneously to reduce memory holding. Example: Narrations and animations are presented simultaneously rather than separately, either text presentations first, then animations or animations first, then text.

VARK Learning Style

Table 2 presents the VARK (Visual, Aural, Read/Write, Kinaesthetic) learning style model, the second theory covered in this book chapter. According to the VARK framework, people learn in four distinct ways. People with visual learning styles benefit most from visual aids like charts, diagrams, and pictures. Learning through

conversation and listening is well-suited to the aural (auditory) mode. People who learn best through reading and writing prefer taking notes during class by reading and writing printed or written words and using those words as examples. Finally, those who learn best through kinaesthetic means actively engaging in the tasks, whether touching, feeling, seeing, or listening. Consequently, the developed instruction strategies should be more student-centred to accommodate the variety of learning styles present at once.

Table 2: Five Principles in Reducing External Processing.

Mode	Learning Process Tendency
Visual	Learn through viewing pictures, graphs, videos, and graphics. It is not possible to copy complete notes during the lecture.
Aural	Learn through listening methods through speech or from music, discussion, and description
Read / Write	Learn through printed words and text. This mode prefers the presentation of lectures in the form of text or writing.
Kinaesthetic	Learn through experience from learning activities carried out by themselves. This mode prefers skilful, practical learning in a natural setting.

The screencast's most vital data will be gleaned from the available options for words and images. The audio component, in the form of narration, will be chosen by the auditory system. In contrast, the visual system will choose the visual element as a screencast with accompanying text. These words and pictures will then be pieced together in the individual's working or short-term memory to form a mental model that incorporates the person's prior knowledge. The plan calls for the individual's working or short-term memory to be supplemented by prior knowledge, after which the resulting database would be stored in the individual's long-term memory. Individuals can re-establish the framework by resolving problems presented in practical ability examinations.

Which of the four screencast-based teaching approaches has the potential to significantly influence a learner's policy to take in and use knowledge? Screencasts' varied presentation modes will likely impact how people's information processing styles develop. Each of the four methods may place more or less strain on working memory depending on the learner.

Previous research has shown that screen casting and narration are particularly useful when creating unique schemes. However, there is still a discrepancy between the results of studies examining the effect of varying teaching modalities on students. In this way, the screencast's design can influence the formation of a scheme in long-term memory by aiding in constructing the correct mental model.

The individual's learning style is also likely to play a role in forming the mental model. An individual's approach to learning is shaped during childhood and persists into adulthood. People tend to lean toward the learning approach they found most successful as children. Therefore, more informed decisions can be made regarding developing effective instructional strategies by identifying the most prevalent individual learning styles.

All four of these screencast layouts lessen the load on working memory (also known as short-term memory) by cutting down on the amount of external processing they require. To this end, the screencast's processing and combination of text and narrative should have the most significant possible effect on the learner's activities. The information it contains will aid the individual in creating an accurate mental model and, ultimately, a comprehensive and efficient scheme for long-term memory.

Conclusion

Using a screencast as a teaching and learning tool can significantly improve students' ability to learn and apply the software skills they are being taught. Screencast videos can be thought of as a teacher who instructs students capable of producing content with the same level of delivery as the lecture itself. Also, it's useful for people

as a supplement to their efforts to learn application software independently. Previous research has established that screencasts can be supplementary instructional resources. However, it has not been demonstrated that its use is effective for all subgroups within the same class. Each person has a slightly different way of filtering out what isn't essential and focusing on what is. Knowledge is shaped and translated into easily understandable forms in various ways, including through the efforts of individual learners. Developers of training materials, especially those concerned with examining software programs, must conduct individual group assessments before creating training materials.

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CHAPTER 2: How Green Is Your Green Technology In Food Packaging Materials?

Rohaya Mohd Saleh, Suhaini Mat Daud

Introduction

Food packaging is an operational process that aims to protect the product from the environment and provide useful information to consumers before they decide to purchase the product. The packaging also gives a specific identity to the product in terms of its durability, marketability, suitability of the product to the latest lifestyle and aesthetic value that the product has. Good packaging will produce food products that can last longer in the natural environment, thus bringing profit to food/drink manufacturers.

Figure 1: Examples of product packaging

The packaging not only serves to provide physical protection but also guarantees the cleanliness of the products to be eaten, helps to reduce the waste of dumping products on the farm and facilitates the transportation of these products from the factory to the supermarket. Packaging is also a very effective marketing agent for attracting customers. The silent-salesman properties of this food wrapper can entice customers to buy it.

Today, packaging focuses heavily on wholesome packaged products. It's well suited to today's lifestyle that averages all users of all ages who are chasing time, want to enjoy more edible food, quickly prepared and fill the stomach for a longer period. If earlier, packaging used a lot of materials from tin, aluminium, paper, glass, ceramics and plastic, now the use of wasted materials or the term secondary material become the choice of food packaging manufacturers. It is now known as green technology in food packaging.

Green Technology

Green Technology is a term recently introduced to the world concerning the optimal use of raw materials. It is also known as sustainable technology. Efforts towards upholding green technology in food packaging have been undertaken since immemorial. Here, food packaging manufacturing operators use wasted materials as the main ingredient. As previously reported, examples of the use of wasted materials are the use of agricultural waste (ligninselulose), nano cellulose, leaves of plants and chitosan. The question here is, why is the use of wasted ingredients becoming the main ingredient in food packaging becoming a trend nowadays?

Green Technology Advantages/Privileges in Food Packaging

Using wasted materials to produce food packaging can reduce the use of non-renewable sources, thus reducing plastic-based waste. This is because plastic is the main base material in packaging made from non-renewable petroleum sources. Using wasted materials from processing waste also benefits the company because it is a cheap resource, can reduce the cost of supply of raw materials and reduce difficulties in farm management. This can thus optimize the use of agricultural residue products.

Using wasted materials in processing also has better biodegradable (naturally decaying) characteristics than plastic-based packaging (Patel, 2020). This is because the materials used are based on natural ingredients that tend to decay more easily than petroleum-based materials that are feared to threaten the ecology of nature. Food

packaging produced from this sustainable technology consists mainly of polymer compositions such as carbohydrates, proteins, glycerol, and sorbitol require a shorter period to decay.

Content of Green Technology-based Food Packaging Materials

According to Associate Professor Dr Siti Hajar Othman, Lecturer from University Putra Malaysia, the contents of food packaging materials made from natural ingredients can consist of materials as in the table below:

Table 1: The Contents Of Food Packaging Materials

Natural Materials	Resources	Example /Property
Main material	Kanji, cellulose, chitosan, seaweed, gelatin, gluten, alginate, collagen	Corn, rice, yam, potatoes, tapioca
Plasticizing agent	Glycerol, sorbitol, xylitol	Elastic, flexible wrappers
Filler material (filler)	Chitosan, cellulose, zinc oxide	The wrapper is more resistant to pressure, heat, water, air

Food packaging materials made from wasted/secondary foodstuffs are a smart alternative in addressing the issue of dumping processing waste in the industry. Apart from its biorosotic properties, it can also be eaten and digested by the body. Nevertheless, this packaging also has unresolved flaws.

Application of Green Technology values in the Minds of Society

Today, the application of knowledge and value of the importance of green technology in the minds of the community is also intensified through the development of research at the university as well as the involvement of the industry. This is evidenced by the production of disposable plates produced through the use of tapioca starch, the use of banana peels in the production of food wrappers,

Issues and challenges

The use of this packaging actually requires external packaging for transportation purposes which certainly has better safety and durability features

compared to it. This is because food wrappers, biodegradable and edible, also have relatively weak resistance to environmental moisture or drastic temperature/moisture changes when transferred from location to location. Of course, it goes against the original goal of reducing waste dumping based on non-renewable resources. It is difficult to decay naturally and is less friendly to nature.

Suggestions

Knowledge, understanding and awareness of the potential use of food processing waste materials as the main ingredient in food packaging should be applied in the school curriculum. Knowledge of this can be included in the syllabus of the Food Packaging. Labelling courses offered at Community Colleges, Polytechnics and TVET institutions so that innovation in this resource-based food packaging can be seriously intensified by future TVET graduates.

Conclusion

The food packaging revolution will continue to evolve in line with the changing minds of the people pursuing progress. The use of materials resulting from food processing waste is a desirable alternative to the optimal use of raw materials, reducing waste and helping to eliminate the problem of pollution of nature for the sustainability of human life.

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CHAPTER 3: Empirical Evidence Of The Impact Of Packing On Relationship Quality Formation

Suhaini Mat Daud, Rohaya Mohd Saleh

Introduction

Businesses in today's highly competitive market always look for new and improved ways to stay ahead of the pack. Branding is a powerful competitive weapon. An established brand can keep its customers satisfied by forging a bond with them based on mutual trust and expertise, allowing for seamless brand-customer interactions. As a result, practitioners and academics have paid much attention to the benefits of relationship quality as a tool for improving corporate performance and profitability. Quality in relationships is a tactic that may be utilised to make an impression on customers for the long haul, benefiting businesses and their brands. The strength of customer relationships can also be leveraged to raise customers' aggregate spending, boosting the company's bottom line. However, looking at relationships from the branding standpoint, quality is in short supply, especially in Asian regions.

The way a product is packaged is a strong indicator of its quality. It is well-established that the packaging a product comes in can significantly influence how customers behave. Some research suggests that consumers are more likely to buy a product if they have a favourable impression of its quality and worth, thanks to its attractive packaging. However, empirical studies of how packaging affects relationship quality are few and far between. The opinions of consumers were prioritised in earlier studies of packaging. The purpose of this book chapter is to discuss the effect of packaging on the quality of relationships, especially as it relates to the food products of small and medium-sized enterprises (SMEs) in Malaysia. Choosing a food product from a small or medium-sized enterprise (SME) depends on the intensity of the competition from international brands.

Relationship Quality

Losing customers is notoriously difficult and expensive. This is because it costs five times as much to attract a new customer as it does to keep an old one. Because of this, businesses work hard to establish and maintain meaningful connections with their clientele to inspire loyalty and boost sales and profits. Establishing strong bonds with clients is crucial to the success of any business since it provides a distinct advantage over rivals that can be maintained over time and ultimately leads to increased sales.

The phrase "relationship quality" refers to a customer's overall judgment of the quality of his or her connection to a particular brand. In particular, when customers have a high relationship quality with a brand, they trust its honesty and reliability and are optimistic about its future success. Studies done in the past have shown that various components make up a quality relationship. However, only trust, commitment, and contentment with the brand were considered in this book chapter. This medium is because scientists commonly use these three factors to evaluate the health of interpersonal bonds. Also, the researchers emphasised the importance of trusting the brand, being committed to the brand, and being satisfied with the brand as the three primary components of a quality connection. Customer confidence in a brand exists when consumers know they can count on it to fulfil their needs and expectations. When we talk about brand loyalty, we mean the customer's persistent yearning to create and sustain an ongoing relationship with the brand. Brand satisfaction, "the degree to which a company's goods or services live up to the expectations of its customers," is widely recognised as a crucial indicator of relationship quality.

Packaging and Relationship Quality

According to experts in the field of marketing, packaging is one of the most effective ways to grab customers' attention and gain an edge over the competition. A

product's ability to stand out in a crowded marketplace is often attributable to its packaging. Products with distinctive packaging are more likely to be spotted by consumers as they quickly scan the shelves. Packaging is how a product is identified, and a brand's identity and worth are communicated to consumers. According to the published literature, several studies have examined factors contributing to a quality relationship. Relationship quality is correlated with the care taken when packaging a gift.

The impact of packaging on relationship quality in the context of SMEs in the food sector has been the subject of several studies, albeit few. In earlier studies on SMEs' use of packaging in Malaysia, researchers mainly looked at how customers felt about the packaging and how the system for SMEs' food packaging evolved.

Scientists have shown that how products are packaged might affect how satisfied customers are with their purchases. Consumers' feelings about a product can be affected by factors including the packaging's technical, functional, and instructive qualities. However, some researchers found that the link between packing and customer happiness is weaker than others. In this article, we identify this crucial factor in relational success. Brand trust, satisfaction, and commitment are shown as a three-dimensional continuum in Figure 1, with the independent variable of packaging as the dependent variable.

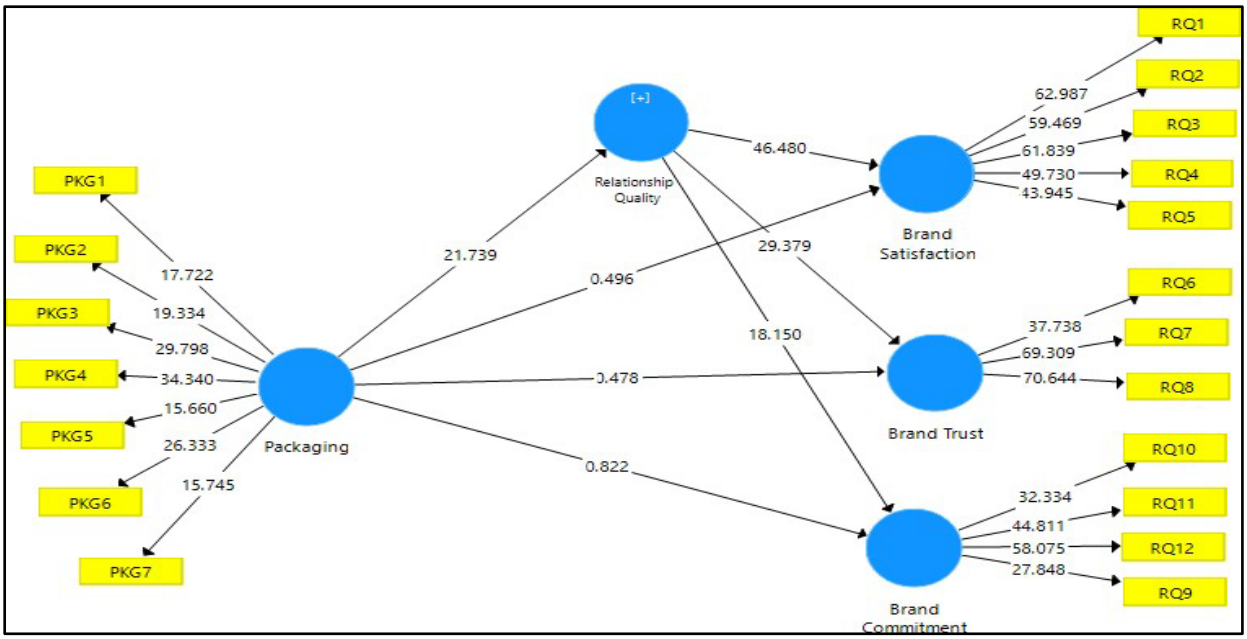

Figure 1: Research Model

Conclusion

Packaging was found to have a highly favourable impact on all measures of relationship quality. Customers are more likely to be satisfied with a product and its brand when they perceive that the product has good packaging. Other research has shown that the quality of the relationship between a consumer and a brand can be improved by using creative and original packaging for the product. Relationship quality is reflected in several dimensions, one of which is contentment, boosted by thoughtful packaging. Packaging serves marketing and logistical purposes in the food industry, including confining, protecting, preserving, and transporting food. To increase sales and keep existing consumers happy, we suggested that food businesses increase the value of their products by investing in more attractive packaging. The value may be added to items, and profits can be increased using aesthetically pleasing and functionally novel packaging.

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CHAPTER 4: Integrating Mechanical R&D In Embracing TVET: Design & Simulate Before Aad Fabrication

Mohd Hazwan Mohamed Norli, Norisza Dalila Ismail

Introduction

In recent years, numerous noteworthy improvements and advances have been made in the medical management of cerebral palsy (CP). A cerebral palsy is a group of conditions with variable severity that experience certain developmental features in familiar Children. It is with spastic or dyskinetic CP who struggle to stand still and spend most of their time seated in a wheelchair. In addition, it affects children's motor function and has more psychological difficulties than normal children. Therefore, a suitable headrest as an Adaptive Assistive Device (AAD) to maximize independence and functionality in a sitting position is a good addition. This book chapter aims to analyze the effects of material properties density in selected 3D printing material in an adjustable headrest. It will discuss total body involvement in CP children and fabricate the adjustable headrest using the chosen material in a 3D printer.

Children with cerebral palsy can have several problems, such as muscle weakness, stiffness, slowness, shakiness, and difficulty balancing. The problems' severity can range from mild to severe. A good sitting position is required for CP children to stabilize their heads and trunk together with alignment. To achieve a stabilized resting position, reasonable postural control is needed. However, the condition was also associated with functional neuromuscular alterations, contributing to the lack of head control in the resting position. Thus, a suitable headrest with improved functions such as attach ability, economically inclined and user friendly is essential to improve their sitting position and posture. For the headrest to accommodate all shapes and sizes. A clamp mechanism is used to secure the headrest to any wheelchair. A buckle strap is optional to tighten the headrest to the user’s head.

Material Properties

There are five 3D printing materials considered, specifically ABS (Acrylonitrile Butadiene Styrene), Nylon (Polyamide), PETG (Polyethylene Terephthalate), PC (Polycarbonate) and PLA (Polylactic Acid). A set of predetermined loading conditions is applied to the headrest, given by 1.8 kPa (Franz, 2012), 5 kPa, 10 kPa, 15 kPa, 20 kPa and 25 kPa, respectively. Mechanical properties are summarised in Table 1. All materials are subjected to a loading condition of 1.8kPa as most materials failed at 5kPa, rendering any analysis for other pressures null.

Table 1.1 Mechanical properties of selected materials

Material	Young Modulus (MPa)	Poisson ratio	Yield strength (MPa)
ABS	2.3	0.36	35.9
Nylon	2.0	0.35	39.0
PC	2.2	0.43	53.0
PETG	3.3	0.39	27.8
PLA	2.6	0.36	62.1

Loading Conditions

A set of predetermined loading conditions is applied to the headrest. Distributed pressure at the headrest is assigned at 1.8 kPa, representing the average load during the headrest. Increments of pressure magnitudes of 5 kPa, 10 kPa, 15 kPa, 20 kPa and 25 kPa are also considered to predict the product's safety at higher impact load. Figure 1 illustrates the pressure loading at the headrest and fixed constraint at the distal end.

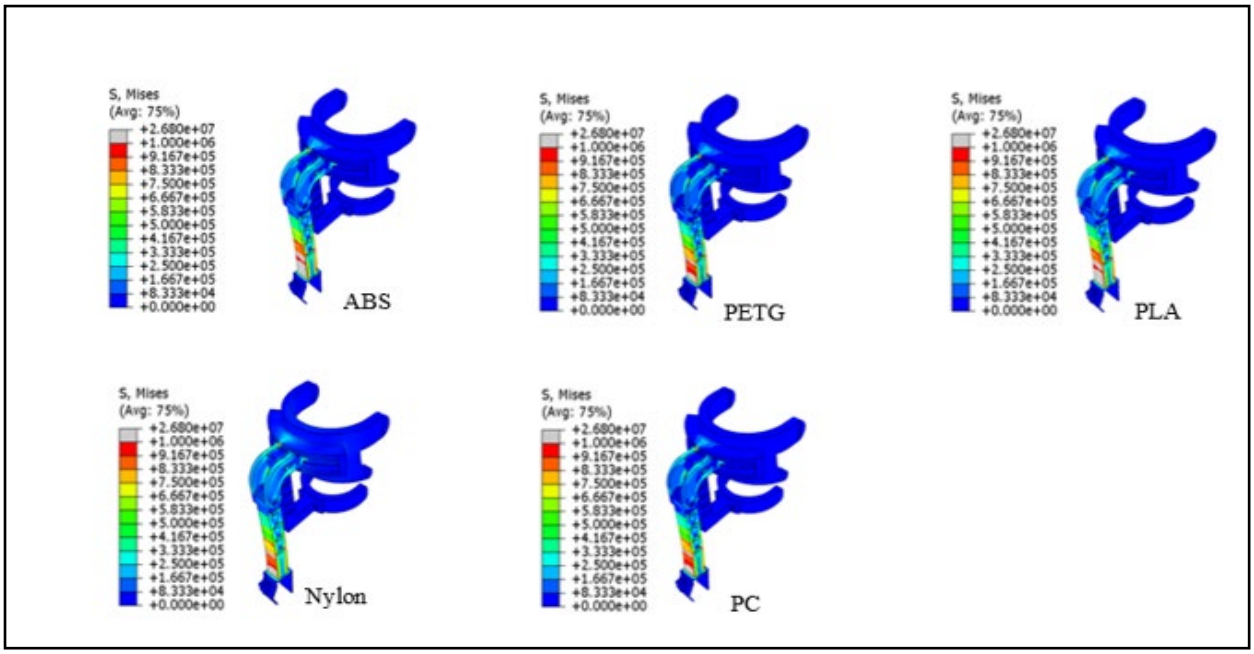

Figure 1: Stress Distribution In The Headrest

3D Printing

The headrest was fabricated using a 3D printer. The finalized design CAD files were converted to an STL (Standard Triangle Language) file format before calibrating the process parameter in a slicer software, in this instance, Ultimaker Cura 4.3. Processing parameters such as extruding temperature, bed temperature and infill speed were calibrated to achieve a uniform layer height of 0.24 mm. The infill density used is also reduced to 10%, as an infill density between 10% and 20% will suffice for basic 3D prototypes (Bhatia, 2017). This is corroborated by Redwood, 2017, for a prototype where the form is essential. It can be printed with very low infill (10%), saving significantly on cost and time. Fabrication is completed using the Ender Creality CR-10S5 3D printer to conclude the process.

Effects Of Material Selection

Five 3D printing materials, namely ABS, Nylon, PETG, PC and PLA have been subjected to a load of 1.8 kPa. Table 2 shows the stress and deformation distribution in ABS, Nylon, PC, PETG and PLA. It can be established that PETG, with 25.45 MPa, has the lowest stress compared to other materials utilized and is most likely the least

to yield under pressure. The material that will be most likely the fastest to yield under pressure is ABS, with 28.80 MPa. This is in line with Jones, 2009 where it is indicated that an immense Von Mises stress implies the material is closer to the yield point, thus exacerbating fracture. A low value denotes material is least likely to fracture due to the material being closer to the yield point.

Subsequent FEA analysis yields the stress distribution in the headrest, as shown in Figure 1. The colour contour scale shows blue as the minimum stress and red as the maximum stress, with a range of values from 0 to 26.80 MPa. The affected area is the adjustable mechanism of the headrest, where the maximum stress is represented by the more prevalent red colour in PETG.

The more prevalent blue colour denotes that the material has a minimum Von Mises stress distribution, thus, does not yield under the loading pressure applied. While the red area shows the maximum stress endured, the material has not undergone failure. Failure or yield is represented by the colour grey. Theoretically, failure happens when the Von Mises stress exceeds the value of yield strength of any given material. To show the grey colour in the analysis, the portion of the colour scale is adjusted to distribute evenly across the stress range, the value being lower than 26.80 MPa. With the adjustment added, it shows that the height adjustment part of the headrest will yield under pressure at the specific grey colour contour.

It is established within the confines of deformation that ABS will most likely yield under pressure with a displacement of 0.9964 mm as opposed to Nylon with 0.6017 mm. As ABS is known for its strength and printability (Greene, 2016), the high deformation substantiates the fact. The FEA analysis in Figure 2 clearly indicates the deformation the materials can withstand when subjected to pressure. The principle of colour contour affected by Von Mises stress is applicable here. The deformation can easily be distinguished where the exact place failure will occur because the more general red colour contour can clearly be seen.

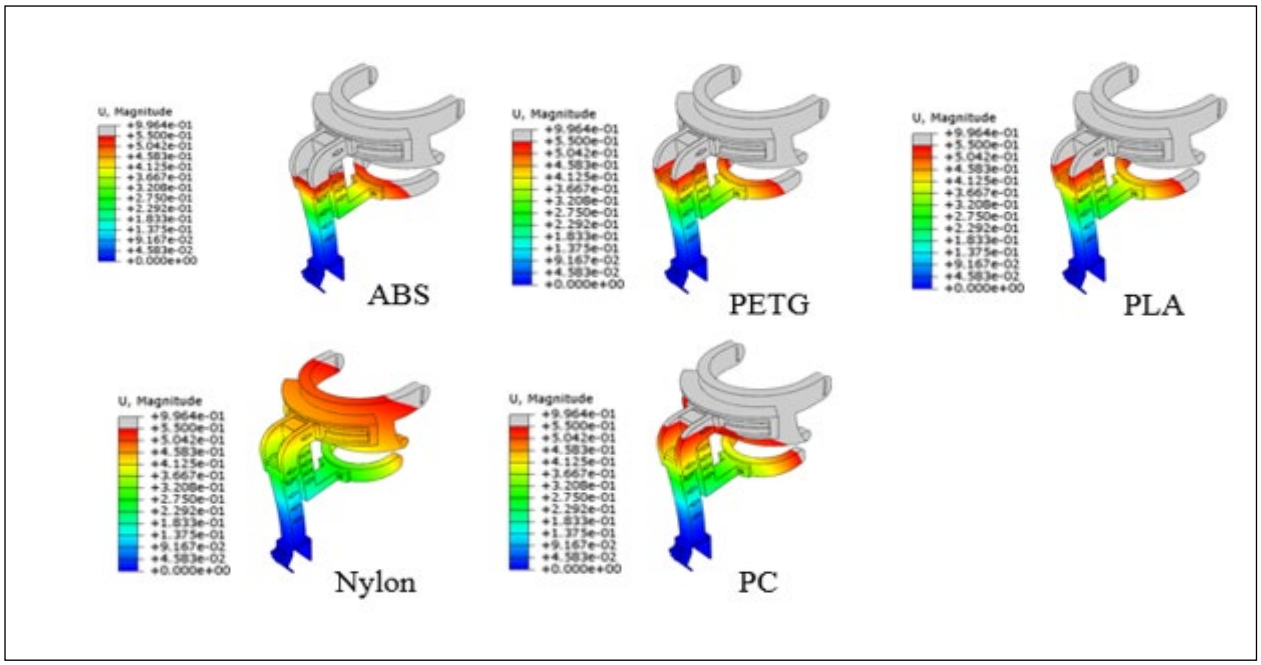

Figure 2: Deformation In The Headrest

Discussion And Conclusion

The improvement of adjustable headrests for total body involvement in CP children has been successfully analysed and fabricated. Consequently, the effects of material properties in ABS, Nylon, PC, PETG and PLA have been determined and evaluated. Regarding Von Mises stress, PETG has the lowest stress at 25.45 MPa. It made for an excellent material for high-impact mechanical parts. Subsequently, concerning deformation, ABS, with the highest deformation of 0.9964 mm, is the least likely to yield under pressure, owing to its strength. By referring to the results, it is always beneficial to do the design and simulate the analysis at the earlier stage so that better assumptions and convincing arguments can be listed before proceeding into the developing or fabricating stage.

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CHAPTER 5: The A - Z Of Sustainable Landscape Design (Portable Ferro Cement Waterfall)

Azhar Yaakub, Mohamad Imran Hassan, Sulianah Sani

Introduction

Sustainable Landscape Design is a design that meets the needs of today's generation without neglecting the ability of future generations to meet their needs. In a nutshell, Sustainable Landscape Design is a development that meets current and future needs to achieve continuity and economic, social and environmental development for the sake of common well-being without compromising the needs of the next generation. Sustainable Landscape Design is a development that balances economic growth with social and environmental requirements. The aspects of sustainability for planning purposes consist of ecological, economic, social, cultural, agricultural, environmental and urban sustainability. The community and each individual are also responsible for contributing to sustainable design. Among the agendas that can help sustainable development is to practice recycling to reduce waste disposal and thus reduce environmental pollution. At the same time, it is possible to avoid waste through the use of recycled materials.

History Of Ferro Cement Construction

Ferro cement is a distinctive type of mortar structure (a mixture of sand, cement and water) that is thinly plastered on a Reinforcing Fabric of Steel (BRC). Thus, the term Ferro cement means a combination of ferrous (iron) and cement substances.

According to the history of Ferro cement, it was pioneered by Joseph Louis, a Frenchman, in 1848 and was patented in 1852. Using the Ferro cement method, he has built several structures, such as artificial mushrooms, flower pots and benches. In Australia, the Sydney Opera House building was constructed using Ferro cement. Railway stations and mosques are built in Indonesia and India utilising this technology. In Malaysia, FIN Malaysia (Ferro cement Information Network), based at

Universiti Pertanian Malaysia, is the institution responsible for introducing and developing this technology since 1979.

Ferro Cement Construction Materials

The Ferro cement composite consists of mortar (a mixture of sand, cement and water), Reinforcing Fabric of Steel (BRC), steel mesh and old newspaper, which has been shaped according to the desired structure. Mixing should be done carefully to ensure that the structure of the Ferro cement can meet the desired quality.

Figure 1: Materials Used To Produce A Ferro Cement Construction Consisting Of Reinforcing Fabric Of Steel (BRC), Steel Nets, Old Newspaper, Cement And Fine Sand

Figure 2: Construction Of Hardscape Furniture Built By Using The Method Of Ferro Cement

Construction Of Ferro Cement Waterfalls Using Conventional Methods

Constructions of Ferro cement waterfalls are widely used to beautify landscape environments. The function is to be used as a decorative element of the landscape to brighten up the landscape scenery. The primary material for constructing this Ferro cement structure is steel reinforcement, which forms the waterfall's basic shape. Then the structure is double-wrapped by using a steel net to strengthen the structure more. After that, old newspaper paper is stuffed inside the structure's wire frame to support cement plastering work on the structure's surface. The cement plaster will penetrate the wireframe if the structure is empty/void. Before the cement plaster goes hard, it is necessary to pattern the structure's surface according to the suitable pattern. The final process is to paint the surface of the cement by combining it with a specific combination of colours to achieve a natural stone appearance. The construction of Ferro cement waterfalls is popular in the landscape garden's support activity. It can make function to create a natural impact through the design appearance and sound effects of waterfalls. The construction cost is relatively cheap as it uses readily available materials. In addition to the long service life to be damaged, it does not require high maintenance costs (It only requires treatment for repainting work when the construction colour fades due to weather factors and is exposed to rain and heat).

Figure 3: Steel Reinforcement And Steel Net Formed Into Ferro Cement Waterfall Construction

Figure 4: Ferro Cement Waterfall Construction Wire Frame Stuffed With Recycled Old Newspaper To Make It Solid Inside For The Purpose Of Cement Plastering Work

Figure 5: The Wire Mesh Of The Ferro Cement Waterfall Construction Is Coated With Cement Plaster And Shaded Like A Stone Pattern Before The Cement Hardens. The Cement's Surface Is Painted With A Mixture Of Paint To Create The Effect Of Natural Stone.

The Issue In The Construction Of Ferro Cement Waterfalls Using The Conventional Method

The manufacturing technology of this Ferro cement waterfall used today needs to be improved based on several issues. The process involves many work steps to be done. This will cause the time to complete the construction to take a longer time. For example, to enable the work of cement plaster laying on the structure's surface, we need to stuff the old newspaper inside the structure.

The product is too heavy to be lifted or moved to another location as the structure is constructed by double using cement plaster. (the first plaster forms the structure and the second plaster forms a stone pattern). Lastly, this method will increase the material cost to provide steel mesh because this material is quite expensive. It is necessary to operate the waterfall on construction using a water motor pump that consumes electricity. Therefore, it involves the cost of increasing the consumption of electricity.

Improvements (Portable Ferro Cement Waterfalls)

Several approaches need to be taken to address the issues mentioned above. Touching on the relatively long completion period as it involves a considerable work process, the improvement made is to ignore the process of clogging old newspaper into the wireframe structure by replacing it with a user of the recycled towel. The method is to soak/mix the recycle towel into a mixture of cement, waterproof material and water (without sand). The towel is then wrapped on the wireframe structure to form/strengthen the structure of the skeleton. This method can indirectly save construction time as there is no need to do cement plaster work on the structure surface. The sand medium mixture is not used in this construction technique, where the mixing medium only involves cement, waterproof material and water medium. Indirectly, it can reduce the load/weight of the construction. Therefore, the Ferro cement waterfall's structure is lighter and easier to lift/transfer to another location to be made as hardscape furniture. Terms of construction costs can also be saved as it does not use sand materials during the cement mixing process and only uses recycled towels and cement materials. Indirectly, these improvements can support green technology using recycled materials.

In terms of energy consumption, it used electric power to operate waterfalls on Ferro cement constructions. The improvement is to use a solar power system that does not consume electricity. In the meantime, it can save electricity consumption.

Description Of Improvement Of Portable Ferro Cement Waterfalls

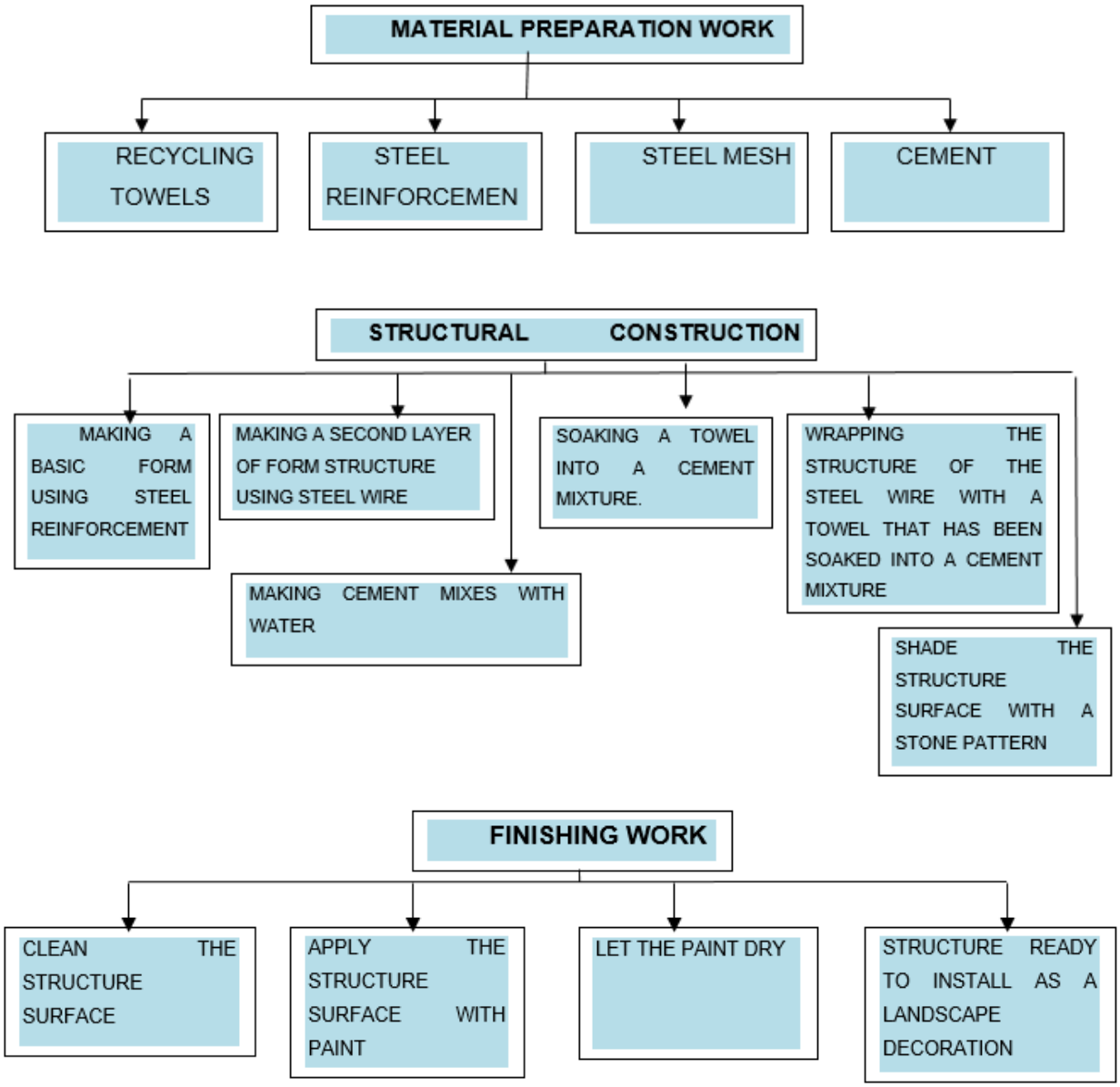

Chart 1: Description Of Portable Ferro Cement Waterfall Construction Improvement

Figure 7: The Steel Reinforcement Frame Of The Pool And Waterfall Structure Is Made Using BRC 2X2 Inch Steel Mesh

Figure 8: Recycle Towel Soaked Into Cement Mixture Mixed With Waterproof Material According To A Certain Measure

Figure 9: Recycle Towel That Has Been Soaked With Cement Mixes Wrapped In The Structure Of The Waterfall Pool Construction

Figure 10: The Cement Mixture Was Laid On The Hard Recycled Cement Towel To Form A Stone Pattern On The External Surface

Figure 11: Painting Work On The Mobile Waterfall Of Ferro Cement

Figure 12: Solar Panel Energy Used As A Source For Activating The Waterfall Pump

Figure 13: Construction Of Sustainable Mobile Ferro Cement Waterfall Completed

Advantages Of Improvement Of Portable Ferro Cement Waterfalls Construction

The advantage gained after improvements to the Ferro cement Waterfall allows it to be mobile as the construction method is more straightforward than the previous. This is because the building materials used do not require a mixture of sand medium, which will cause the building to become heavier. Indirectly, this advantage can help in terms of marketing strategies where delivery and installation work are made easier due to its relatively light structure.

It can be shortened in terms of construction time because it does not involve clogging the old newspaper inside the structure's frame or cement plasterwork on the construction surface. The process has been replaced with another alternative where used towels soaked in cement mixes are wrapped directly on the construction surface. Cement medium was mixed with a waterproof liquid during the cement mixing process to ensure that there were no leaks at the structure and pool of waterfalls.

Nowadays, the government aspires to produce products that are characterised by green technology. Among the criteria meant by green technology is the saving on the use of energy resources and natural resources. If this energy source is used without control, it will affect the environmental balance. The following criterion of green

technology is to encourage renewable resources. For example, re-applying used materials that have not been used by making some improvements to ensure that they can be used safely. Improvements to the construction of the portable Ferro cement waterfall support green technology through solar power panels to activate the portable Ferro cement waterfall motor. Solar power panels are more environmentally friendly. The installation work is also quite simple as it does not depend on the power source of electricity. The use of recycled towel materials also supports green technology through the use of renewable resources. Recycle towels are used to wrap the construction structure of a portable Ferro cement waterfall. Therefore, the capital cost of constructing this mobile Ferro cement waterfall can be saved as it does not use sand and steel nets, which are expensive in the market.

Conclusions

In conclusion, the improvement of the structure of the Ferro cement waterfall has excellent potential to be further highlighted. Besides being portable, it also has a high aesthetic value. It looks more natural, is environmentally friendly and mainly uses recycled materials. Therefore, this product can be produced at a cheaper cost but marketed higher.

For improvement, this construction can be used as a reference basis for environmentally friendly and recycled materials. The design style and building materials used can vary according to the customer's taste.

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CHAPTER 6: Towards Aviation Sustainability: Where Are We Now?

Norisza Dalila Ismail, Mohd Hazwan Mohamed Norli

Used Cooking Oil To Power The Jet Engine?

In early June 2022, the first passenger aircraft of Malaysia Airlines flew from Kuala Lumpur to Singapore, powered by a mixture of regular jet fuel and biofuel made entirely from renewable waste and by-products, including animal fat waste. This replacement of standard engine jet fuel is known as Sustainable Aviation Fuel (SAF) compared to conventional fossil jet fuel. This sustainable fuel option, made from 100% renewable waste and residue raw materials (such as cooking oil), can reduce greenhouse gas emissions by up to 80%.

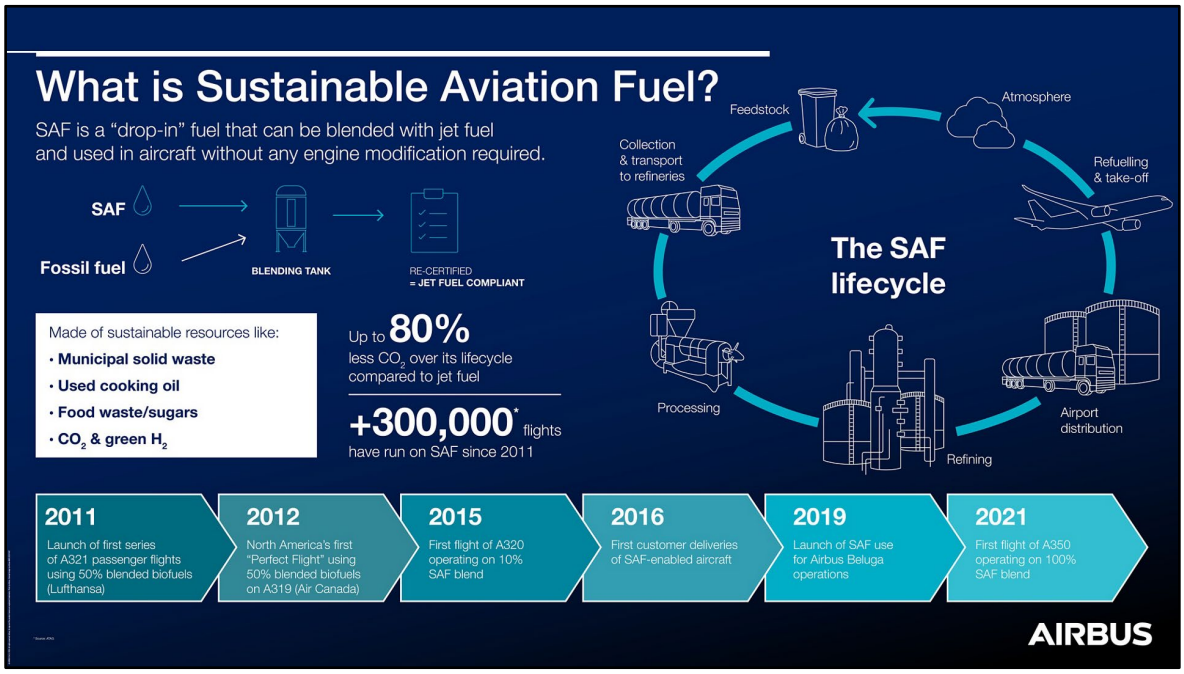

Figure 1.1: Sustainable Aviation Fuel Infographic (Airbus, 2021)

Aviation accounts for 2 to 3 per cent of overall climate impact. It is expected to keep increasing by introducing SAF, which can immediately replace fossil jet fuel to reduce air travel emissions. Neste MY turns renewable and sustainably sourced waste and residue raw materials such as used cooking oils, rendered fats, and greases into fuel that can safely power aircraft. From the figure above, we can summarize that SAF

already took part in its contributed over 300 thousand flights since 2011. But referring to a fact sheet from the International Air Transport Association (IATA), the first test flight with biojet fuel was done by Virgin Atlantic in 2008.

International Civil Aviation Organization (ICAO) defines alternative aviation fuels that have a lower carbon footprint will be necessary to meet the 2050 goal underlined below:

i. Achieve net GHG [greenhouse gas] emissions reduction on a life cycle basis.
ii. Respect the areas of high importance for biodiversity, conservation and benefits for people from ecosystems under international and national regulations; and
iii. Contribute to local social and economic development, and competition with food and water should be avoided (ICAO 2018).

Air bp, one of the aviation fuel providers, mentions SAF is more expensive than conventional fossil jet fuel. The existing accessibility of sustainable feedstocks and the ongoing advancement of innovative manufacturing technology are to blame for this. It is anticipated that as technology advances, customers will pay less for it since it will become more efficient. The clients and their passengers become aware of and realize the advantages of the emission reductions, as there is increasing uptake of SAF. How does the industry take action about this SAF?

Malaysia Aviation Group (MAG) Sustainability Blueprint

The nation's top aviation company, Malaysia Aviation Group (MAG), recently unveiled its new Sustainability Blueprint to target net-zero carbon emissions by 2050.

Under the Sustainability Blueprint, MAG has highlighted 66 initiatives from 23 sustainability sectors, falling under the Economic, Governance, Safety and Security, Environmental, and Social categories. The Group's new objectives call for a 25 million kilograms reduction in global CO2 emissions by 2021. By 2025 and beyond, it aims to

use 50% biodegradable materials for in-flight operations and recycle and upcycle 50% of all trash from the ground and in-flight operations. This is in line with Sustainable Development Goal 2030 of the United Nations.

Several programmes have been implemented, including using idle reverse thrust power on long runways. Like those at London's Heathrow Airport, which saves 18 kg of fuel or 3,420 kg of CO2, taxiing aircraft with one engine after landing to save 50 kg of fuel or 158 kg of CO2, sub-cycling projects to turn waste items like leather seats, lifejackets, and uniforms into handbags, aprons, and toiletry bags. Additionally, it has participated in carbon offset programmes under the International Aviation Carbon Offsetting and Reduction Scheme.

MAG used General Electric's Fuel Insight and Flight Pulse aviation software in partnership with General Electric to help modernize the fuel efficiency of its airlines as part of efforts to reduce its carbon footprint.

The fuel efficiency programme at MAG has improved fuel burn by up to 15% over the last eight years since it was implemented more than ten years ago.

Aircraft Design With Collaborations Of Giant Aviation Role Players

CFM's Revolutionary Innovation for Sustainable Engine (RISE) demonstration programme, on board an Airbus A380. Airbus and CFM International, a joint company between G.E. and Safran Aircraft Engines, are collaborating to flight test CFM's cutting-edge open fan engine architecture.

As part of CFM's RISE demonstration programme, the Flight Test Demonstrator intends to mature and expedite the development of breakthrough propulsion technologies on board an Airbus A380. The Airbus Flight Test facility in Toulouse, France, will host the flight test campaign over the second half of this decade. At G.E. Aviation's Flight Test Operations facility in Victorville, California, USA, CFM will conduct engine ground tests and test validation before the A380 test flights.

The flight test programme will achieve several goals that could lead to future advancements in engine and aircraft efficiency, including a better understanding of engine/wing integration, aerodynamic performance, and propulsive system efficiency gains; validating performance benefits, such as improved fuel efficiency, which would result in a 20% reduction in CO2 emissions compared to today's most efficient engines; evaluating acoustic models; and ensuring it.

Collaboration Between Boeing And Alder Fuels

Another giant aircraft manufacturer, Boeing, took the initiative to support SAF usage with Alder Fuels for testing and qualification Alder-derived SAF using Boeing aeroplanes. Boeing pledged in January 2021 to deliver 100% SAF-capable aircraft by 2030 and is currently deploying SAF in its operations and expanding the provision of SAF globally. This new partnership will be able to cater 700 to 1000 times more SAF to achieve the civil aviation industry's commitment to net zero carbon emission by 2050.

Boeing was the first to make SAF a reality. To qualify, undertake biofuel test flights in 2008, and receive clearance for commercial usage in 2011, the company collaborated with airlines, engine manufacturers, and other industry heavyweights. In partnership with FedEx Express, the Boeing Eco Demonstrator flight test programme flew a 777 Freighter on the first commercial flight to use only sustainable fuels. Boeing has collaborated with U.S. government clients on SAF activities, including SAF flight testing on a F/A-18 Super Hornet with the U.S. Navy and a thorough fuel analysis with the Air Force as part of their attempts to certify the C-17 Globemaster for use with SAF.

The aviation sector is currently poised to take another remarkable stride forward. Still, the commercialization of SAF is a hurdle that the sector as a whole must overcome. In 2011, the industry's bold vow to start using SAF on commercial flights became a reality. By 2020, a significant amount of alternative fuel will likely be

incorporated into jet fuel. Aviation's low-carbon, alternative future is now in the hands of committed industry players, with help from governments, feedstock, and fuel providers.

TVET Roles And Contribution Towards Aviation Sustainability

Above all, examples illustrate the unique and vital contribution that allows TVET to achieve aviation sustainability goals. Proper research and development grants equip facilities with the knowledge and the qualified human resources needed to enhance for finding appropriate solutions to the significant challenges faced by humanity. Why don't we take best practices from medical education and research to meet health sustainability purposes? Training is provided for medical doctors, nurses, technicians, and public health specialists from universities with collaborations associated with health institutes. Then, any substantial advancement in the battle against diseases and health dangers depends on the fundamental research that universities and related health institutes do.

The sector should continue to support efforts to improve environmental sustainability. To accelerate industry investment in this area, government support will be required to develop a sustainable market for alternative fuels, such as by investing in biofuel development and infrastructure. The approval of the ICAO Carbon Offsetting and Reduction Scheme for International Aviation in October 2016 provides momentum for further industry efforts reaching beyond traditional market-based measures (operations, infrastructure and renewables). The sector should continue to promote research into, and production and commercialization of alternative fuels.

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CHAPTER 7: The Need To Unlock Digital Literacy In Teaching Vocational Education & Training (TVET)

Mohd Saharudin Abuludin, Muhammad Razuan Abdul Razak

Introduction

Information, communication, and technology are referred to as ICT. It follows logically from the quick evolution of information technology. ICT integration has changed the globe over the last few decades. Workers can use technology to boost production efficiency and effectiveness when ICT is integrated with modern tools in factories and industries. The topics addressed by ICT are growing along with technological advancement and information technology's growing number of applications. It primarily consists of but is not limited to, computers, the Internet, television, radio, satellite, mail, data analysis technology, and linguistic technology. Numerous prospects for career advancement, personal fulfilment, and value creation can be found on the Internet. It has become essential for working, learning, getting basic services, and staying in touch since the COVID-19 pandemic. A statistic from the International Telecommunication Union webpage as shown in Figure 1, shows that the number of Internet users increased by 10.2% in 2020, the first year of the pandemic, the highest growth in ten years, driven primarily by an increase of 13.3% in Internet use in emerging nations. Growth has decreased to a more moderate 5.8% in 2021, which is in line with pre-crisis levels.

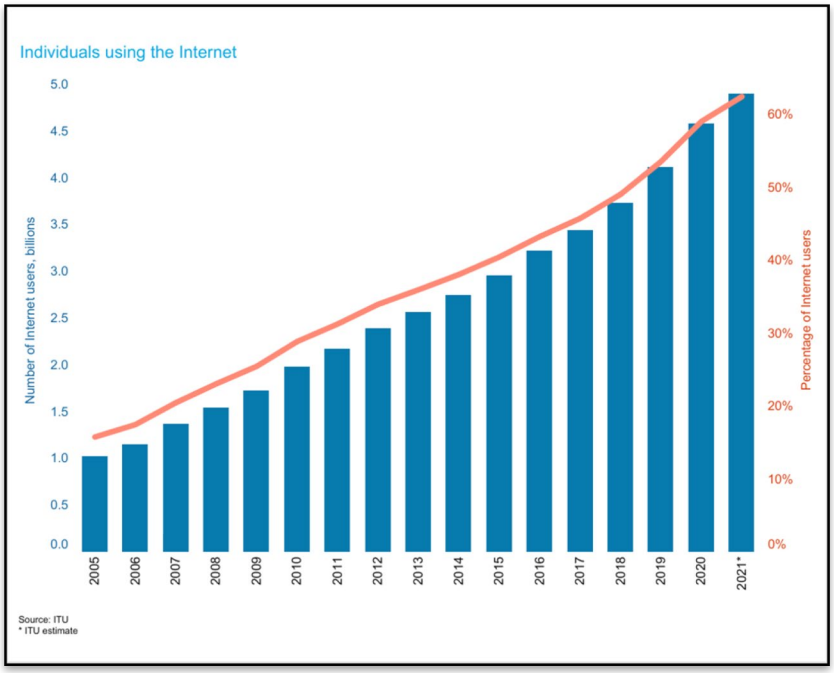

Figure 1: Number Of Internet Users

Digital Literacy

Navigating our modern environment requires digital literacy by utilizing critical thinking, technical expertise, reading, and writing. It involves using technology to find, assess, and transmit information, including smartphones, PCs, e-readers, and more. Employers are looking for workers with digital skills, including the ability to conduct independent research, explore new platforms and term knowledge, develop and establish cooperation with prospects, learn new technologies, and teach or explain existing technologies.

Teaching Vocational Education & Training (TVET)

TVET combines formal, non-formal, and informal education that equips young people with the information and abilities needed in the workplace. TVET trains and provides students with the necessary skills for a particular job, making it easier for them to get employment. TVET graduates have an advantage in the labour market over recent college graduates who may not have the necessary skills for the working industry. According to the United Nations Organization for Education, Science, and

Culture (UN), the term technical vocational education and training (TVET) has been used for TVET under various names over the years, including apprenticeship training, technical education, technical-vocational education, occupational education, vocational education and training, professional and vocational education, career and technical education, workforce education, workplace education, and others.

Research & Development (R&D)

Activities that businesses or organizations carry out to create and introduce new goods and services are called research and development (R&D). It frequently marks the beginning of the development process. The usual objective is to bring innovative goods and services to market to increase revenue. Through R&D, a firm or organization gains new information applied to developing new goods and improving existing ones. R&D is a systematic research effort to incorporate innovations into the organization's or company's current product offerings. It accomplishes this by creating a new product line or improving existing goods and services.

Challenges Between The R&D and TVET

Teaching someone a particular skill or habit is implied by the phrase "training" in its broadest sense, frequently provided to operational-level staff. It differs slightly from education, which is a method of systematic learning in a setting that fosters employees' sense of judgment and thinking. Training at TVET is merely experiential learning. It is a carefully thought-out program aiming to improve human resources' knowledge and specialized abilities. It is a prevalent idea in human resource development to increase current and potential employees' competence, performance, and productivity through learning. Employees that receive training are better equipped to perform their jobs effectively and efficiently.

Technology is constantly changing regardless of the state of the economy or the market. Innovative new technologies are being developed to address global concerns. In these uncertain times, it must seem strange that predictions of technology are being

made, but here is the fun part: these developments will make life more straightforward in the years to come. The technology sector is changing our lives, and we should be on the lookout. These include systems that might detect the risk of viral transmission and drones that could carry necessities to our homes.

To keep up with the rapid advancements in technology, we require research and development, which are the investigative actions taken by an individual or organization in the hopes of making a discovery that would lead to the production of a brand-new product, product line, or service. Research is any creative science or style of thinking that results in developing a new product or features for an already existing one. There are two types of research: primary research and applied research. Basic research investigates scientific concepts from an academic standpoint. In contrast, applied research seeks to apply primary research findings in the real world. R&D isn't just about developing new items; it may also be utilized to improve an already-existing good or service.

The pandemic has disrupted Technical and Vocational Education and Training (TVET) systems, offering a significant obstacle in shifting from in-person training to digital or mixed learning modes. The epidemic has sped up efforts to implement a digital transformation, including e-commerce, digital payments, artificial intelligence, educational technology, and others. The impact of the digital transition is twofold: First, more effort is being put into developing online and distance learning technologies while addressing delivery challenges like limited mobile phone access, poor internet connectivity, a lack of digital literacy, a lack of ToT in online teaching, monitoring and verification of online skill training, and so forth. Multi-stakeholder collaboration is necessary to address these limitations.

There must be provisions for the workforce to be upskilled and reskilled in new-age technologies at various stages of their careers to keep them up to date with the most recent advancements in digital technologies as the world prepares for

Industry 4.0 (4IR) and the continued digitization of industrial processes. Modern skills that must be incorporated into TVET curricula include augmented automation, AI, blockchain technology, simulation, and gamification. As a targeted response to the impending problems provided by 4IR, industry-led TVET programs and incentive-linked schemes for the industry to upskill the workforce in new-age skills might be investigated. This points to the need for initiatives to improve the TVET system's digital preparedness and prepare young people for Industry 4.0 through digital skills.

Digital Literacy Needs

Understanding and using technology are both components of digital literacy. Your ability to find, consume, and produce information online can be improved with digital literacy skills. Understanding digital literacy allows you to utilize technology properly and helps you avoid its risks. As we can see, digital technologies are becoming increasingly important in everyone's daily lives. We can see that this technology has emerged as a critical factor in economic progress on a global scale.

It also serves as a stimulus for innovation and change within pre-existing economic activity patterns. All levels of education, including TVET, must be able to adapt and adopt to support economic activity. Digitally literate individuals have access to chances and resources that may encourage them to embrace emerging technology. The focus of the engagement is math and computing literacy. People with better digital literacy are more employable.

We can read, interpret, apply, communicate, and discuss information with the help of digital literacy. This enables us to become more transparent, data-driven, and fact-based in our decision-making. These facts can help decision-makers make informed choices. They can do with speed, accuracy, and impact. In doing so, they will also need to take measures not to harm individuals or communities.

Conclusion

The workforce for the future needs to be equipped for the rapidly changing digital world. The government needs interventions to update skilling curricula and regulations to cover new skills and competencies and deploy new training delivery methods. TVET has acquired momentum at the international, regional, and national levels when considering what has been happening locally and globally. By putting the R&D process into practice, all stakeholders will be able to respond appropriately and use TVET's potential to support socio-economic and environmental sustainability. TVET should not only prepare graduates for the local and national labour market but also for the regional and global communities in which they will work and live. To address sustainable development, TVET, a key producer of skilled labour, must play a substantial role. Various roles for TVET participants are required, including raising awareness, generating a workforce supportive of green technology, and developing and implementing regulatory or monitoring mechanisms to evaluate sustainable practices. All parties involved must make considerable, coordinated efforts if sustainable development is to be achieved. Employees must be well-versed in digital literacy for a nation to seriously consider TVET and how it may integrate into R&D processes for better results and a brighter tomorrow.

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CHAPTER 8: Journey Into Tie Dye And Malay Traditional Headdress

Azhani Hasibah Ab Karim, Norain Abdul Rashid

Introduction

Headdresses can be anything from a simple headband to an elaborate head covering. Headdresses have been used as a status symbol in Malaysia since the time of Malay rule. The headdresses also symbolise the homeland and must have knot, base, bend, and composition characteristics. In addition to that, traditional according to the Fourth Edition of the Kamus Dewan, traditional means to be of a nature or according to tradition, such as a society that practices a hereditary or traditional way of life. But now, traditional headdresses use is unrestricted. People who like traditional headdresses can wear them however they want, considering the most up-to-date trends in folds, shapes, and styles. When properly worn, it can elevate its owner to celebrity status and even symbolise national pride. If you're going to an event, don't show up without a headdress. Malays are used to it, as their traditional tengkolok, tanjak, and destar headdresses are well-known worldwide. But do the terms tengkolok, tanjak, and destar refer to distinct types of headdresses? Some people believe that the traditional headdress's placement is determined by the fabric used to make it, specifically whether it is made from tengkolok, tanjak, or destar.

Figure 1: Tengkolok/ Tanjak/Destar Source: Abdullah, M. S. (2016)

Based on Wikipedia, the tie and dye technique is a technique to produce patterns on fabric. It is used to create rainbow patterns and shibori fabric. This technique existed from 618-906 BC during the Tang Dynasty in China. This technique is a process of patterning cloth by tying certain parts and dipping it in dye. The traditional way of making tie dye is also found in the Middle East, Africa, Latin America, and almost all of Asia. Tie-dye in Indonesia is known as Pelangi. In India and Pakistan, it is known as Bhandhana. In Japan, it is known as Shibori; in Nigeria, it is known as Adire Aleso.

First, let's examine the fabric from which the folded headdress is fashioned. Fabrics like cotton, satin, and adhesive are frequently used because of their portability and ease of folding. Still, woven songket and woven songket/cotton blends are also popular. Fabrics with tie-and-dye patterns, such as songket, are used to distinguish between tengkolok (a fold that uses songket fabric and is worn by relatives) and tanjak (worn by groups other than relatives). The headdress will be called destar because it does not use material from songket entirely.

Therefore, the terms tengkolok, tanjak, and destar are synonyms for the traditional headdress used by men. Some say that tanjak, tengkolok, and destar are the same, just called according to the place where they are used.

Traditional Headdress From Fabric Of Tie And Dye Technique

Once upon a time, the nobility pioneered this traditional headdress, especially state rulers and nobles. Given that it's sewn from the rare and expensive songket woven fabric, only a select few can afford to do the headdress. During the Malacca Malay sultanate, the Sultan would wear a headdress made of silk from China or India. In contrast, most people would wear a headdress made of plain cloth.

But with the changing times, now all groups have to wear traditional headdresses in formal or informal events and their daily activities. This development occurs when the fabric is readily available and affordable for all groups, and various

designs have been produced to meet the wearer's taste. Therefore, in the development of tie-dye in terms of various patterns, colours, and functions to meet the demand in the market or increase the power of experimentation as a work of art, the use of this fabric also leads to other things such as women's handbags, umbrellas, hats, household accessories and other handicrafts.

Tie and dye fabrics are not left behind in the folds of this traditional headdress. The style or solek, folds, and shapes to depict the Malay identity remains and can be seen from the naming of each headdress, the shape produced, and the manners practised throughout the process of making the traditional headdress. It can be seen here various types of fabric can be used to create folds and styles or solek.

This tie and dye fabric is a process of patterning the fabric using tie and dye. Each tie and dye will produce different patterns. Knots, folds, and different stitches are among the types of ties made. The dyeing technique produces an expanding pattern, whether large or small. If you dip it, it could be shallow or deep. If the dip is made shallow, the pattern produced is small, and the deep dip will produce a large dip. Then the fabric is stretched, and you can see the pattern formed due to the dyeing done.

Figure 2: The List of Tie Dye Process Patterning Source: Rohaida, H. (2012)

The Tie-dye technique is the earliest way to decorate cloth from songket and batik decoration techniques. The technique used is to bind part of the fabric, and through the dyeing process, the fabric is then coloured. Usually, seeds, beads, or other things are inserted at the end of the fabric tie, which leaves a decorative effect on the fabric.

The application of design theory on dipped batik is divided into lines, shapes, and colours. Lines are used to expressing human feelings or emotions. The shape

results from a combination of lines with two dimensions. At the same time, colour is an element of beauty in art and design. Next, design planning starts from scratch using mind mapping that requires alternatives and considerations related to the product to be planned, followed by a mood board as inspiration that contains elements of shape, colour, and pattern. After that, the concept sketch revolves around the products made, the materials used, and the added functions taken from the previously produced mind mapping.

The terms tengkolok, destar, and tanjak are synonymous. Therefore, let's focus on the production of destar following the fabric used is the fabric produced from the tie and dye technique. Destar is a headdress formed from processing by hand and functions as a headdress. Before that, let's see the process before, during, and after producing destar. This production process involves measuring the fabric's size, folding the fabric, and making styling or solek.

First, tie and dye fabric are sewn to the end of the square fabric before starting the folding process. After that, let's look one by one starting with the fabric measuring process. At the initial stage, the square-shaped fabric is folded in half to form a triangle with a length of 31" or folded to 33".

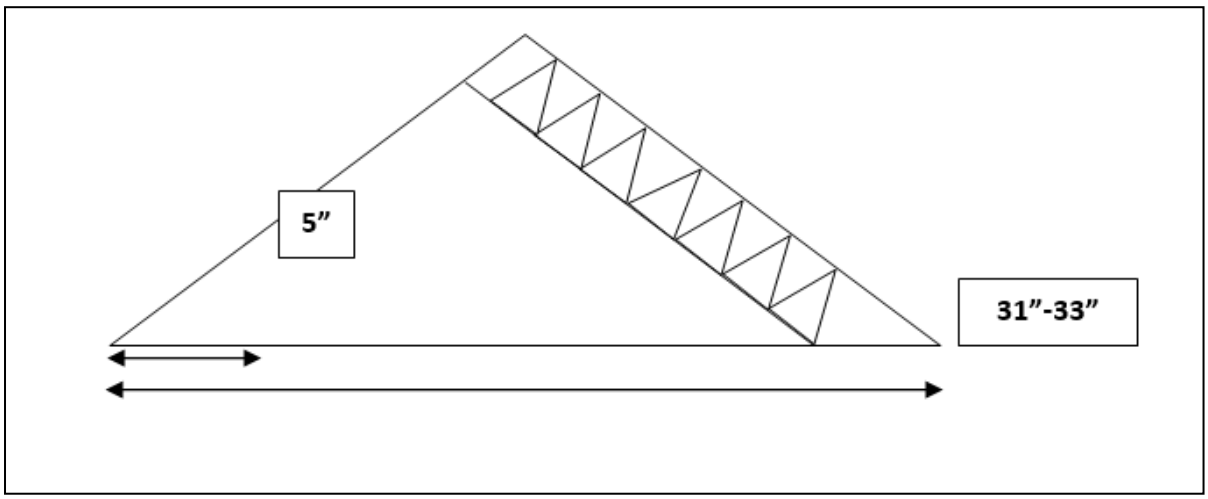

Figure 3: The Production of Destar

Right sides together, fold the fabric in half to form a triangle. Sew around the fabric, leaving a 5-centimetre-long gap. Next, the fabric was folded to leave a triangle-shaped opening the same size as the lining. The side of the fabric with the pattern should face outward. Here we see the pattern used to determine where the ornamentation will go on the crown. As a result, the right side of the fabric is where the tie-and-dye patterns go so that the final pattern can be viewed in all its glory.

Once the triangular lining is cut to size, you can flip the fabric inside and insert it into the fabric. Sew a five-pointed star next hand-stitching over a long distance. An infiltration technique that allows for stitching is one in which the thread is concealed. Machine stitches are sometimes used if a hole needs to be patched up. The tailor can select his or her preferred stitching method for this purpose.

In preparation for sewing, fold the fabric in half along its longest side (the 31" or 33" side) to create a triangle. Although there is no universally applicable standard for this fold, it is generally estimated to be between 1 and 1 1/2 inches wide, depending on the wearer's head circumference. Consequently, each individual's fold will be different in size, making them truly one-of-a-kind. It takes many repetitions of this fold to create a gap at the top of the folded fabric that is a span in width.

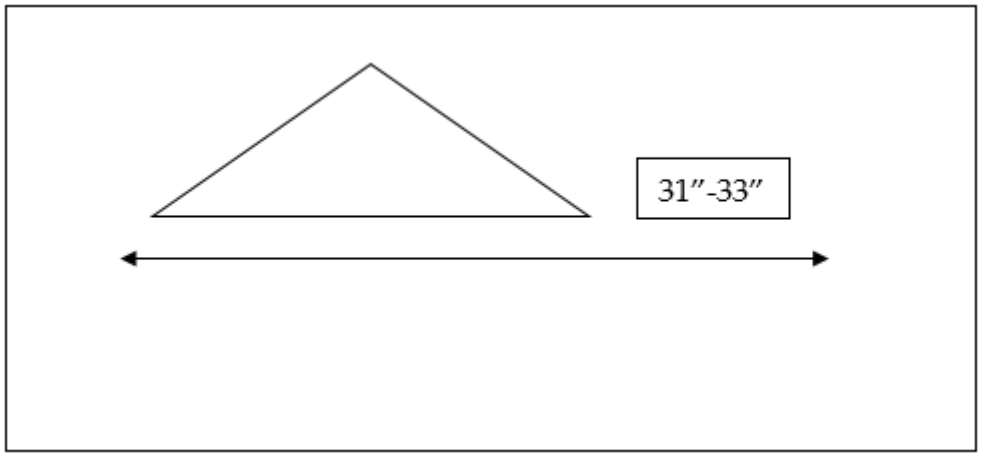

Figure 4: Length of fabric

There is a protocol to follow when folding fabric: the stylist, or tukang solek, must place the folded piece's right sides together, and no shoes may be stepped on. To keep the fabric in place while walking, some people have taken to stepping on it. They are soiling one's feet with a piece of cloth that was meant for one's head is generally frowned upon, as it is considered impolite.

There are prohibitions imposed on the wearer of this traditional headdress so that they take care of it well and carefully. It is forbidden to throw or place it unevenly, such as in the bathroom. The folds produced also represent the verses of the Quran and Malay customs. It can be seen here that even though there have been changes in the use of fabric tie and dyeing, the styling and tying techniques are still the same.

As for the shape of this traditional male headdress, there are various types of solek applied by tukang solek, and there are various names for each solek produced. Readers must be wondering when they see the word solek. What is solek? Solek is the form produced on the headdress. It is named according to the solek like Balung Ayam, Lang Siuh, Lang Menyusur Angin, Ayam Patah Kepak, and Dendam Tak Sudah.

The traditional headdress is the genetic heritage of a country. It features the identity of the Malay race in terms of name, style, and unique tying technique. It also represents every state in Malaysia. There is also a stream for each headdress for knowledge seekers interested in learning about this traditional headdress. The king's group usually pioneers this trend. One of the trends is from a teacher from a noble family, His Highness Raja Ahmad Akashah bin Raja Haji Abdul Malek. He is also known as King Tengkolok of Perak. He has a collection of traditional headdresses that have been passed down from generation to generation, as well as the original techniques of tying and style.

The word solek is used when styling a traditional headdress which involves style, shape, and folds. It is made up according to the state, is different, and has a unique name after being made up. Folds and styling are made according to the type

of folds and are made directly on the wearer's head. The purpose is to style directly on the head to get the right size and match the wearer.

The folds on the headdress have their names, such as Lilit Kacang, Pucuk Rebung, and Simpulan Buku Garam. These folds are associated with the image of the Malays and with the religion of Islam they follow. Therefore, some manners must be practised before, during, and after putting on this traditional headdress. Let's look at the manners practised together.

It can be seen during the process of stretching the headdress fabric, the tukang solek must crouch down, and the stretched fabric must not be stepped on even if stepped on to prevent the fabric from moving or fixing its position because it will be worn and something worn must be placed in a high state just like the wearer. The folds will be covered on the thighs to create styling or solek on the headdress. The creations are also styled on the headdress, and the tukang solek creates new designs but still follows conventional manners. Creations are new folds from the makeup artist's ideas and are produced by individuals skilled in styling.

Some tips when styling is to understand the shape, pray when you forget while making solek, focus while making solek and be in a pure state.

The Traditional Characteristics Of Traditional Malay Men's Headdresses

The tie and dye fabric still maintain the traditional characteristics of traditional Malay men's headdresses and does not change the folds formed, such as the Buku Garam, Pucuk Rebung, and Ayam Patah Kepak (rooster with broken wings) and Anak Gajah Menyusu knot folds.

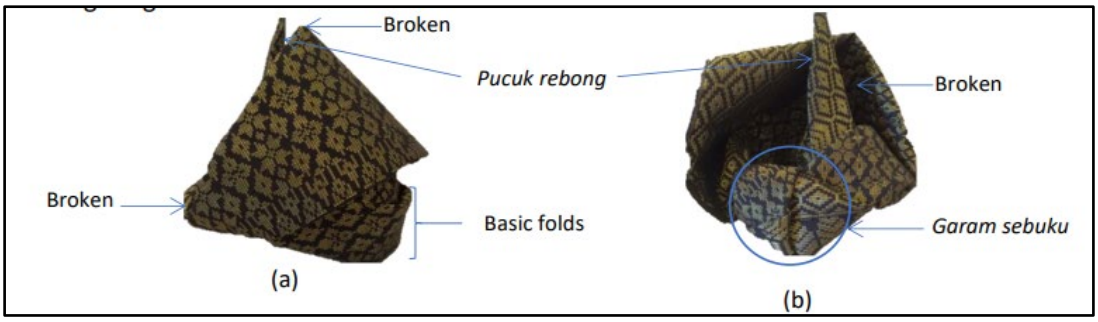

Figure 5: Sketch of the Ayam Patah Kepak (rooster with broken wings) (a) Front view and (b) Side view. Source: Salina et.al (2021)

The formed folds still fulfil the existing characteristics even though the pattern resulting from the tie and dye technique looks diverse, difficult to control, and not the same.

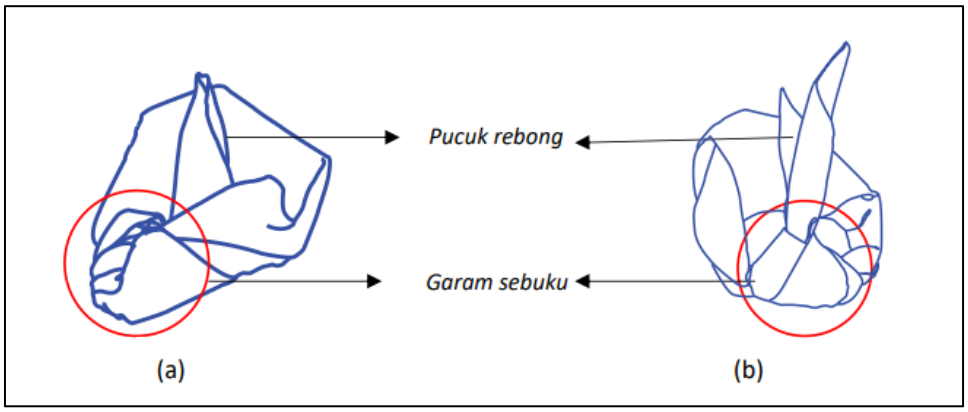

Figure 6: Sketch of the pucuk rebong and garam sebuku (a) right view of the tengkolok Ayam Patah Kepak (b) back view of the tengkolok Anak Gajah Menyusu. Source: Salina et.al (2021)

Therefore, the pattern from the tie and dye technique does not affect the tie's characteristics, manners, and form of style that is made.

Figure 7: The Pattern From The Tie And Dye TechniqueSource: MyCraftShoppe

Figure 8: The Pattern From The Tie And Dye TechniqueSource: D qilas

Figure 9: The Pattern From The Tie And Dye TechniqueSource: D qilas

The tie and dye technique is an attractive force in the production of traditional headdresses. It makes the traditional headdress in different variations and remains attractive. Therefore, the patterns used are not limited to songket and batik fabrics. It can be seen that the selection of patterns on the fabric is open and not limited to certain fabrics. Lovers of tie and dye fabric can use this pattern on their respective traditional headdresses. However, it is included in the destar range due to the use of fabric that is not entirely from songket.

In terms of bonding technique and style can be seen still maintained and unchanged. This styling follows the skills of each tukang solek and the flow learned to produce the traditional headdress.

Conclusion

Advances in tie dye in terms of the variety of looks and colours come from human desire and improve tie-dye products by providing a variety of decorations to produce motifs and colours from the various techniques used.

The use of tie-and-dyed fabrics in headdresses further diversifies the kinds of self-decoration because the patterns created, the colours used, and the weaves are very different from those of pre-existing fabrics. Common uses for them include the making

of tengkolok, tanjak, and destar. Because of this, the production of headpieces has taken on a new spin and style. Traditional headdresses are given a modern update with the help of tie-and-dye techniques, which add decorative motifs by using mixed colours while dying colours and fabrics.

This method may have emerged in the Middle East around 3000 years ago. Still, it is widely practised in Asia, Oceania, and Africa. Classical tie-and-dye techniques originated in Indonesia and have since gained international renown. Because of the widespread belief that the resulting fabric possessed magical properties, tie-dying was primarily employed in religious and cultural rituals. In addition to its primary function, it is also worn as a scarf to accentuate classic styles. Since it was once only worn for special occasions, fabrics made with tie-dyes fell out of favour in favour of more practical textiles like batik and weaving.

In the past, tie and dye techniques were mostly applied to traditional clothing such as scarves, clothes, and headdresses. Various products such as pants, shirts, and tops are produced from tie and dye cloth. It attracts community interest as a result of diverse techniques and the use of dyes from chemicals that can produce unlimited product colours. Therefore, the use of tie-and-dye fabric in traditional men's headdresses draws attention to tie-and-dye as a form of folk art with a long history.

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CHAPTER 9: Evolution Of Fashion And Design Learning Thru TVET And Rnd From Conventional To Technology In The Education System

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Introduction

The world is expanding quickly. Then, many improvements are made to our daily lives, and developments also impact the fashion industry. The conversion of fashion items into technological goods is another facet of the link between fashion and technology. Today's fashion world is rich in creativity, trends and innovation, which involves changes in business models, new communication strategies, emerging patterns of use and advanced material manufacturing techniques. Fashion is generally the style of dress of each person in determining a personal appearance or lifestyle fashion is a universal subject, a language many people understand and speak. The change and influence fashion has seen have been exponential over the last 100 years. Decade after decade, new trends have been introduced, themselves heavily influenced by pop culture, political attitudes and inspiring style icons of the time. Not only changes in dressing style the use of tools and technology is also evolving.

Along with the latest technological developments in garment manufacturing, illustration and pattern making are seen to change from conventional styles to technologies requiring skills in operating specific tools and software. Fashion is time-based and culturally contextual, combining design and creativity. Its characteristics are context-dependent and relative, not determined. Because of this, fashion can be integrated into any product.

After we briefly examine the development of fashion today, let's look at the history of TVET in Malaysia. The government has adopted a comprehensive strategy to attain Malaysia's objective of becoming a high-income nation by 2020. This strategy is based on the Malaysia Economic Transformation Program (ETP), which the Prime Minister introduced on October 25, 2010. Developing our human capital to have

excellent technical skills is one of the primary methods toward economic change. As a result, 23 per cent of the education budget would go toward improving TVET, and the RMK 10 will launch a new TVET certification system. As a result, the Malaysian government has implemented several policies and incentives to strengthen the National Technical and Vocational Education and Training (TVET) system as part of its Tenth Malaysia Plan (RMK10), which is set to last for five years from 2011 to 2015. The National Skills Development Act of 2006 was published in the gazette to provide guidelines and standards for the National Occupational Skills Standard (NOSS) and the management of TVET institutions and curriculum. The target of TVET has been shifted from producing technical personnel to meet the needs of government agencies to fulfilling the demands of skilled labour for industries more generally. In addition to public funding, the private sector and industry have an increasing role in providing TVET.

To implement and promote sustainable development, TVET must play significant roles. A wide variety of general and domain-specific abilities are needed to enable people to adapt to future technology and work organisations and to become experts in their fields who can reflect on and optimise work processes. To ensure the future security of these capabilities, TVET must partially limit itself from the actual demands of the labour market.

In general, the goal of TVET is to educate individuals in a way that prepares them for the future labour market, for future changes in technology and work organisation, and even for active participation in those changes. Because of this, it is crucial to foster the next generation of TVET researchers and developers. Today, many products and applications innovated due to a technological need, with R&D done regularly. This is no exception with the most recent fashion products, tools, and software for educational institutions and industry use. According to earlier studies, technology is a tool for learning in the educational system.

Regarding the provision of the educational process for students, the educational sector is one of the numerous other sectors that used and were impacted by information technology for students. The rationale is that technology has the potential to improve educational systems and increase interaction between educators and students. But starting in 2020, educators used technology to combat the Covid-19 epidemic. Depending on their resources and level of understanding, students to acceptance varies. How can we prepare students and the new generation to face the current technological shift as a necessity in the industry and revive the culture of RnD in TVET using the tools and technology in teaching and learning nowadays?

Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) has been developed to forecast user adoption of technology in organisational contexts. The prior models used to study human behaviour and computer science, such as the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model (MM), the Theory of Planned Behaviour (TPB), a combination of the TAM and TPB, the Theory of PC Utilisation (MPCU), the Innovation Diffusion Theory (IDT), and the Social Cognitive Theory, were combined to create the new model (SCT).

The unified theory of acceptance and use of technology model comprises four key independent variables: performance expectancy, effort expectancy, social influence, and facilitating factors. The four antecedents affect the user's behaviour and the individual's behavioural intention. The framework included four moderator variables: age, gender, experience, and voluntariness of use and also explains how the UTAUT Model can predict 70% of the variance in user intention. The UTAUT model is the most helpful model for studying technology adoption. It suggested that the extended UTAUT model can increase the variety of user intentions. Both of these claims were based on prior research.

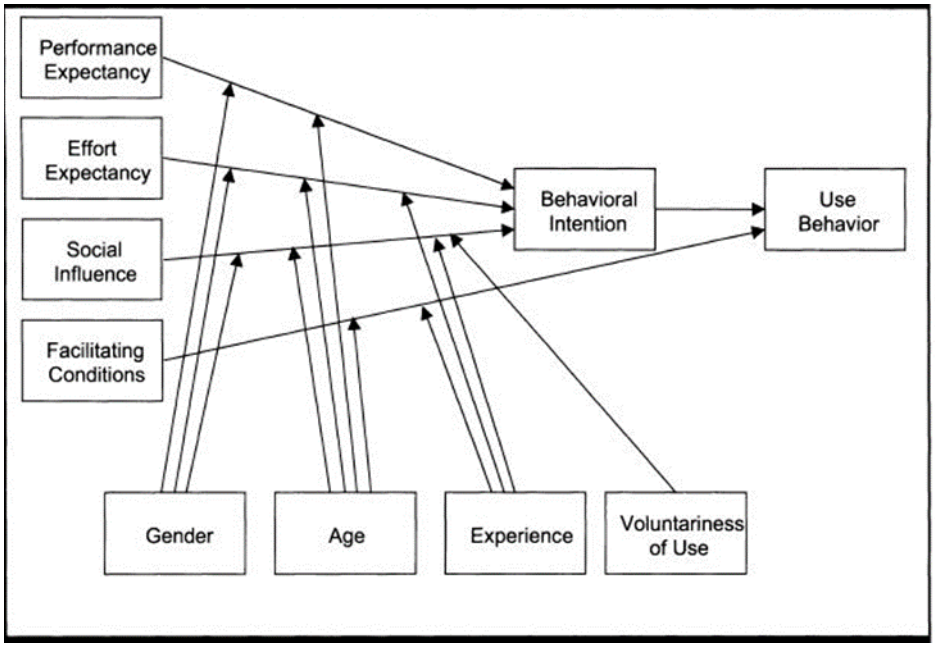

Figure 1: UTAUT Model by Venkatesh et al. (2003)

Table 1: The Variables Definition In The UTAUT

Variables	Definition
Performance Expectancy	How much technology helps a user when engaging in a particular activity (Venkatesh et al., 2003) The degree to which a user anticipates that using the technology would improve task performance (Van Schaik, 2009) The extent to which a person thinks the system enhances their ability to perform at work (Chao, 2019)
Effort Expectancy	The degree of ease with which the system can be used (Venkatesh et al., 2003) How much the user anticipates the system to be user-friendly (Van Schaik, 2009) A system's performance is measured by how user-friendly it is, which becomes the subjective standard (Jayaseelan, Koothoor and Pichandy, 2020)
Social Influence	How much someone thinks it's important that other people think they should utilise the system (Venkatesh et al., 2003) The degree to which the user thinks that other people who are significant to him or her think they should use the system (Van Schaik, 2009) The extent to which a user believes that important people find using technology vital (Diaz & Loraas, 2010)

Facilitating Conditions	A user's perspective of the available tools and assistance when completing a task (Venkantesh et al., 2003) How much the user thinks a technological and organisational infrastructure exists to facilitate system use (Van Schaik, 2009) The extent to which a person is convinced that a technological and organisational framework is in place to facilitate the use of the system (Jayaseelan et al., 2020)
Behavioural Intention	User's intention to use the system (Van Schaik, 2009) The degree to which a person has formulated conscious plans regarding whether to perform a specified future behaviour. (Chao 2019)
Use Behaviour	User's rate of system used (Van Schaik, 2009)

There is a strong link between goal setting and future behaviour. Students' expectations of how their use of application technology will affect their academic performance are known as "performance expectancy."

Table 2: Unified Theory Of Acceptance In Higher Education Questionnaire Items (Van Schaik, 2009)

Variables	Items
Performance expectancy	X helps me in my studies, I think. I can complete jobs more rapidly by using X. My productivity rises as a result of X. I'll have a better chance of excelling in my coursework if I use X.
Effort expectancy	I can learn how to use X well rather quickly. Using X is simple for me. I have no trouble picking up how to use X
Social influence	People who have the power to affect my behaviour believe I ought to use X. I should use X according to crucial people in my life.
Facilitating conditions	University staff has been helpful in the use of X. In general, the university has supported the use of X.
Behavioural intention to use the system	In the upcoming month, I'll use X. I anticipate using X in the upcoming month. In the upcoming month, I intend to employ X.
Motivation Intrinsic (Use Behaviour)	It's fun for me to use X. The use of X itself is a pleasurable experience. I enjoy utilising X.

Relationship With Andragogy

The technological strategy employs software and hardware to facilitate knowledge management and sharing. Further, a user-friendly, easily accessible, reusable, and interoperable information system must be developed to simplify the information-sharing process. The resulting system design will be overly complicated by failing to understand these requirements. Therefore, it's important to think about how to make technology more accessible.

Prior literature in UTAUT research was used to inform the selection of independent variables, moderator or mediator variables, and dependent variables. These variables include behavioural intention as a mediator and demographic factors such as gender, age, experience, and voluntariness of use as a moderator. Finally, user behaviour is a dependent variable. The mediator is a behavioural intention, and the dependent variables are actions taken. The independent and additional independent variables are associated with performance expectancy, effort expectancy, and social influence facilitating conditions. Expectations for performance, effort, social impact, and conducive environments were all found to be correlated with additional independent variables. Behaviour is the dependent variable, and behavioural intention and expectation are the mediators; gender, age, experience, and intentional use are the moderators (system use). Performance expectancy, effort expectancy, social influence, and facilitating conditions are all independent variables with behavioural intention as a mediator. Gender, age, and level of experience also play a role. Finally, we can say that user action is the dependent variable.

Performance anticipation, effort anticipation, social influence, and enabling conditions are all interconnected variables and independent variables. The intention to behave is a mediator between the independent and dependent variables. Expectations of performance and effort, as well as those of social influence and favourable environmental factors, are among the many independent variables at play. Behavioural intention is a go-between for the independent variable of actual user

action. While this study did find a correlation between performance expectations, expected levels of effort, and social influence and facilitation, it also found a correlation with other variables and independent variables. Anxiety and body structure are additional considerations. Behaviour intention is the moderator, while gender, age, experience, and outlook all mediate. Users' actions are another important dependent variable. Variables and additional independent variables include user behaviour as the dependent variable and performance expectancy, effort expectancy, social influence, and conducive conditions as independent variables. Satisfaction as a mediator and perceived risk as a moderator are among the variables and additional independent variables included in the analysis. Behaviour prediction is the dependent variable. Effort expectation, social influence, and performance expectation are independent variables. Together, the moderator's behavioural intention and the facilitator create a facilitating environment for the mediator: User behaviour can be affected by factors such as gender, age, level of expertise, and choice.

Issues And Challenges

Distant learning is more frequently conducted online, thanks to the extensive usage of internet technology. Online education can be defined as educational programmes that use the internet to disseminate educational content and facilitate interactions between teachers and students or among students. Online fashion education is gradually becoming a subset of online education. The two-course elements that make up a fashion design curriculum are typically fashion design and garment construction. These courses can be classified into three categories:

i. Two-dimensional (2D) techniques are used in fashion design courses, such as fashion illustration and style design, including hand sketching, 2D computer graphic (CG) software, and 2D computer-assisted design (CAD) software.
ii. A few of the courses in garment construction, like pattern making, used 2D computer-aided design (CAD) software.

iii. The other courses in garment production, such as draping, stitching, and knitting, call for operating in a real-world, three-dimensional setting.

The operating-in-2D courses in the conventional online fashion education curriculum heavily use digital technologies. CG and CAD software are the two broad categories into which these digital technologies can be divided. Adobe Photoshop, Adobe Illustrator, and other sophisticated commercial tools are available for use. Although certain digital solutions can be implemented, they are still not well-established in the market, which lessens the appeal of utilising this technology in the classroom. As a result, between the operating-in-2D and operating-in-3D courses, an invisible wall between the digital and physical worlds arises, which has the following adverse effects. On the other hand, most operating-in-3D courses must be completed in a physical setting, such as cutting, sewing, or draping.

In the fashion sector, computerised design approaches have several advantages over conventional ones for altering designs. The first is high efficiency: digital data can be changed again much more quickly than physical ones, allowing for quick improvements or even repurposing.

The second is high standardisation. Since digital files can be developed and adjusted parametrically, standard works can be created with more precision and less work. These benefits are entirely utilised in operating-in-2D courses in the conventional fashion design curriculum by employing digital 2D technology. Still, they cannot be extended to operating in 3D methods without using digital 3D techniques, which restricts the development of students' skills.

The internet is the only communication between educators and students in online fashion education. Interactive teaching can be achieved by utilising digital fashion design approaches. Interactive education allows educators and students to collaborate on the same documents remotely and in real-time rather than emailing

each other text, image, or video files. To better reflect in-person instruction, this will allow teachers to provide feedback by making real-time changes to students' work. Without digital 3D fashion design skills, interactive teaching in operating-in-3D courses is impossible, making it difficult for students to comprehend and absorb the educator's instructions. It harms the way that students learn and lowers teaching effectiveness.

Conclusion

Future fashion and design students will need to be able to conduct more thorough research to back up design concepts due to the quick and turbulent changes taking place in the industry. By reinventing the future of fashion design education, academia is thinking about how to educate graduates in this fast-paced and highly unpredictable professional context. Educators will increasingly emphasise helping students develop their conceptual skills and design processes with RnD to enhance their abilities within a curriculum that offers more interdisciplinary study options. Therefore, one of the primary problems for TVET colleges is to generate TVET graduates that match the industry's needs and future trends. During the 4th Industrial Revolution, it was crucial to create new TVET programmes that fostered skilled people. To remain relevant and responsive to the demands of higher institutions, industry, and community groups, the educational and training systems were examined, modernised, and redesigned from time to time.

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CHAPTER 10: TVET Sustainability Via Commercialization

Noodini Abdullah, Suhaini Mat Daud

TVET Sustainability in Malaysia

Malaysia needs highly-skilled human resources to close the demand-supply gap in various industries, particularly those driving economic growth. Technical and Vocational Education and Training (TVET) programme is key to sustainable development based on UNESCO since education is considered the key to effective development strategies. Therefore, the role and contribution of TVET institutions to sustainability are critical in addressing various issues, such as improving the economy, social, environmental and cultural conditions without negatively impacting future generations. The main objective of sustainability is to emphasise community development, particularly among graduates and educators who possess the knowledge, abilities, and values necessary to support sustainability. TVET must be the master key that can alleviate poverty, promote peace, conserve the environment, improve the quality of life for all and help achieve sustainable development viable and higher standard of living. As everyone is aware, a nation is created on the foundation of education. Therefore, education is the key to ensuring that our students realize their full potential as productive members of society and upright citizens. But how can we design an educational system that best prepares upcoming generations? Building institutions that will meet the demands of the 21st century's rapidly evolving environment is not easy.

Understanding Sustainability.

There is no specific definition of sustainability that everyone agrees upon. There are many ways to look at this idea and how it might be accomplished. The term "sustainable" describes something that can be kept up, something that is "durable" and "able to continue to some extent." In the end, sustainability can be viewed as a process

that maintains a specific level of something. From other perspectives, sustainability appears to place a greater emphasis on the present and on keeping things over a certain level. However, it is critical to understand the areas and components that will support the TVET program's sustainability. The program's sustainability will eventually result in TVET students who are competitive in the 21st century and can contribute to the sustainable development of the country's economies, ecosystems, and societies. The TVET program's sustainability depends on the commitment and a positive response to policymakers', educators', and other stakeholders' demands for current and future educational analysis challenges. Developing students' creativity, innovation, generic skills, knowledge, interests, and ICT abilities should be a priority for TVET institutions. These components are crucial for their character development and for preparing them for their future employment.

Prospects: Can TVET systems contribute to sustainability?

Today's higher education market is crowded with more specialised academic programmes, and applicants have unparalleled access to information. Numerous considerations related to the profession influence students' decisions to attend TVET institutions, especially polytechnics and community colleges. According to John Webster, education should be outcome-driven and prepare students for lifelong learning, whether students can learn the basics in their first year. Students work on projects for industry or community in their second and third years. One of these is the opportunity to design and innovate. Therefore, the goal of education in TVET is often to produce graduates who can design, improve or invent new products. However, most invented products can only create outputs like prototypes, publications, or intellectual property. Although the effects are helpful to society or industry, commercialization cannot proceed for some reason. As a result, the lack of attention given by TVET institutions to commercialization might lose favour with the industry and community.

Collaboration with industries or community is one of the components that will support the TVET program's sustainability. Collaboration with industry or community provides authentic learning opportunities. It can help students develop an interest in TVET programs, especially polytechnics and Community colleges. This is because the product could be marketed both locally and internationally. It could directly increase graduate earnings opportunities and indirectly raise the number of self-employed people. It could also lower the number of graduates who are unemployed and solve the social problem of unemployment.

Collaborations between academic institutions and industry are anticipated to improve both sides' research capacities and increase output. Also, it can raise the likelihood that items developed via the research initiatives will be commercialized. This must be accomplished while keeping Polytechnic and Community Colleges relevant and in demand. Since it was identified, the data showed a steady decline in student interest in pursuing study in higher institutions, including polytechnic. Fast action is essential to making the TVET system sustainable and relevant in the current educational landscape. Additionally, TVET needs to show the public the system has advanced to a particular point or to a certain level.

Commercialization of Product Innovation, is it a key for TVET to Sustain?

Commercialization is the process of transforming a new product or service all the way from conceptualization to actual sale. There are various definitions for commercialization, but simple commercialization is introducing or offering a new product to the market. Commercialization is a series of activities that transform innovation into a final product or service from which economic benefit can be derived. As such, innovation commercialisation has been defined as the act or activities required for introducing innovation to the market.

Currently, higher education institutions are encouraged to create more than simply scientific publications by the Ministry of Higher Education. Higher education

is urged to create a high-value product that may both benefit the community and be commercialized. It implies that research and innovation are viewed as an investment rather than just an academic pursuit. The completion of the research report and the successful marketing of the research products serve as indicators of research success. Therefore, commercialization is a prime example of generating educational impact because it constitutes immediate, measurable market acceptance for academic research output.

The increased focus on commercialization has led to the development of Direction, Policy and Commercialization Procedures in Polytechnics and Community Colleges. The first issue in 2020 was to promote such policies to strengthen TVET within the country. The policy serves as a guide and main reference to polytechnics and community colleges in planning, implementing, monitoring and reporting commercialization activities.

Furthermore, the government has recognized the important contribution of higher education institutions through collaboration with industries to promote innovation in the form of MoU or MoA in areas of staff mobility, supervision, product development, commercialization and technology transfer at local and international levels in promoting ecosystem-based innovation through research and development.

Issues and Challenges- Challenges in Commercialization

Malaysia Polytechnic is aggressive in developing high-quality product ideas that can be sold commercially on a global scale rather than just at the research stage. This institution has successfully filed patent applications for 42 out of 124 product inventions made by the Malaysian Intellectual Property Corporation (MyIPO). Only 38% of those were patentable. Only 10 student inventions received patents from 2007 to 2015, and only two were marketed by Merlimau's Polytechnic Entrepreneurship Unit.

It shows that the number of successful innovation projects developed each year by Polytechnic Malaysia and those that could be commercialized did not match up. In other words, there is a discrepancy between the number of innovative projects that the Polytechnic produces each year and those that are successfully commercialized. Therefore, institutions should be aware of the factors that can make it more challenging to commercialize student innovation products at polytechnics. The commercialization challenge is complicated because it calls for contributions from researchers, innovators, institutions, entrepreneurs, and capital suppliers. A few obstacles stand in the way of institutions' efforts to promote commercialization. The ability of an inventor to find a willing financier determines how quickly his innovation can be commercialized. The authors revealed the existence of the valley of death at the intermediate stage of the innovation sequence because funds are not available to finance the individuals and firms for taking a new innovation or discovery and transforming it into commercial products.

Another issue is that since the Polytechnic staff must prioritize tasks related to administration, teaching, and learning simultaneously, they cannot continue commercializing their innovations. While students who have developed inventions should also refrain from commercializing them because they must concentrate on their final semester exam to graduate. The problems mentioned above play a role in exhibiting or obstructing the commercialization process

Conclusion

This article first highlights the role of TVET and how it is connected with innovation, leading to commercialization. The aforementioned above play a part in helping exhibit or hindering TVET sustainability via commercialization. Although there is a policy on commercialization, authors find that this commercialisation area for TVET institutions has not been exhaustively refined. There may be differences in the commercialization-related challenges that affect universities, polytechnics, and community colleges. Therefore, problems need to be addressed differently. There is

room for improvement on the existing commercialisation policy for TVET institutions, especially for polytechnic and college communities. The key focus is to tackle the deeper problem—that of long-term sustainability and to be able the institution to adapt and move with the fast-changing world.

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