Stimulating the Student Through Experimental Activity

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Overview

• Requirements

• Implementation

• Achievements
Requirements

- Combined First Year Engineering Science
- A variety of student backgrounds
- Five Different strands of Engineering
- An opportunity to create a completely new experimental activity
General Requirements

• All students take every laboratory exercise
• Laboratory lasts for four hours
• Four cohorts of 45 students
• No Power Available
• No Computers Available
• Marking completed within a week
Just For Fun

Additional Requirements

• Each student to work individually
• Low cost
• Minimal Supervisors
The Robot Arm

• A maximum of two hours to assemble

• Minimum of tools needed

• Manufactured within the Department of Engineering Science

• Capable of useful activity
Open Source Design

Use an open source design
http://www.instructables.com/id/MeArm-
Build-a-Small-Hackable-Robot-Arm/
Adapt as necessary
User Interface and Control

• Use what the students already have (Smart Phone)
• Low Cost Communication (Bluetooth)
• Use an existing App (BlueTerm for Android)
• Simple Text Based User Interface
Arduino and Bluetooth

- HC06 Bluetooth interface
- Mini servo motors
Assessment

• 50% - Robot Arm Assembly
• 10% - Measurements
• 10% - graph
• 10% - Discussion
• 10% - Conclusion

• 10% - YouTube
50% - Robot Arm Assembly

• Everyone would be able to produce a completed assembly within the four hours
• (Basic level of pass)
• No plagiarism
• Students engaged mentally, physically and emotionally.
Minimising Demand on the Supervisors

Normal distribution of student arrival + Normal distribution of student progress = Distributed demand for supervisor assistance
20% Experimental Activity

- Taking Measurements

- Deliberately vague and imprecise, requiring students to innovate and think

- Calculations

- Involvement of theory and reality

- Graph

- Data visualisation and comparison
20% - Reflection and Deduction

- Providing the student with the opportunity to comment
- Encouraging the student to perform comparison and analysis between theory and reality
- Developing the higher intellectual capabilities
10% - YouTube

• Start Engaging the students with Social Media for learning purposes
• Challenge the student in a novel area
• Provide the opportunity for reflection and re-recording
• Extended the activity time-frame
• Time-Shift the assessment requirement
<table>
<thead>
<tr>
<th>Activity</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot Arm Assembly</td>
<td>88%</td>
</tr>
<tr>
<td>Experimental practice</td>
<td>59%</td>
</tr>
<tr>
<td>Reflection</td>
<td>36%</td>
</tr>
<tr>
<td>YouTube</td>
<td>63%</td>
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</tbody>
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Robot Arms Assembled

• Every student (except two) completed the assembly
• The majority had complete or almost complete movement
• A small number (<5%) had assembly defects
The Results of the Experimental Activity

- The majority of students struggled to obtain the correct measurements
- The majority of graphs were not correct
Reflection

• There was minimal student reflection
• Little comparison of theory and reality
89 YouTube Videos produced
Some were innovative and creative
A surprising number did not contain audio or visual commentary

Search for
University of Greenwich Robot Arm Experiment
Example
Conclusion

• The use of an open-source design proved to be effective
• Component costs were minimised
• Marking was achieved within a 48 hour period
• Lecturer costs were minimised
Finally

• Nearly all students were successful.
• Informal student feedback indicated that it had been enjoyable.
• Their varied background did not appear to have any negative impact on the outcomes.
But Mostly

I had a great time!