Swarm Robotics Lesson Plan

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| **Subject:** Computer Science | **Year Group:** KS4 | **Duration:** 2 hours |
| **Summary:**  Swarming Robots are a great tool to teach computer science. Swarm robotics emphasises the use of many simple robots that communicate and work together to complete tasks. The algorithms that govern the interactions between robots are relatively straightforward, being easily understood even by inexperienced individuals. Greenfoot allows robots to be modeled by actors, and swarm simulations to be run.  Using the Greenfoot simulations students can edit and explore the concepts and algorithms behind swarming robots and object oriented programming in general. Each robot in the swarm can be thought of as an object which can only communicate with its neighbours through function calls. Students may find this way of learning more intuitive than using more abstract ideas.  **Learning Objectives:**   * Improve confidence of using the Greenfoot environment * Develop understanding of key features of Objective oriented Programming * Learn about swarm robotics, specifically understanding and editing your own projects | | |

**Resources:**

* Student worksheet
* Worksheet slides
* Empty worksheet Greenfoot project
* Completed worksheet Greenfoot project

**Student Prerequisites:**

* Basic prior knowledge about programming. (**Essential**)
* Previous experience with Java and Greenfoot, Scratch, or similar IDEs. (**Essential**)
* Interest in Computer Science, Swarm Robotics, and nature. (**Recommended**)

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| **Teaching Outline and Key Points:** |
| **Introduction:**   * Assess the skills of the class, see how much explanation about programming is needed. * Recap of object oriented programming. * Introduction to Swarm Robotics. |
| **Lesson Outline:**   * The lesson shall mainly consist of following the Workshop Slides, and completing the activities as specified on the slides. * During the activities and the worksheet instructors shall walk around the room offering assistance to any students that asks for help or appear to be struggling. * After the students have been given ample time to complete the the first section of the worksheet, an instructor shall complete that section of the worksheet live on the projector. This shall give any students stuck a change to see how it can be done. |
| **Activities and Experiences:**  *It is assumed that the instructor has a good level of knowledge with the algorithms used in the workshop*   * Physical firefly synchronisation:   + Explain the key ideas and the pseudocode behind firefly synchronisation.   + Split students into small groups and get them to perform the firefly activity, where each student pretends to be a firefly. * Firefly Worksheet:   + Get students to complete the first part of the worksheet and create their own firefly simulation.   + Encourage them to use the cheat sheet if they require assistance.   + Complete the worksheet live on the projector to assist students who are stuck. * Physical boid flocking:   + Explain the key ideas and pseudocode behind boid flocking.   + Split students into small groups and get them to perform the boid flocking activity, where each student pretends to be a boid. * Boid Worksheet:   + Get students to complete the final part of the worksheet. They should now have created a working implementation of both algorithms.   + Get them to tweak the parameters of the simulation and see how that effects flocking. |
| **Conclusion:**   * Summarise what has been taught. |
| **Evaluation /Success Criteria:**   * Ask students what they have learned during the session. * Workshop will be a success if students are now more comfortable with using Greenfoot. |