Eco-friendly styrofoam cutter

The Problem – Its Background

Ourenvironmenttoday is experiencing a lot of superfluous phenomena like floods, earthquakes and other incidents andpollutionis the root of all of these incidents. Serving the environment would be a big help to Mother Earth. The researchers decided to make junk into a new and useful thing that may be used by students and that may be a progress in our economy. Plastic is one of our society’s main problems for it is hard to decompose; it takes years to decompose a single plastic bag.

Plastics are one of the reasons why we experience flood for the reason that they block the water that passes the inland waterway that makes the water level go up rather making it go down. Plastic can be useful but it is also harmful to our environment. Using plastics correctly would be a great help. The principle is quite simple; there is a strong electric current in a thin resistive wire. The wire under the effect of current and heat cut easily and cleanly Styrofoam, much better than with a knife or a cutter, particularly for large pieces.

Styrofoam is also a plastic and it is a light, expanded polystyrene plastic. Styrofoam is a very versatile material used in many hobby applications ranging from remote-control airplanes to home remodeling. Like other plastics it takes years to decompose Styrofoam, a reason why we should use it efficiently and correctly. Styrofoam is an important part of the modern economy. It's a very versatile product, used for cups, plates, and even some interior decorating items.

Another very popular use is that of packing material. Packing Styrofoam comes in either loose form, or as " peanuts. As consumers, we use this

product every day. However, it has many other uses besides those for household decorating or shipping. Styrofoam has a very low melting temperature that is why the researchers decided to melt the Styrofoam rather than cutting it. It can also be used to cut plastic or synthetic foam.

A guitar string has a number of frequencies at which it will naturally vibrate. These natural frequencies are known as the harmonics of the guitar string. Guitar string can be made of Bronze Wound the most common guitar string, the Phosphor Bronze Wound is a bronze string with phosphor added to he alloy, Silk & Steel is a special design string where the unwrapped strings are plain steel and the wrapped strings have a thin steel core surrounded by many nylon filaments and then wrapped with silver plated brass windings, Nickel Plated a string consists of nickel plated steel wraps around a steel core, Pure Nickel a string consists of nickel wraps around a steel core. Due to the pure nickel content and Stainless Steel is defined as a steel alloy with a minimum of 10. 5 or 11% chromium content by mass.

The researchers decided to make a research/experiment that would help the environment by maximizing the use of their resources and by making recycled materials useful. Another reason why the researchers chose this experiment was so that they may help provide new business opportunities in the industry of Styrofoam carving/modeling. Statement of the Problem The researchers aimed to study if it is possible to make Styrofoam cutter made of guitar sting and other recycled materials. Specifically, this study seeks to answer the following questions:

- What are the materials that can be used in making a Styrofoam cutter?
- Does the product function properly?

- How will the finished product made or guitar string and other recyclable materials be effective in terms of being a Styrofoam cutter :
- Quality and effectiveness
- What would be the advantages and disadvantages of the product over the other cutting materials?
- How could this product make a change in the society?

Statement of Hypotheses Sub – Problems| Null hypotheses| Alternative hypotheses

- Would the materials be eco friendly?
- The materials that are needed are harmful to our environment.
- The materials needed are recyclable materials and Eco friendly.
- Would the experiment be functional?
- It would not bring any help and it would be just a waste of time.
- The experiment would serve it’s propose why it is done.
- Would the researcher accomplish the experiment?
- It won’t work for the researcher lacks experience and knowledge.
- The experiment will work for the researchers persevere a lot and guidance of the researchers reviews.
- Would the researcher meet all the needed requirements? |
- It would be hard for the researchers to find some of the materials and tools needed to make the machine.
- The researcher will make ways to continue the experiment and finish the product with a good quality.
- 5. Would the experiment provide innovation in ourtechnology?
- The experiment will not be an innovative one.

- The experiment will provide a new technological development.
- Would the experiment be a successful one?
- The researchers would fail in their experiment for the product would not work.
- The researchers would succeed in creating their product as a useful material for cutting Styrofoam.

Scope and Limitation

This study is limited in making an effective Styrofoam cutter made of guitar and other recycled materials that can be found at home. Guitar string will be the main material used in making the Styrofoam cutter. This study must be conducted within ten (10) months period. This study is limited on how far the researcher can go. This study aimed to provide a new innovation in the industry of Styrofoam carving. This study would look for ways to make waste into a useful object that will be a help in improving our quality of life, which can help in making life easier and in making things go faster.

It is an innovation, an improvement and the researchers chose this topic to help improve life and not to make people lazy. It is just on how the users utilize the machine. Significance of the Study This study aimed to produce a Styrofoam cutter made of guitar strings and other recycled materials. This study would provide a great innovation in the industry of Styrofoam craving. It would help in cutting, craving and shaping Styrofoam in a faster and easier way. It can also help in preventing too much waste from carving Styrofoam for this machine can cut Styrofoam efficiently.

This study would provide another development in our municipality for it can help in providing employment for housewives or skilled craftsmen for extra

income, for this machine could be done at home and with recycled materials. This machine can create simple craft that can be traded to other country. That can promote our economy and our country.

Definition of Terms

1. Carving foam – is a foam product which is designed to be worked by carving. A wide variety of foams can be used for carving, including urethane foam, expended polystyrene foam and polyusocyanurate foam.

2. Conductor - is a material which contains movable electric charges. In metallic conductors such as copper or aluminum, the movable charged particles are electrons.

3. Decomposition - is the process by which organic material is broken down into simpler forms of matter. The process is essential for recycling the finite matter that occupies physical space in the biome. Thesciencewhich studies decomposition is generally referred to as taphonomy from the Greek word taphos, meaning tomb.

4. Dimmers - devices used to vary the brightness of a light. By decreasing or increasing the RMS voltage. Although variable-voltage devices are used for various purposes, the term dimmer is generally reserved for those intended to control resistive incandescent, halogen and more recently compact fluorescent lighting.

5. Environmentally friendly – is also known as eco-friendly, nature friendly, and green are terms used to refer to goods and services, laws, guidelines and policies claimed to inflict minimal or no harm on the environment.

6. Fuse - a type of low resistance resistor that acts as a sacrificial to provide over current protection, of either the load or source circuit. It's essential component is a metal wire or strip that melts when too much current flows, which interrupts the circuit in which it is connected.

7. Guitar - a plucked string instrument usually played with fingers or a pick. The guitar consists of a body with a rigid neck to which the strings, generally six in number, are attached. Guitars are traditionally constructed of various woods and strung with animal gut or, more recently, with either nylon or steel strings. Some modern guitars are made of polycarbonate materials.

8. Heat transfer - is a discipline of thermal engineering that concerns the generation, use, conversion, and exchange of thermal energy and heat between physical systems. Heat transfer is classified into various mechanisms, such as heat conduction, convection, thermal radiation, and transfer of energy by phase changes.

9. Hotwire foam cutter - is a tool used to cut polystyrene foam and similar materials. The device consists of a thin, taut metal wire, often made of nichrome or stainless steel, or a thicker wire preformed into a desired shape, which is heated via electrical resistance to approximately 200°C. As the wire is passed through the material to be cut, the heat from the wire vaporizes the material just in advance of contact.

10. Lead - an electrical connection consisting of a length of wire or soldering pad that comes from a device. Leads are used for physical support, to transfer power, to probe circuits, and to transmit information.

11. Plastic – are typically organic polymers of high molecular mass, but they often contain other substances. They are usually synthetic, most commonly derived from petrochemicals, but many are partially natural. Plastic materials are any of a wide range of synthetic or semi-synthetic organic solids that are moldable.

12. Polystyrene – also known as Thermocole. It is an aromatic polymer made from the monomer styrene, a liquid hydrocarbon that is manufactured from petroleum by the chemical industry. It is also a thermoplastic substance, which is in solid state at room temperature, but flows if heated above its glass transition temperature of about 100 °C, and becomes solid again when cooled. Pure solid polystyrene is a colorless, hard plastic with limited flexibility. It can be cast into molds with fine detail.

13. String - is the vibrating element that produces sound in string instruments, such as the guitar, harp, piano, and members of the violinfamily. Strings are lengths of a flexible material kept under tension so that they may vibrate freely, but controllably.

14. Styrofoam - a trademark of The Dow Chemical Company for closed-cell extruded polystyrene foam currently made for thermal insulation and craft applications. In 1941, researchers in Dow's Chemical Physics Lab found a way to make foamed polystyrene. Led by Ray McIntire, they " rediscovered" a method first discovered by Swedish inventor Carl Georg Munters. Dow acquired exclusive rights to use Munters' patents and found ways to make large quantities of extruded polystyrene as closed cell foam that resists moisture.

15. Switch - is an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another.

16. Temperature - is a physical property of matter that quantitatively expresses the common notions of hot and cold.

17. Transformer - a device that transfers electrical energy from one circuit to another through inductively coupled conductors—the transformer's coils.

18. Vinyl Polymer - are a group of polymers derived from vinyl monomers. Their backbone is an extended alkane chain, made by polymerizing an alkenes group (C= C) into a chain (.. -C-C-C-C-..)

19. Voltage - the difference in electric potential between two points — or the difference in electric potential energy per unit charge between two points. A voltage may represent either a source of energy, or it may represent lost or stored energy.

20. Wire - is a single, usually cylindrical, flexible strand or rod of metal. Wires are used to bear mechanical loads and to carry electricity and telecommunications signals.

Wire is commonly formed by drawing the metal through a hole in a die or draw plate.

Chapter II Review of Related Literature and Studies

In Chapter I, the researchers were trying to find the problem, looking for more sources about it and trying to find ways to solve the stated problem. In this Chapter, the researchers find sources for their research. The researchers found some related information about hot wires or Styrofoam cutters that

will be their guide for the research. Foreign There are many ways of cutting Styrofoam and the researcher has chosen use guitar string or hotwires.

Hotwire cutters can be used in cutting any hard plastic or Vinyl polymer and it also has many uses for it is not just for cutting but also for shaping, molding, craving and even for commercial uses. And according to a website hot wire cutter are defined as: Hot wire cutters are used for cutting polystyrene foam types of Styrofoam, or upholstery foam into a variety of shapes and sizes for a wide variety of commercial and happy application. Hotwire foam cutters are usually made of metals. Metals are known for being a good conductor of heat and electricity and that is why it can be a good aterial to be used in making a hot wire foam cutter. Hot-wire foam cutter is a tool used to cut polystyrene foam and similar materials. The device consists of a thin, taut metal wire, often made of nichrome or stainless steel, or a thicker wire preformed into a desired shape, which is heated via electrical resistance to approximately 200°C. As the wire is passed through the material to be cut, the heat from the wire vaporizes the material just in advance of contact. The researchers chose guitar string as the main substance in creating a foam cutter made out of recycled materials.

A usual guitar string is made of steel which makes it a heat conducting metal; a factor why the researchers chose it for it fits to be the special wire in this apparatus. Moreover, guitar strings are also cheap; resource oriented, and can be found at home. These are the reasons why the researchers picked steel guitar string as the special wire. Metals are much better thermal conductors than non-metals because the same mobile electrons which participate in the electrical conduction also take part in the transfer of heat.

Hot wire cutters can create a simple Styrofoam in different useful crafts. It can make cash out of junks. It is used by different professionals like Architects, artists, designers, and many more. It can also provide occupation or source of income. It can promote our country’s economy. Local Our countrymen are well known as skilled craftsmen and very creative people; as the saying goes, Filipinos can make junk as useful things. So, the researchers decided to help our countrymen by creating a Styrofoam cutter made of recycled materials.

It can lessen the waste in carving Styrofoam. Styrofoam is made of plastic that can damage our environment; a reason why some organizations recommended to stop using Styrofoam for commercial uses. It is said that Styrofoam is just an additional waste problem for our country. It was said in a new article: It shouldn’t take much convincing to Say NO to Styrofoam, but there’s so much of it! We are almost as addicted to Styrofoam as we are to oil. And majority of the Styrofoam made ends up in the landfill.

The answer to this problem is the proper usage of Styrofoam and having the ight equipment in cutting Styrofoam to lessen the waste or mistakes that can be done. Lastly, caring and having fullresponsibilityof our environment. Man draws almost endless benefits from great gifts of technology like styrene. What it calls for in return is simple: proper use and responsible disposal. With the current waste segregation scheme implemented by the local government, it falls to consumers to play their part in ensuring that their various garbage, particularly polystyrene and plastic, are segregated and undergo the proper recycling process, acquiring yet a whole new range of useful by-products.

Review of Related Studies Foreign A flexible automated foam cutting system M. Jouaneh, A. Hammad and P. Datseris Department of Mechanical Engineering, University of Rhode Island, Kingston, RI 02881, U. S. A. Abstract: Direct cutting of foam has the advantage of greater flexibility and reduced lead time over molding. This paper discusses the design and development of a flexible automated system for foam cutting that utilizes hot-wire cutters. The cutters are moved through the use of a five-axis gantry-type robot system equipped with a tool turret.

A method for modeling the cut geometry, based on representing the three-dimensional cut shape as a combination of basic geometrical block shapes, is presented. This method gives the system flexibility to handle different work piece geometries. A technique for generating the required cutting paths from the modeled geometry is also shown. The developed methodology was applied for the cutting of automotive seat cushions. The results show that the automated system significantly reduces the cutting time and produces cuts of improved quality. ttp://www. sciencedirect. com/science/article/pii/S0890695596000223 Plastic Foam Cutting Mechanics for Rapid Prototyping and Manufacturing Purposes by: Hadley Brooks Abstract: Development of foam cutting machines for rapid prototyping and manufacturing purposes began shortly after the first additive manufacturing machines became commercialized in the late 1980s. Increased computer power, the development and adoption of CAD/CAM software and rising demand for customization has caused the rapid prototyping industry to grow swiftly in recent decades.

While conventional rapid prototyping technologies are continuing to improve in speed and accuracy the ability to produce large (> 1mA?) prototypes, moulds or parts it is still expensive, time consuming and often impossible. Foam cutting rapid prototyping and manufacturing machines are ideally suited to fulfill this niche because of their high speed, large working volumes and inexpensive working materials. Few foam cutting rapid prototyping machines have been commercialized to-date leaving significant opportunities for research and development in this area.

Thermal plastic foam cutting is the material removal process most commonly used in foam cutting rapid prototyping to shape or sculpt the plastic foam into desired shapes and sizes. The process is achieved by introducing a heat source (generally a wire or ribbon) which alters the physical properties of the plastic foam and allows low cutting forces to be achieved. In thermal plastic foam cutting the heat source is generated via Joule (electrical) heating. This study investigates the plastic foam cutting process using experimental cutting trials and finite element analysis.

The first part of this thesis presents an introduction to conventional foam cutting machines and rapid prototyping machines. It is suggested that a market opportunity lies out of reach of both of these groups of machines. By combining attributes from each, foam cutting rapid prototyping machines can be developed to fill the gap. The second part of this thesis introduces the state-of-the-art in foam cutting rapid prototyping and investigates previous research into plastic foam cutting mechanics. The third part of this thesis describes cutting trials used to determine important factors which influence plastic foam cutting.

Collectively over 800 individual cutting tests were made. The cutting trials included two main material sets, expanded polystyrene and extruded polystyrene, three different wire diameters, two hot-ribbon configurations and a wide range of feed rates and power inputs. For each cut the cutting force, wire temperature and kerfs width was measured as well as observations of the surface texture. The data was then analyzed and empirical relationships were identified. An excel spreadsheet is established which allows the calculation of important outcomes, such as kerf width, based on chosen inputs.

Quantitative measurements of the surface roughness and form, of cuts made with hot-tools, will not be addressed in this thesis. This body of work is currently under investigation by a colleague within the FAST group. The fourth part of this thesis describes the formation of a nonlinear transient two-dimensional heat transfer finite element model, which is developed for plastic foam cutting simulations. The conclusion is that the cutting trials contributed to a better understanding of plastic foam cutting mechanics.

A new parameter was identified called the mass specific effective heat input, which is a function of the foam material and the cutting tool, it allows the prediction of cutting conditions with given cutting parameters and hence provides the necessary relationships needed for adaptive automated foam sculpting. Simulation results were validated by comparison with experimental data and provide a strong base for further developments including optimization processes with adaptive control for kerf width (cut error) minimization.

This study has added considerably to the pool of knowledge for foam cutting with a hot-tool. In general, much of the work reported herein has not been previously published. This work provides the most advanced study of foam sculpting work available to date. http://ir. canterbury. ac. nz/bitstream/10092/4291/3/Thesis_fulltext. pdf. txt Cutting apparatus for plastic foam solids or the like Abstract: A cutting apparatus for plastic foam solids or the like which comprises a cutting wire system having a plurality of cutting wires attached ubstantially perpendicularly between two substantially parallel supporting rods spaced from each other so that a piece of plastic foam solid to be cut can be passed through the cutting wires between the supporting rods, and an oscillating drive engaged with the supporting rods so as to oscillate rotatably the supporting rods in opposing rotational directions and therefore to oscillate the wires to and fro lengthwise. The cutting wires are spaced from each other in either of two cutting wire positions lengthwise along the supporting rods.

The cutting wires are attached eccentrically to the outer periphery of the supporting rods, each of the cutting wires which are each in a different one of the cutting wire positions lying in planes parallel to the supporting rods and each of the cutting wires in the same cutting wire position lying in the same plane. Each of the cutting wires in the different cutting wire positions is guided to and attached to opposite outer peripheral sides of each of the supporting rods so that the planes formed by the cutting wires of each of the different cutting wire positions cross each other at an acute angle.

Preferably the cutting wires are heat able electrically and attached to the supporting rods by way of coil springs. http://www. patentstorm.

us/patents/4608893. html A study on the influence of the sloped cutting angle on kerfwidth and part quality in the hotwire cutting of EPS foam for the VLM-Srapid prototyping process Abstract: The VLM-S rapid prototyping process employs hotwire cutting of an EPS foam sheet using a four-axis synchronized automatic hotwire cutter. The dimensional accuracy and the quality of the cut part are highly dependent on cutting parameters such as effective heat input, and cutting angle, etc.

The objective of this study is to investigate the influence of cutting angle on the kerfs width and the part quality in hotwire cutting of EPS foam for the case of the sloped cutting including single-sloped cutting with one cutting angle and generally sloped cutting with two cutting angles. Experiments are carried out to obtain the relationship between kerfwidth and effective heat input for each cutting angle, and to find the relationship between the melted area and the cutting angle for each effective heat input.

In order to investigate the influence of cutting angle on temperature distribution in EPS foam, transient heat transfer analysis using the sloped heat flux model and the conformed mesh structure is carried out. Through comparison of the results of the experiment and the transient heat transfer analysis, it has been shown that the sloped heat flux with an elliptical cross-section and the conformed mesh structure are needed to estimate the three-dimensional temperature distribution in the EPS foam in the sloped hotwire cutting. http://www. ciencedirect. com/science/article/pii/S0890695503001706 Polymer–cement composite based on recycled expanded polystyrene foam waste Abstract: A new polymer–cement composite based on a recycled expanded polystyrene (EPS)

resin has been developed as an effective method for EPS foam wastes management. The liquefied polymer is prepared by dissolving the foam waste in acetone, then in toluene at the ratio 113: 2: 1 per volume, respectively. The composite is made by incorporating the resulting resin into cement-paste at selected water: cement ratios.

At the end of defined curing periods, the physical, mechanical, and thermal characterizations of the obtained composite were evaluated under variable factors e. g. , Acetone: toluene ratio, water: cement ratio (w/c), curing periods. Compressive strength, apparent porosity, bulk density, and specific gravity were determined for the composite under the various stated conditions. FT-IR, XRD, thermal analysis, and scanning electron microscope (SEM) were performed for the hard blocks to study the effect of the added recycled EPS resin on the microstructure of the end products.

Based on the data so far obtained it can be concluded that the candidate dissolution process of EPS foam wastes is an easily environmental friendly technique that allows afterward using the resultant resin for producing an added value, low cost, promising market competitive, and multipurpose light weight cement composite. http://onlinelibrary. wiley. com/doi/10. 1002/pc. 21171/abstract Short-hot-wire method for the measurement of total hemispherical emissivity of a fine fibre Seiji Fujiwara, Xing Zhang, Motoo Fujii Received 20 December 1999 Abstract:

A new short-hot-wire method for the measurement of total hemispherical emissivity of a fine fibre is proposed. This method uses two short hot wires and is based on the analytical solution of one-dimensional steady-state heat conduction along the hot wires and fibre. Two hot wires are arranged parallel

to each other. Both the hot wires are supplied with a constant direct current to generate heat and maintain the same average temperature. A test fibre bridges the wires and its ends are attached to the centre position of each hot wire to form an H-type probe.

By the use of this two hot wires technique, the total heat transmitted from the hot wires to the fibre is completely radiated from the fibre to the surroundings under vacuum conditions. Therefore, the average temperature rise of the hot wire depends on the emissivity of a fibre. The steady-state heat conduction for the H-type probe is analytically solved to obtain the accurate relationship between the temperature rise of the hot wires and the fibre emissivity. Based on this relationship, the emissivity of the fibre can be estimated when the average temperature and the heat rate of the hot wires with known thermal properties are measured.

The theoretical analysis has confirmed that the present method can obtain emissivity in the range of 0. 1 - 1. 0 within an error of ±1% for the fibre with its diameter around 10 ? m. http://www. perceptionweb. com/abstract. cgi? id= htwu375 Synthesis: Styrofoam is of the most used polymer product. It is often used in architecture, carving and alike. There are many ways to cut Styrofoam, like using blades or cutter, also by the help of laser and also by using hot wires. There are many ways to create a Styrofoam cutter or better known as hot wire. And it is also sold in the market.

A hot wire is not only for Styrofoam but it can also use for cutting plastics and other polymer substance. For heat can divide polymer materials better than blades. Heating metals/wires can create a physical or chemical change to an object or it can also make a new product. While the electricity that

would run in the wire would be the source of heat of the heated wire. Hot wire is a process of heating metals or wire in order to burn or cut an object. Using hot wire as an instrument of cutting may be complex but faster and more accurate than using blades.

Styrofoam is a polymer product that takes time to decay. It is said in that the ratio of toluene is 113: 2: 1 per volume. It takes time of a small piece of Styrofoam to decay, a reason that Styrofoam should be used properly and should not be wasted. Styrofoam is one of pollutant that affects our environment a lot. Local Hot-wire parallel technique: A new method for simultaneous determination of thermal properties of polymers Abstract: The hot-wire parallel technique standardized for determining the thermal conductivity of ceramic materials was employed in the determination of the thermal properties of polymers.

For these materials, additional care must be taken considering the low melting point of polymers, when compared with that for ceramic materials. Samples can be prepared either in the shape of bricks or in the shape of half-cylinders. The thermal conductivity and the specific heat were simultaneously determined from the same experimental thermal transient, and the thermal diffusivity is derived from these properties. Five different polymers with different structures at room temperature were selected, and measurements were carried out from room temperature to approximately the maximum service operating temperature.

A nonlinear least-squares fitting method was employed in the calculations, so that all the experimental points obtained are considered in the thermal properties' calculations. The apparatus used in this work is fully automatic.

The reproducibility is very good withrespectto the thermal conductivity, even with a defective experimental arrangement with respect to the theoretical model. However, deviations from the theoretical model have a severe influence on the specific heat values and, consequently, on the thermal diffusivity.

Experimental results were compared with those available in the literature, showing the applicability of this technique for the determination of thermal properties of polymers. © 2002 Wiley Periodicals, Inc. J Appl Polym Sci 85: 1779–1786, 2002 http://onlinelibrary. wiley. com/doi/10. 1002/app. 10681/abstract Abstract: The hot-wire calibration method as proposed by Cimbala and Park (1990) has been showen to be accurate within a temperature range of 20–45°C. This is a significant extension of the range used by Cimbala and Park (27. 5– 34. 5°C). The accuracy of the calibration is not affected by the ambient temperature.

The calibration curve obtained seems to hold over a long period of time, thus reducing the need for frequent calibrations. Due to contamination the accuracy eventually decreases and the probe has to be re-calibrated. http://www. springerlink. com/content/r774213w086k2572/ Paper, Rice Hull and Polystyrene Foam Blocks John Gil E. Jimena, Jonathan Lloyd N. Lunsayan, Franco C. Flores Abstract: Nowadays, people in the construction industry here in the Philippines and abroad can always attest to the rising prices of the construction commodities in the market, not to mention the equally increasing cost of labor.

This economic scenario is indeed an offshoot of the worsening global crisis that both highly developed and developing countries are experiencing.

http://ejournals. ph/index. php? journal= CUEJ Synthesis: Styrofoam as we know can affect our environment. We cannot just let our environment ruined by these styrofoam, m the styrofoam cutter decreases the damage in our environment, the right temperature should be followed because if the wire is not that hot, it cannot cut styrofoam. Safety measure should always be guided when doing the experiment.

Hot-wire can cut easily because it has more heat produces than the other. It will be seen because of the styrofoam, sometimes if the styrofoam does not cut then the wires are not that hot to cut a styrofoam. Observe proper room temperature when doing the experiment is needed. Hot wires used when it needs to cut a certain material. Chapter III Methods of Research and Procedures In the previous chapters the researchers had gathered data for the experimentation that the researchers are about to conduct. The researchers looked for references for the experimentation.

And in this chapter the researchers are going to conduct the experiment. It is putting all the researcher’s ideas and collected information into application. Method of the Study In this research the researchers used experimental research for them to obtain the target output. Experimental Research is used to identify the dependent and independent variable and to know it’s relationship to each other, to see the result of the study if it will succeed or not and to test the hypotheses which is used for basis of investigation.

Also in this chapter, it involves the creation or invention of products and also, the creation of new ideas that may help the people who would encounter this kind of studies for the innovation of the country for the future. This study was intended to discover the effectiveness of styrofoam cutter made of

guitar string and other recycled materials. Materials and Methods In conducting this experiment, the researchers created a homemade styrofoam cutter made of some recyclable materials and use guitar string as its main material. Since the experiment is made of recyclable materials, materials should come from junks and other old stuffs.

The researchers only bought a single-pole dimmer switch from Ace Hardware. And all of the other materials came from some recycled stuffs like the guitars string number 1 from an old broken guitar, a 12 feet 16 gauge used extension cord, some old plywood came from excess ones, old or broken CD cases, an old 25 volt 2 amp transformer, an assembled length of two conductor electrical wires with a regular plug on the end, some excess metal wires shaped as rings, wooden rod and the tools needed to create the product. The materials do not need to be expensive nor classy.

The materials have to be in good quality and durable so that the experiment work properly and be successful. With all the materials needed for the experiment the researchers started making the product. The researchers first made the frame of the styrofoam cutter. The researchers drew an arc on the plywood to serve as the frame of the styrofoam cutter. The frame should be stable and durable for long use. The researches put two machine screw nuts in the both end of the frame, these machine screw nuts would serve as the conductor of electricity and heat that comes from the wire.

The machine screw nuts should not be small and not too tall for it can cause burns and other injury when touch. The next procedure was to attach the wires that carry the 25 Volts current to the cutting wire by the help of two machine screws as its terminal posts. Save the plug and outlets for future

projects, if you like. Strip the insulation off the last inch of one end of one wire of the cord and insert a machine screw in the top of the right side of the frame. The next thing to do is to attach the guitar string as the hot wire. Make a loop by feeding the other end through this metal rings.

Hook the loop over one terminal. The guitar string should not touch the frame and also the wires for it can burn but remember to keep it close to the nuts. And finally the researchers connected the dimmer switch and the transformer by the use of electric tapes. This will create an outlet and a wire that is connected to the guitar string. Finally the researchers enclosed the transformer in a box made of recycled materials to make the product more creative, presentable and be eco-friendly. Statistical Treatment of Data The all the gathered data were subjected to the following formulas: Frequency Distribution

Frequency Distribution is an arrangement of the values that one or more variables take in a sample. It is used for identifying a specific proportion of the population. It is the number of times of occurrence of a variable. This statistical method is used by the researcher for calculating gather data. It can also show the rate percent of each value included in the set of questions. The scale is used in calculating gathered materials from the questionnaires. This is the formula being use: Wherein: P = percentage f = frequency n = number of samples Weighted Mean

Weighted mean is also called as weighted average. It means finding the middle or the average where instead of each of the data points contributing equally to the final average, some data points contribute more than others. It was tallied for verbal interpretation of data. Verbal Interpretation| Weighted

Mean| Strongly Agree | 3. 31 – 4. 00| Agree | 2. 30 – 3. 30| Disagree | 1. 90 – 2. 29| Strongly Disagree| 1. 00 – 1. 89| Flowchart Chapter IV Analysis, Presentation and Interpretation of Data The pervious chapters are all about knowing the problem to be answered.

Looking for facts that may help the researchers answer the problem to be solved. In this chapter, the researchers would be analyzing, presenting and interpreting all the gathered data in this research. The questionnaires made by the researcher would provide answers for the said study. This would serve as the researchers' medium in data gathering the researchers. This study was composed of 40 respondents selected randomly. Presentation is the practice of showing the gathered information or data and explaining the content of a topic to be discussed. It is the method used to organize and store data or information.

Analysis is the process of breaking or subdividing complex topic or substance into smaller parts to gain a better understanding and better comprehension of it. It is where data are being evaluated and examined under the critical investigation of the study. And lastly, interpretation of data is giving meaning of an act. It is putting donation on the gathered data. It is the process of explaining and elaborating all of the data gathered. Table 1 The Materials that can be Used in Making a Styrofoam Cutter Items| Frequency| Percentage| Blade/Knife| 3| 1. 92%| Wire| 29| 18. 47%| Fire| 0| 0%|

Guitar string| 25| 15. 93%| Transformer| 16| 10. 19%| Dimmer| 11| 7%| Switch| 20| 12. 74%| Metal rods| 15| 9. 55%| Needle| 2| 1. 27%| Plug| 20| 12. 74%| Cable wire| 13| 8. 28%| Laser| 3| 1. 91%| Total:| 157| 100%| It can be deduced from Table 1 the materials that can be used in making a styrofoam

cutter. One point ninety-two percent (1. 92%) said that blade or knife is needed in making a styrofoam cutter. While eighteen point forty-seven percent (18. 47%) said that wires are needed in making a styrofoam cutter. Nut zero percent (0%) said that fire is needed in making a styrofoam cutter.

Fifteen point ninety-three percent (15. 93%) said that guitar strings are needed in making a Styrofoam cutter. Ten point nineteen percent (10. 19%) said that transformer is needed in making a Styrofoam cutter. Seven percent (7%) said that dimmer is needed in making a styrofoam cutter. Twelve point seventy-four percent (12. 74%) said that switch is needed in making a Styrofoam cutter. Nine point fifty-five (9. 55%) percent said that metal rods are needed in making a Styrofoam cutter. One point twenty-seven percent (1. 27%) said that needle is needed in making a Styrofoam cutter.

Graph 1 shows the possible materials to be used in making a Styrofoam cutter. Most or majority of the respondents chose wires, guitar string, switch and plug as the materials needed in making a Styrofoam cutter. Those materials are some of the materials used by the researchers in making the Styrofoam cutter. Table 2 Functionality of a Styrofoam Cutter Made of Guitar String and Recycled Materials Items| Frequency| Percentage| Yes| 37| 92. 5%| No| 3| 7. 5%| Total:| 40| 100| It can be deduced from Table 2 how functional the Styrofoam cutter made of guitar string and other recycled materials.

It can be inferred that 37 out of 40 responds or ninety-two point five percent (92. 5%) believe that the Styrofoam cutter made of guitar string and recycled materials is functional. While 3 out of 40 respondents or seven point five percent (7. 5%) do not believe that the Styrofoam cutter made of guitar

string and recycled materials is functional. Graph 2 shows how functional the Styrofoam cutter made of guitar string and other recycled materials. Majority or most of the respondents agree that the Styrofoam cutter made of guitar string and other recycled materials is functional and working properly.

Table 3 The Quality of the Styrofoam Cutter Made of Guitar String and Recycled Materials Items| SA| A| D| SD| WM| VI| 1. The product can create quality output. | 15| 22| 3| 0| 3. 3| SA| 2. The product is presentable to the eye. | 6| 28| 10| 11| 3. 45| SA| 3. The product will last long. | 7| 16| 15| 1| 2. 67| A| 4. The product proves that expense and quality could co-exist. | 10| 19| 10| 1| 2. 95| A| 5. The product needs careful handling. | 29| 11| 0| 0| 3. 72| SA| It can be deduced from Table 3 the quality of the Styrofoam cutter made of guitar string and other recycled materials.

It can be inferred from the table that the respondents strongly agree that the product can create quality outputs with the weighted mean of 3. 3. Moreover, they also strongly agree that the product is presentable to the eye and the product needs careful handling with a computed weighted mean of 3. 45, and 3. 72 respectively. Furthermore they agree that the product will last long and proves that expense and quality could co-exist with a computed weighted mean of 2. 67 and 2. 95 respectively. Graph 3 shows the quality of the Styrofoam cutter made of guitar string and other recycled materials.

Majority of the respondents agreed that the Styrofoam cutter made of guitar string and other recycled materials is in good quality. Table 4 The Effectiveness of the Styrofoam Cutter made of Guitar String and Recycled Materials. Items| SA| A| D| SD| WM| VI| 1. The product can function

effectively. | 13| 22| 4| 1| 3. 17| SA| 2. The product can cut with less waste. | 10| 18| 12| 0| 2. 95| A| 3. The product can do better than man power. | 9| 20| 8| 2| 2. 85| A| 4. The product can cut better than blades. | 9| 26| 4| 1| 3. 07| SA| 5. The product does not create the shapes that are complex. | 9| 21| 8| 2| 2. 2| A| It can be deduced from Table 4 the effectiveness of the Styrofoam cutter made of guitar string and other recycled materials. It can be inferred from the table that the respondents strongly agree that the product can function effectively with the weighted mean of 3. 17. Moreover, they also strongly agree that the product can cut well than blades with a computed weighted mean of 3. 07. Furthermore they agree that the product can cut with less waste, can do better than man power and can create the shapes that are complex with a computed weighted mean of 2. 95, 2. 85 and 2. 92 respectively.

Graph 4 shows the effectiveness of the Styrofoam cutter made of guitar string and other recycled materials. Majority of the respondents agreed that the Styrofoam cutter made of guitar string and other recycled materials is effective in cutting Styrofoam. Table 5 The Advantages and Disadvantages of Using Styrofoam Cutter Made of Guitar String and Other Recycled Materials Items| SA| A| D| SD| WM| VI| 1. The product can be used significantly. | 9| 26| 4| 1| 3. 07| SA| 2. It is expensive. | 7| 14| 13| 6| 2. 55| A| 3. The product can easily cut Styrofoam. | 11| 23| 4| 2| 3. 07| SA| 4. It makes work faster. | 9| 21| 10| 0| 2. 7| A| 5. It is eco-friendly for it is recycled. | 10| 25| 2| 3| 3. 05| SA| 6. It can easily be used without the help of manuals. | 10| 22| 7| 1| 3. 02| SA| 7. It gives hard time cutting small pieces of Styrofoam. | 8| 18| 10| 4| 2. 75| A| 8. It takes a lot of time heating the wire. | 10| 22| 8| 0| 3. 05| SA| 9. The

product is capable of accurate cutting of Styrofoam. | 9| 27| 3| 1| 3. 1| SA| 10. It helps in creating less waste in cutting Styrofoam. | 15| 21| 2| 2| 3. 22| SA| It can be deduced from Table 5 the advantages and disadvantages of using Styrofoam cutter made of guitar string and other recycled materials.

It can be inferred from the table above that the respondents strongly agree that the product can be used significantly with the computed weighted mean of 3. 07. Moreover, they also strongly agree that the product can easily cut Styrofoam, eco-friendly for it is a recycled one, can easily be used without the help of manuals, takes a lot of time heating the wire, capable of accurate cutting of Styrofoam and helps in creating less waste in cutting Styrofoam with the computed weighted mean of 3. 07, 3. 05, 3. 02, 3. 05, 3. 1 and 3. 22 respectively.

Furthermore, they agree that the product is expensive, makes work faster and gives hard time cutting small pieces of Styrofoam with the computed weighted mean of 2. 55, 2. 97 and 2. 75 respectively. Graph 5 shows the advantages and disadvantages of using Styrofoam cutter made of guitar string and other recycled materials. The respondents showed that the product has disadvantages and advantages when it comes to its function and effectiveness. It is also showed that the Styrofoam cutter made of guitar string and other recycled materials has more advantages than disadvantages. Table 6

The Possible Changes in the Society with the Use of Styrofoam Cutter Made of Guitar String and Other Recycled Materials Items| SA| A| D| SD| WM| VI| 1. It would be a big change in our craftsmen. | 8| 24| 7| 1| 2. 97| A| 2. It can lift our exports of Styrofoam crafts. | 5| 27| 7| 1| 2. 9| A| 3. It can replace men in

their works. | 8| 15| 15| 2| 2. 72| A| 4. It could cause economic growth. | 12| 20| 8| 0| 3. 1| SA| 5. It can be made at home. | 15| 22| 2| 1| 3. 27| SA| It can be deduced from Table 6 the possible changes in the society with the use of Styrofoam cutter made of guitar string and other recycled materials.

It can be inferred from the table that the respondents agree that the product would be a big change in our craftsmen with the computed weighted mean of 2. 97. Moreover, they also agree that the product can lift our export of Styrofoam crafts and the product can replace men in their works with a computed weighted mean of 2. 9 and 2. 72 respectively. Furthermore, they strongly agree that the product could cause economic growth and that the product can be made at home with a computer weighted mean of 3. 1 and 3. 27 respectively.

Graph 6 shows the possible changes in the society with the use of the Styrofoam cutter made of guitar string and other recycled materials. Majority of the respondents strongly agree that the product can possibly change the society. Chapter V Summary, Conclusion, Recommendation In this chapter, Chapter 5 the result of all the gathered data would be discussed. This chapter contains the summary, the conclusion and the recommendation for the future researchers and for the readers. This chapter is based from the gathered information from the analysis and interpretation of data and also from the previous chapters. Summary of the Finding

This study focused on the Effectiveness of Styrofoam Cutter Made of Guitar String and Other Recycled Materials. The investigative method was implemented in order to determine relevant and up to date study. In this study forty respondents which came from randomHigh School studentsof

Cavite School of Life – Bacoor Campus, were chosen to partake in this study through expedience sampling technique. After demonstrating the product, questionnaires were handed over to the respondents for data gathering for the study. Based on the gathered data from the selected respondents the following are found relevant in the study:

1. What are the materials that can be used in making a Styrofoam cutter? According to the data gathered from the respondents and presented in table 1 and graph 1 that wire with 18. 47%, guitar string 15. 93%, switch with 12. 74% and plug with 12. 74% are some of the common materials used and needed in making an effective Styrofoam cutter. And according to the respondents that fire, blade/knife, needle and laser are some materials not needed in making a Styrofoam cutter.
2. Does the product function properly? According to the data gathered from the respondents and presented in table 2 and graph 2 that 92. % of the respondents said that the Styrofoam cutter made of guitar string and other recycled materials is functioning well and it does not malfunction. While 7. 5% of the respondents said that the product does not function well or did not pass their standard when it comes to being functional.
3. How will the finished product made of guitar string and other recyclable materials be effective in terms: a. Quality; and According to the gathered information presented in table 3 and graph 3 that the product can create outputs that are creative and in good quality.

The product was also presentable to the eye and it does not look like trash. The product seems to be durable and can last long. The negative thing about

the product was it needs to be handled with care and it also proves that expense and quality can co-exist. b. effectiveness? According to the gathered information presented in table 4 and graph 4 the product can function efficiently and can cut well than blades. The product can also cut with less waste and it could also do better than output made by man. The negative thing about the product is it cannot create the shapes that are complex.

4. What would be the advantages and disadvantages of the product over the other cutting materials? According to the gathered information presented in table 5 and graph 5 the advantages of a Styrofoam cutter made of guitar string and other recycled materials are: the product can be used significantly, can easily cut styrofoam, makes work faster, is eco-friendly for it is made of recycled materials, can easily be used without the help of manuals, is capable of accurate cutting of Styrofoam and lastly it helps in creating less waste in cutting Styrofoam compared to using blades. And also according to the gathered data the disadvantages of the Styrofoam cutter made of guitar string and other recycled materials are: that the product gives hard time cutting small pieces of Styrofoam and takes a lot of time heating the wire.

5. How could this product make a change in the society? According to the gathered information presented in table 6 and graph 6 that the product can make different changes in the society. The product could cause economic growth for our country and it can be made at home.

The product can also be a big change in our craftsmen, can also lift our exports of Styrofoam crafts and can replace men in their works. Conclusions

After summarizing the result of the study the researchers came up with the following conclusions based on the authenticity and cooperativeness of high school students of Cavite School of Life – Bacoor Campus, as the respondents in answering the questions.

1. There are many materials that can be used in this experiment. But in this study the researchers found out the top five materials that can be used in this experiment. Top choice was wire which was used as the connection between the source of electricity and the output. The second top choice was guitar string which was used by the researchers as their hotwire. The third top choice was plug and switch. The fourth choice was transformer which was used as the source of electricity. And lastly, the fifth choice was metal rods that can also serve as hotwires.

2. Malfunctioning is one of the product number one problem. Good thing the product in this experiment did not malfunction and function efficiently.

In this study the researchers found out that the Styrofoam cutter made of guitar string and other recycled materials was functioning well and can do its work properly.

3. 1. In every product quality is always checked. In this study the researchers found out that the Styrofoam cutter made of guitar string and other recycled materials can provide outputs that are of good quality. The product is also presentable to the eyes. This product proves that expense and quality could co-exist which means that there are cheap product that can give good quality than expensive one.

They could be reliable and durable with almost the lower range of price.

4. 2. Effectiveness of a product should always be observed. The researchers found out that the Styrofoam cutter made of guitar string and other recycled materials is better than blades when it comes to cutting or craving Styrofoam. The good thing in this product is it creates less waste when cutting Styrofoam and it can also do better than cutting or carving manually. But the product also has its limitations for it is not that good in cutting or craving complex shapes.

4. Every product has its weakness and strength. The researchers found out that the Styrofoam cutter made of guitar string and other recycled materials has different advantages and disadvantages. It is also said to be time consuming when heating the guitar string. The said disadvantages do not hinder the product to perform well. The research also found out the advantages of using a Styrofoam cutter made of guitar string and other recycled materials that it is capable of accurate cutting of Styrofoam than other cutting instrument. It is also eco-friendly and easy to use for it is just a simple machine.

The product can also make work faster and easier.

5. The researchers found out that the Styrofoam cutter made of guitar string and other recycled materials can make a big change in our society and for our society. It can develop the way our craftsman cut or crave Styrofoam. And it could also improve our product and our economy.

Recommendation

- 1. The researchers recommend that Styrofoam should be used properly and not be wasted.

- 2. The researchers recommend that the product should be improved to solve the products disadvantages.
- 3. The researchers recommend that having innovation of Styrofoam cutter will make it more effective to be used and function in the best way it could.
- 4. The researchers recommend that this product should open the eyes of the people to be eco-friendly.
- 5. The researchers recommend that the readers should appreciate recycled things and make usable stuffs from trash or old materials.
- 6. The researchers recommend that the use of Styrofoam cutter made of guitar strings and recycled materials could make a difference and can provide economic growth.

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