Green and Digital Technologies in Design

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ABSTRACT

The goal of the study is to develop conceptual projects and products with an experimental nature within the module "Green Technologies in Design" of the innovative integrative module "Innovative Design". This module is studied in the extended professional training program at PGD "Elisaveta Vazova," Sofia, over a two-year period from 2021 to 2023. Project-based learning for students in the eleventh and twelfth grades, specializing in "Computer-Aided Design and Drawing of Textile Flat Products," is implemented through the application of digital, green, ecological, sustainable, waste-free, and low-waste technologies, techniques, and materials in design. It has led to the creation of original designer projects and environmentally friendly ecological products. The project develops sustainable practical skills and emotional-aesthetic competencies for creative ecological thinking, ecological education, culture and behaviour, solving ecological problems, practical application of the interdisciplinary and competence approach, and transforming "green" skills into a "green" way of life.
Keywords: green and digital technologies in design, innovative design, product design.

INTRODUCTION

The study is developed as project-based learning from students in the eleventh and twelfth grades, specializing in the protected field of "Computer-Aided Design and Drawing of Textile Flat Products." whose primary objective is to provide viable experimental product proposals for addressing "green" issues, posed by the natural sciences, through the application of digital and green technologies. The products are crafted using an interdisciplinary approach that combines the professional and practical skills of students in textile design, materials science, and redesign to address ecological problems discussed in natural sciences such as ecology, green chemistry, and environmental conservation.

EXPERIMENTAL
Products used
Digital products
Educational digital video game "Green Restart"

An educational video game, "Green Restart", has been created as an interactive, digital, and emotional means for building, assessing, developing, and enhancing students' green and digital skills. The game can be expanded with new interesting questions and scenarios (Fig. 1) [1].

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Development process

1. Selection of suitable questions from the lessons of the "Green Technologies" module;

2. Construction of answers to the questions;

3. Game development in the "Crey" application;

4. Game rules:

4.1. Open the link and click the "Play" button,

4.2. Download and install "Crey",

4.3. Open the link, click "Play," and "Open Crey",

4.4. The game starts in a cave from which you must exit and continue along the path to the questions,

4.5. After providing the correct answer, proceed to the next educational question,

4.6. Once you answer all situational questions correctly, your adventure concludes.

Controls are as following: W: Move forward, A: Move left, S: Move backward, D: Move right, Shift: Run, Space: Jump

5. Record the gameplay in MP4 format.

Kids room border [2]

A project using the CorelDRAW program for a kids' room border, which can be either textile or printed on a self-adhesive strip.

Development process

1. Crafting and colouring the frame of the border, which consists of soccer balls.

2. Using Pen tool and Shape tool to create the animated character – Bugs Bunny, which is repeated in various variations.

3. Creating a background for the border.

Products from modern materials
Glass fabric (fiberglass)

Glass fabric is a material that is successfully used as fiberglass wallpaper in interior design. Two innovative products have been developed that can be used in interiors as tapestries or boutique embroidered fiberglass wallpapers.
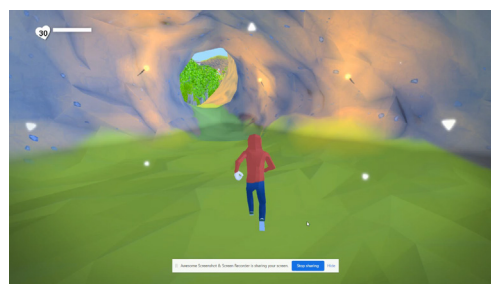
Development process

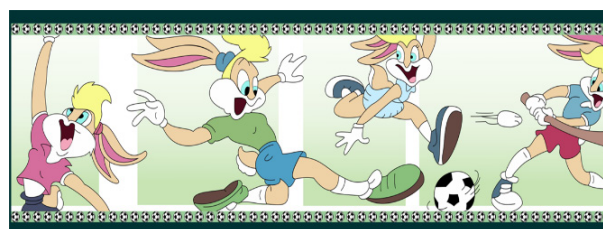Fig. 1. A scene from the created game "Green restart".

Fig. 2. A created scenario of Kids Room Border.

1. Drafting a scheme for embroidery.

2. Using 300 g m^{-2} plain glass fabric.

3. Embroidering on the glass fabric (Fig. 3 and Fig. 4).

Carbon fiber

Carbon fibers and fabrics are high-quality polyacrylonitrile polymer materials that are hard, durable and have significant strength under tension (7 - 9 times stronger than steel), low relative weight (2 times lighter than steel), small thickness: 0.7 - 1μm (100 times thinner than human hair), high chemical, thermal, shock-absorbing, and corrosion resistance, as well as radio and electrical conductivity.

A carbon fiber bracelet has been crafted and treated with epoxy resin.

Development process

1. Carbon fabric fibers of 240 g m^{-2} spread tow are used.

2. A bracelet is woven from 27 individual fibers, 9 shallow weaves, and 3 triple weaves.

3. The bracelet is treated with epoxy resin

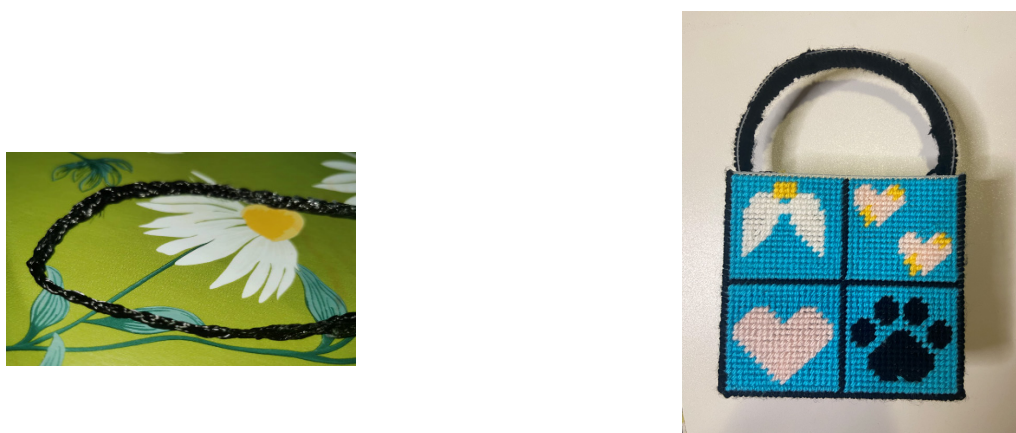Fig. 3. Examples of embroidering on the glass fabric.

Fig. 4. A created bracelet.

Fig. 5. The created new bag on plastic canvas.

MULTIPOX PR227 and PVA release agent in a ratio of 1:4.

Embroidered bag on plastic canvas

An attractive women's bag made of embroidered plastic canvas has been created.

Development process

1. A conceptual project for embroidery on all four sides of the bag is prepared.

2. Embroidery is applied to all four sides of the bag on white plastic canvas.

3. The bottom and handle of the bag are crafted.

4. The parts of the bag are separated from the plastic canvas.

5. The finished parts are joined together through stitching.

"Green restart" and redesign products [3 - 5, 6, 10]

The created products are experimental proposals for numerous and functionally viable "green" transformations of old textile garments and waste items. They serve as examples of how nature, resources, energy, and labour can be "saved"; how ecological thinking, education, and behaviour can be developed; and how "green" skills in the classroom can be formed and transformed into a "green" way of life.

Avant-garde, attractive, youthful outerwear from old textile materials - "Walking painting"

The product is unconventional, avant-garde, attractive, and experimental, crafted using the patchwork technique and hand-sewing. This

approach allows for creativity, utilization, and repurposing of old textile garments, contributing to waste reduction.

Product creation

1. The garment is made using the patchwork technique from 8 pairs of blue, black, and yellow denim, 4 colours of thick threads, and textile paints.

2. Denim pieces are cut and hand-sewn together, then adorned with textile paints.

1.3.2. Children's toy from recycled materials Creation of the product:

1. The body, head, and hair are crafted from discarded materials - a medicine bottle, styrofoam, and oakum, respectively.

2. The toy's clothing and accessories are made from old denim, vintage fabrics, lace, and beads.

Redesign of old textile materials into a three-piece set

Renovation has been performed on old garments to create a modern, avant-garde, youthful three-piece set. An old denim jacket has been revamped with pearls and stylized fabric and lace patches. Old jeans have been renovated with pearls, ornaments, and embroideries. A soft hat with a brim made from old denim has been crafted.

Technological sequence

1. Pearls are affixed along the sleeves and lower edge of an old denim jacket.

2. Stylized fabric and lace patches are attached to the upper front and upper back of the jacket.

3. Old jeans are cut along the outer side seam, and pearls are attached using a silicone gun. Roses are embroidered on the back pockets, and ornaments are applied to the front pockets.

4. Pieces of denim are cut and sewn into a hat with a brim, to which pearls are affixed.

Redesign and reuse of old products

A redesign has been applied to an old bag and old shoes in a faunistic style.

Fig. 6. New product created with redesign technique.

Fig. 7. A newly created children toy.

1. Pre-cut black fabric circles are glued onto an old bag, and additional details are drawn with a black marker.

2. Using red leather paint and a white marker, elements of a red-spotted (24 spots) ladybug are drawn onto old shoes.

Organizer from recycled materials creation of the product

1. The organizer is made from a coffee box

Fig. 8. Example for redesign of old textile materials into a three-piece set.

and fabric scraps.

2. Fabric scraps are stitched to create the external decoration of the box.

3. A decorative fabric rose is crafted and sewn with a button onto the external decoration.

Christmas pouch for cosmetics or office products

The pouch is crafted from fabric scraps, pearls, and decorative fluff.

Creation of the product

1. A white Christmas stocking is cut, decorated with red pearls and decorative fluff.

2. The pouch is sewn, the zipper is attached, and the decorative Christmas stocking is stitched onto it.

Redesign of old textile materials into a brush and toothpaste holder [7, 8]

A wall-mounted holder for brushes and toothpaste has been crafted from an apron, cutlery pouch, and a flat elastic band.

Creation of the product

1. A piece of fabric is cut from the apron with dimensions 44 / 29cm, which is then folded into two equal parts.

2. The flat elastic band is cut into 5 equal pieces, folded in half, and sewn onto the base holder, to which two pockets are also stitched.

3. The strap of the apron is cut, from which 2 hangers are prepared to suspend the holder.

Fig. 9. Examples for redesign and reuse of old products.

Fig. 10. The created organizer.

Fig. 11. The created Christmas pouch for cosmetics or office products.

Fabric keychains

The keychains are crafted from old textile materials such as denim, a blanket, checkered fabric, ribbons, cotton, and buttons.

Creation of the product

1. Two hearts are cut from each fabric using a template.

2. The pairs of hearts are sewn together, filled with cotton.

3. The products are decorated with ribbons and buttons.

Redesign of old textile materials

A redesign has been done on an old blouse to create a youthful blouse, and on old jeans to make a mobile phone case or a pencil and pen pouch.

Creation of the products

1. Lace, cut from an old scarf, is stitched onto the pocket and sleeves of the old blouse.

2. White beads are glued onto the neckline and sleeves of the blouse.

3. A back pocket is cut from old jeans, and a handle is sewn onto it.

4. The pocket is decorated with acrylic textile paint.

Set of two pieces made from old textile items

The set of two tops and a skirt is crafted from old jeans and an old T-shirt.

Technological sequence

1. The jeans are unstitched along the inseams, shortened, and transformed into a skirt.

2. Two square scraps are cut from an old T-shirt and sewn as decoration onto the pockets of the skirt.

3. A section from the jeans' leg and a proportionate part from the T-shirt are taken, sewn together in the middle, creating the top part of the set.

4. Another top is crafted from the remaining part of the T-shirt.
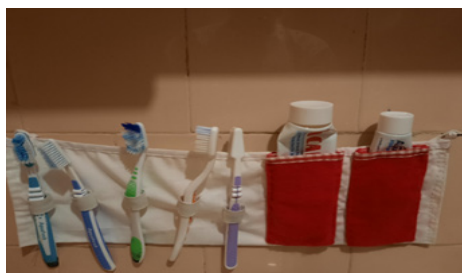

Fig. 12. Brush and toothpaste holder.

Fig. 13. Fabric keychains.

Fig. 14. Examples for redesign of old textile materials.

Fig. 15. Created set of two pieces made from old textile items.

Bag, book divider, and hair band from old textile materials

Three products have been crafted from an old skirt, jeans, and cardboard.

Creation of the products

1. The skirt is cut into two parts.

2. Pockets are cut out of the jeans.

3. Cutting two long strips for the shoulder straps of the bag from the trouser legs.

4. The skirt, pockets, and straps are sewn together.

5. Cardboard and fabric are cut to the dimensions of the book divider [9].

6. The fabric cover is sewn, cardboard is placed inside, and the cover is finally sewn shut.

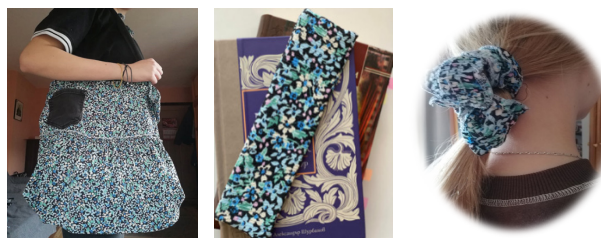7. Band from the top part of the skirt is cut and sewn to become a hair band.

Denim pencil case and notebook cover

The pencil case and notebook cover are crafted from old denim.

Creation of the products

1. Two pieces of denim are cut for the front and lining using a pre-made template.

2. The two pieces are layered, their corners pressed, sides glued, zipper sewn, and then decorated.

3. In accordance with the size of the notebook, part of the jeans is cut out, folded like a binding, glued, and decorated.

Cooking apron from old denim fabrics
Creation of the product

1. An old denim dress is transformed into a cooking apron, to which denim pockets and drapery are sewn, and it is decorated with textile paint.

Organizer made from recycled materials

The organizer is crafted from tin cans, a candy box, white paint, hemp rope, and silicone.

Creation of the product

1. The cans are painted with white alkyd paint.

2. After drying, they are decorated with hemp

Fig. 16. Bag, book divider, and hair band made from old textile materials.

Fig. 17. Pencil case and notebook cover from old denim.

Fig. 18. Cooking apron from old denim fabrics.

rope, glued with silicone.

3. The decorated cans are attached to each other with silicone.

Leather pouch from old leather skirt

A round leather pouch has been crafted.

Creation of the product

1. Two circles with a diameter of 14 cm are cut from an old leather skirt along with a connecting strip measuring 44 cm in length and 10 cm in width.

2. The zipper, the leather circles, and connecting strip are sewn together.

Attractive and functional youth clothing from old textile materials

Jeans, a T-shirt, and a sweatshirt have been redesigned, resulting in jeans that can be used in both warm and cold weather, and a sweatshirt suitable for cold and cool weather.

Creation of the product

1. Pieces are cut from old jeans and adhered only at their upper end to the inner side of the jeans.

2. The T-shirt is sewn onto the sweatshirt.

CONCLUSIONS

The created experimental products represent one of the numerous approaches for transitioning from subject-oriented to problem-oriented learning in natural sciences through the application of digital and green technologies. The products are part of the technological, economic, social, and environmentally friendly aspects of sustainable development.

Fig. 19. Organizer made from recycled materials.

Fig. 20. leather pouch from old leather skirt.

Fig. 21. Youth clothing made from old textile materials.

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