International School of Kenya

Empowering students to create solutions for tomorrow's challenges

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STEM 1 – Digital Design

Semester Course

Course Description:

Students use the design cycle to solve challenges and to create products using multimedia, web-technology, and other design software and hardware. Topics will include identity design, data visualization, motion graphics and video production, as well as interactive design. Although the course is mainly practical in nature, students will be also be engaged in the theoretical aspects of the discipline, studying the elements and principles of design and using them to examine class projects. Technology related environmental and societal issues and career opportunities are explored. No previous digital design experience is necessary, although many skills covered in other STEM courses will be built upon.

Skills:

Students who successfully complete this course will demonstrate experience with:

- following and documenting the design cycle from investigation through to the evaluation stage.
- developing relevant and testable product specifications
- understanding and evaluating products based on design principles
- developing and synthesizing designs using sketching, concept diagrams, storyboards, and flow charts
- demonstrating competence using industry standard design software
- understanding the growing relationship between digital and physical products
- understanding the impact of design on our society and the environment

Required Materials:

Students will document their projects and process online throughout the course. Students are expected to have a laptop and access to Internet.

Expectations:

- Students will keep up with assignments and be prepared to contribute in class
- Students will work collaboratively and develop effective team strategies
- Students will maintain detailed design journals documenting their process
- Students demonstrate independence and self reliance using class time effectively
- Students present their projects professionally.

Software / Hardware:

Adobe Creative Suite (Illustrator, After Effects, Photoshop, Flash)
Final Cut Pro / iMovie
Logic Pro / Garage Band
Scratch
Student Laptops and school computers
Sensor boards

Grades:

The final design projects and the accompanying process journal documenting the design cycle will form the basis of academic grades. All assignments will be accompanied with a rubric that explains clearly how students will be assessed. All grades will be assessed on an overall 1 – 7 grading scale. See handbook for descriptors.

Assessments:

Design Cycle Process Journals
Final Products – based on set specification
Formative Assessments – including presentations, tutorials, HW

Unit 1: Graphic Design

This unit introduces students to the field of Graphic Design. Students will use industry standard software to create visual communications using design principles such as color, space, rhythm, and elements such as photography, illustration and typography to create unique products that address specific design challenges.

Projects:

- *Conceptual Poster*
- *Identity / Logo Design*
- *Infographic / Visualization*

Unit 2: Motion Graphics and Video

This unit explores the discipline of digital video, animation and motion graphics. Students will also develop skills in basic music production and film scoring techniques. The unit will provide students with a foundation in the basics of time-based media.

Projects

- *Dynamic Typography and Motion Graphics*
- *Sound Engineering and Music Production*
- *Public Service Announcements / Music Video*

Unit 3: Interactive design and sensors

This unit explores the interface between the digital environment and the world around us. Students will have the opportunity to create digital projects that use sensory data to solve problems.

Project

- *Arduino / Picoboard project*

STEM 2 – Robotics

Semester Course

Course Description:

Students develop skills in engineering, computer programming, as well as teamwork and creativity as they design, program, and test robots to complete open-ended challenges. Students' investigate how automation and robotics may help solve problems today, and how to invent technologies for a better future. Project documentation and presentation skills are stressed so that student thinking and process is clearly communicated. No previous computer programming or electronics experience is necessary, although many skills covered in previous STEM courses will be built upon.

Skills:

Students who successfully complete this course will demonstrate experience with:

- following and documenting the project design cycle
- developing flow diagrams and writing pseudocode to synthesize ideas
- understanding and applying fundamental programming concepts
- use of the inquiry and the scientific method
- collaborative problem-solving and trouble-shooting
- understanding basic engineering and mechanical concepts
- applying algorithmic thinking and mathematical concepts when programming robots
- understanding the development of automation and robotics in the present and in our future

Required Materials:

Students will document their projects and process online throughout the course. Students are expected to have a laptop and access to Internet.

Expectations:

- Students will keep up with assignments and be prepared to discuss concepts and solve problems during the class periods
- Students will work collaboratively and develop effective team strategies
- Students will maintain detailed design journals documenting their process
- Students demonstrate independence and self reliance using class time effectively
- Students present their projects professionally

Software / Hardware:

EV3 Robotic Kit
Botball Robot Kit
Lego Mindstorms Software
KISS Software

Grades:

The final design projects and the accompanying process journal documenting the design cycle will form the basis of academic grades. All assignments will be accompanied with a rubric that explains clearly how students will be assessed. All grades will be assessed on an overall 1 – 7 grading scale. See handbook for descriptors.

Assessments:

- Design Cycle Process Journals
- Challenge based summative assessments

- Formative Assessments – including presentations, tutorials, HW

Unit 1: Lego Mindstorms EV3

Using the popular Lego Mindstorms block-based programming environment, students will build and program autonomous robots to complete open-ended challenges. This course will further explore the application of robotics in teaching Science, Technology, Engineering, and Math (STEM), encouraging both creative and higher order thinking skills.

Projects / Challenges

- *Motors, gears and robot Movement*
- *Working with sensors and making autonomous decisions*
- *Robot movement challenge and Robot sensor challenge*
- *Final Scenario Challenge*

Unit 2: Botball Robotics and Lego-C

Using the Botball KIPR kit and, in some cases, Lego EV3 hardware, students will work in teams to build and program robots using the C programming language. The Botball robotics kit includes a wide variety of sensors, motors, servos and building materials and C is a versatile programming language, giving students many options as they try to solve open-ended challenges.

Projects / Challenges

- *Motors, gears and robot movement*
- *Working with sensors and making autonomous decisions*
- *Botball Scenario Challenge*

STEM 2 – Application and Game Design

Semester Course

Course Description:

This project-based course focuses on computer programming to build applications and games. Topics include researching games, obtaining client viewpoints, brainstorming solutions, rapid prototyping, testing, and iterative re-design. Students develop best practices for prototyping, examining user interfaces, play testing, game balancing, pacing and workflow. They document and communicate the design process using a design journal as well as develop completed products for specific clients. The programming skills covered will include the use of variables, arrays, functions and looping. Although this unit is practically orientated, students will cover some theoretical aspects of game design and how it is used in our society.

Skills:

Students who successfully complete this course will demonstrate experience with:

- following and documenting the project design cycle
- developing flow diagrams, storyboard and writing pseudocode to synthesize ideas
- game design software and associated programming languages
- troubleshooting and debugging code
- re-mixing open source code
- understanding applying game dynamics
- testing designs and gathering user data at different stages of the project
- usability design and testing

Required Materials:

Students will document their projects and process online throughout the course. Students are expected to have a laptop and access to Internet.

Expectations:

- Students will keep up with assignments and be prepared to contribute in class
- Students will work collaboratively and develop effective team strategies
- Students will maintain detailed design journals documenting their process
- Students demonstrate independence and self reliance using class time effectively
- Students present their projects professionally

Software / Hardware:

Scratch
MIT Appinventor
Unity 3D
Greenfoot
Game Salad

Grades:

The final design projects and the accompanying process journal documenting the design cycle will form the basis of academic grades. All assignments will be accompanied with a rubric that explains clearly how students will be assessed. All grades will be assessed on an overall 1 – 7 grading scale. See handbook for descriptors.

Assessments:

- Design Cycle Process Journals
- Final Products – based on set specification
- Formative Assessments – including presentations, tutorials, HW

Unit 1: Game Dynamics

Students learn about game dynamics and are introduced to basic programming concepts using the block based Scratch programming environment.

Unit 2: Computer Game Design

Students experiment with different game design software to create various types of computer games, including classic arcade games, RPG games, two player games, 3D games and many more. During the course of this unit, students will be completing tutorials, exposing them to various software applications and types of games.

Unit 2: Mobile Applications and Game Design

Students learn how to design and program mobile applications and games for Android and iOS devices using web-based software.

Unit 4: Final Game Design

Students design a unique game or application for a specific client that solves a problem. Closely documenting the design process using their design journals, students will develop a detailed design brief, which they will use to investigate, design, create and evaluate their final game.

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