



Using a Robot Olympiad to Engage Programmers in Collaborative Problem Solving

Michael Scott, Falmouth University

Mark Zarb, Robert Gordon University



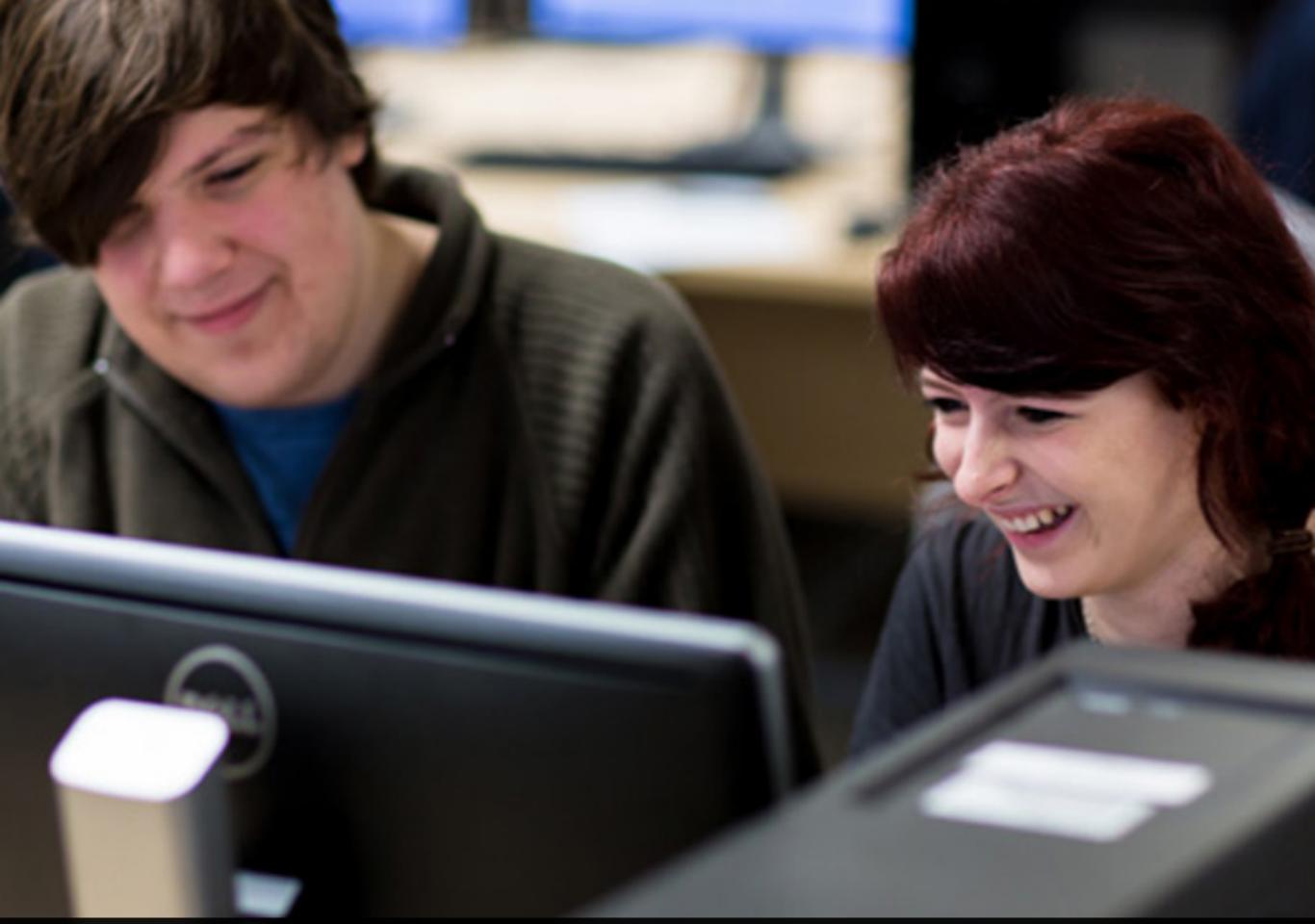
Context: We make games



Students are challenged to make games in *teams*



Problem: Peer-Reviews Indicated a Lack of Team Cohesion



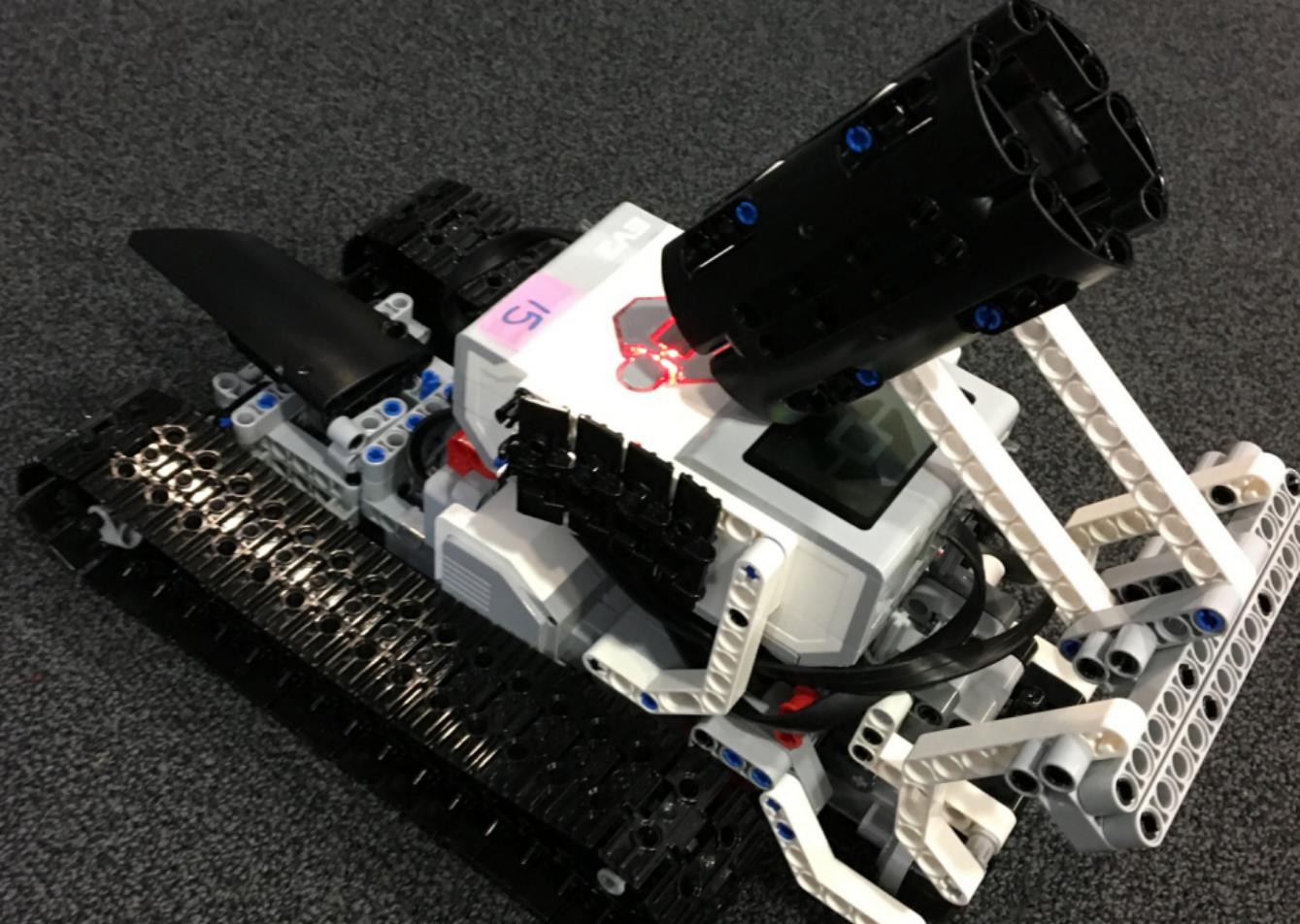
Goal: Inspire Students to Collaborate More Effectively



Question: How?



Proposal: A Robot-Olympiad



Scott & Ghinea, 2013



Zarb & Siegel, 2016



H1: increase in peer interaction, as observed in workshops



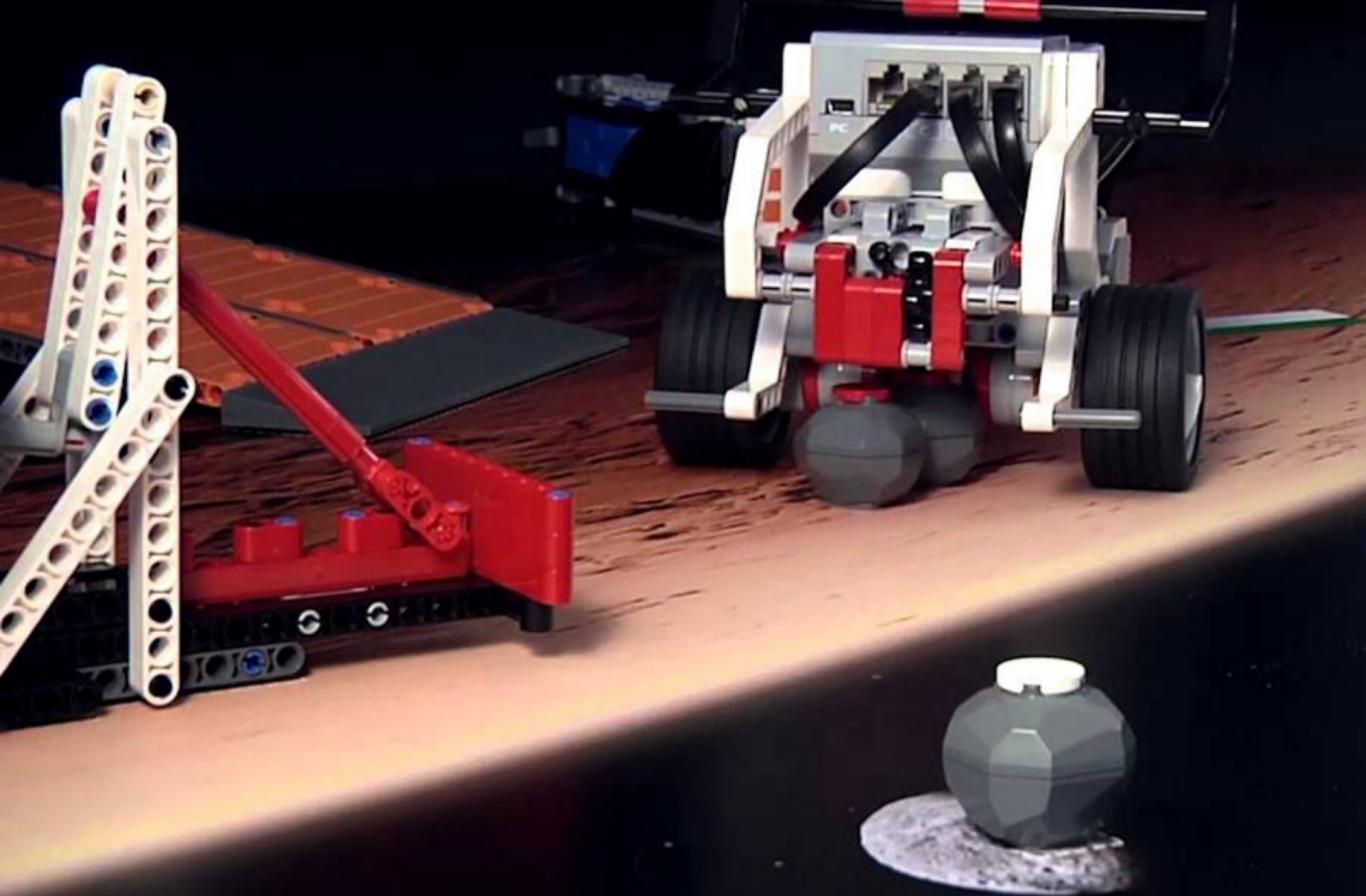
H2: better team cohesion, from peer-reviews



The Plan: Lego EV3 Space Challenge



Seven Challenges



<https://www.youtube.com/watch?v=UFGw16G6ESs>



Insights

“Students engaged in pair and mob programming far more frequently, compared to last year”



A photograph showing two men at a table. In the foreground, a man with short brown hair and a light beard is looking towards the right. In the background, another man with a very long, full reddish-brown beard is leaning over the table, looking down. He is wearing a dark brown t-shirt with a graphic of a yellow robot head and body on it. On the table in front of them are several bottles: a clear plastic bottle with a blue cap, a red plastic bottle with a red cap, and a white plastic bottle with a red cap. A black cable runs across the table.

"The Lego Robots section was exciting and challenging, a great way to have some fun, but also work towards a common goal with your team."

A photograph showing two men at a table during a group activity. In the foreground, a man with short brown hair and a beard, wearing a grey sweater, looks towards the right. Behind him, another man with a long red beard and a brown t-shirt featuring a stylized robot head graphic is leaning over the table, gesturing with his hands. On the table, there are several bottles: a clear plastic bottle with a blue cap, a red plastic bottle with a red cap, and a white bottle with a red cap. A black rectangular box with white text is overlaid on the upper left portion of the image.

"Great way to improve
group working for the class
(and an) excellent way to
meet new people..."

SPARK^{PLUS}: SPA (Performance) and SAPA (Feedback) factors

(the following information has been taken from the SPARK^{PLUS} user guide that can be downloaded from spark.uts.edu.au)

In the norm based assessment mode used to assess an individual's contribution to a team project or task SPARK^{PLUS} automatically produces two factors.

SPA (Performance) factor

The SPA (Performance) factor is a weighting factor that can be used to change a team mark for a project (stage) into an individual mark.

$$\text{SPA Factor} = \sqrt{\frac{\text{Total ratings for individual team member}}{\text{Average of total ratings for all team members}}}$$

Individual mark = team mark * Individual's SPA

For example, if a team's project mark was 80 out of 100 and a team member receives a SPA factor of 0.9 , they would receive an individual mark of 72 to reflect a lower than average team contribution as perceived by a combination of themselves and their peers. Alternatively, if not used to moderate summative assessment the SPA factor can be used formatively to assist student development.

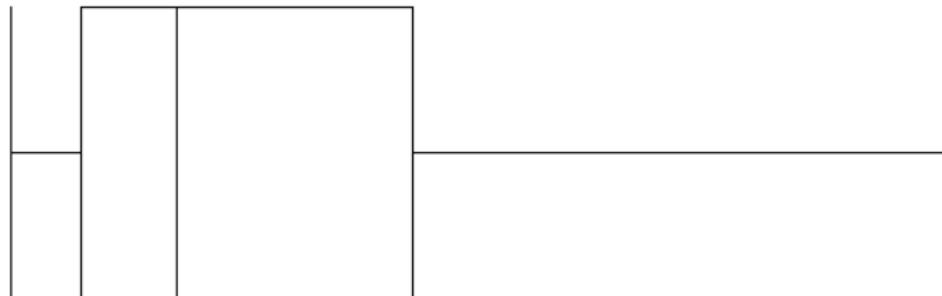
In applying the SPA (Performance) factor we recommend that the maximum mark be capped at 100% to reflecting the maximum available mark for demonstrating the particular learning outcome or outcomes achievement. For example, if the project mark for a high-performing team was 95% and the highest contributor to this team received an SPA factor of 1.1, then without capping this student would receive a mark greater than 100% of the marks allocated for demonstrated achievement of the associated learning outcomes.

$$95\% * 1.1 = 104.5\% \leq 100\%$$

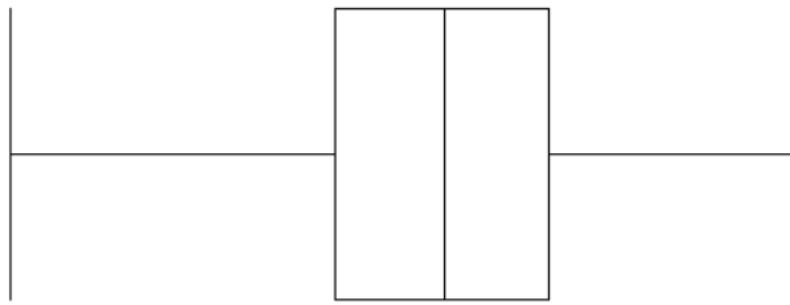
SAPA (Feedback) or Self Assessment to Peer Assessment factor

The second factor calculated is the SAPA (Feedback) or Self Assessment to Peer Assessment factor. It is the ratio of a student's own rating of themselves compared to the average rating of their contribution by their peers. This factor is used to calculate the SPA factor.

Intervention



Control



$$\Delta\bar{x} = -248, t_{\text{inclusion}} = -4.173, p < 0.001$$



Limitations



Questionable Measurement Validity



Limited Quasi-Experiment, Post-Test Only



Conclusion: Looks Very Promising, A Great Ice-Breaker