Measuring Student Motivation during "The Hour of Code™" activities

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Abstract— **The present study reports the experiences from the Hour of Code™ implementation in the context of two introductory Informatics courses, one in a high school level and one in a first-year University level. It explores learning motivation among 47 high school students and 51 first-year University level students, during their participation in the Hour of Code™ activity. The theoretical framework is Self-Determination Theory of Motivation. The theory distinguishes mainly four types of motivation, namely Intrinsic Motivation, Identified Regulation, External Regulation and Amotivation. Students were found to exhibit more self-determined types of motivation during the Hour of Code™ activities. Both groups found the activities to be attractive and useful. The results may be helpful to practitioners in order to design more intrinsically motivated educational scenarios when modeled appropriately.**

Keywords- computer science education, programming curriculum, Hour of Code™ , motivation, self-determination

I. INTRODUCTION

The present study reports the experiences from the Hour of Code™ implementation in the context of two introductory Informatics classes, one high school level and one first-year University level. The Hour of Code™ was a global campaign for students to participate in an hour of coding using free on-line tutorials, during the Computer Science Education Week, December 9-15, 2013. The goal of the campaign was to introduce Computer Science to students and encourage them to pursue Computing careers. More than 20 million students participated worldwide. The initiative can be considered one of the largest scale implementations of technology supported educational interventions. Due to its big impact on student participation, addressing its motivational background can be useful to build evidence–based instructional design principles. The current study starts with a short introduction of Self-Determination Theory of Motivation. Research methodology and the results section follow. Discussions section closes with conclusions and implications.

II. SELF DETERMINATION THEORY OF MOTIVATION

Motivation is a basic driving factor of human behavior. It is also very important in education because it can improve learning [1]. Self-Determination Theory (SDT), [2] is a contemporary theory of motivation that has been successfully used in academic contexts [3], and technology enhanced learning environments [4]. According to the theory, a basic set of psychological needs must be satisfied in order to enhance intrinsic motivation. These needs are autonomy, competence and relatedness. Furthermore, SDT distinguishes among four types of motivation that co-exist when people are engaged in an activity: Intrinsic Motivation (doing an activity because it is interesting or enjoyable), Identified Regulation (doing an activity because of its perceived importance and value), External Regulation (complying with external demands) and Amotivation (the lack of motivation). The theory is concerned with the support of self-determined types of motivation (intrinsic motivation and identified regulation) that lead to satisfaction and better performance.

III. RESEARCH METHOD

A. Participants

The study involves two cases. In the first case study, the sample consisted of 44 students of a European upper-high school. The average age was 14.8 years old. There were 25 females and 19 males. In the second case study the sample consisted of 51 first year (non-computing major) European University students. The average age was 18.7 years old. There were 31 males and 20 females. The two activities implemented during introductory Informatics courses. Students from both groups had no previous programming experience. The two groups had approximately the same socio-economic characteristics.

B. Procedures

During both case studies, students were first introduced to the general purpose of the Hour of Code™ activity through a short video from code.org™. Afterwards they were asked to practice some predefined activities among the free on-line tutorials from the repository of the Hour of Code™. The total duration of the intervention was 45 min. Immediately after the sessions, students were asked to fill-out a questionnaire reporting their level of motivation.

C. Measures

Four motivational components, i.e. Intrinsic Motivation, Identified Regulation, External Regulation and Amotivation were measured using the self-reported Situational Motivational Scale (SIMS), developed by Guay, Vallerand, and Blanchard [5]. Students were asked to self-report their motivation in these four motivational components during the

Hour of Code^TM activity using 7-point Likert scales. The overall Self Determination Index (SDI) is an approach to combine these subscales   and is reported as a sum of the individual motivation subscales appropriately weighted [6]. Values for each subscale of SIMS questionnaire range from a minimum of 4 to a maximum of 28 and the SDI ranges from a minimum of -72 to a maximum of +72 [5]. Higher SDI scores indicate more self-determined types of motivation. We used a non-parametric approach due to the lack of normality in our groups and their relatively small sizes.

IV.   RESULTS

Responses from high school students and first-year University students, in the form of the SIMS subscales are presented in Table I.

TABLE I.   SIMS SUBSCALE AND SDI SCORES

High School Students					
	Intrinsic Motivation	Identified Regulation	External Regulation	Amoti vation	SDI
Median (M)	25.2	21.0	11.2	8.4	43.4
Interquartile Range (IRQ)	7.0	4.2	6.3	4.2	19.1
First Year University Students					
Median (M)	21.0	19.6	12.6	11.2	29.4
Interquartile Range (IRQ)	7.0	5.6	7.0	7.0	32.5

High school students reported high level of intrinsic motivation (the activity was interesting and enjoyable) and identified regulation (the activity was considered valuable). The overall SDI is pretty high indicating that self-determined types of motivation exist during the activity. External motivation (students feel that they had to comply with the activity) and amotivation also reported. First-year (non-Computing major) University students also reported high levels of intrinsic motivation and identified regulation with external motivation and amotivation to be present also. The overall SDI is also pretty high. Due to the lower intrinsic motivation among students from the University group (M = 21) compared to the high-school students group (M = 25.2), the SDI of the University group is reported lower (SDI = 29.4) compared to the SDI of the high-school students group (SDI = 43.4). Also the higher amotivation among University students (M = 11.2) compared to the high-school students' amotivation (M = 8.4), contributes to the difference among the SDI indexes. Comparing the motivation subscales of both groups, we found significant differences between groups in the intrinsic motivation level and amotivation level. No significant differences were found between identified regulation and external regulation for both groups. The effect sizes for intrinsic motivation (r = 0.2) and amotivation (r = 0.17) are considered small to medium (0.10 < r < 0.30). The results are presented in Table II.

TABLE II.   MANN-WHITNEY U RESULTS FOR SIMS SUBSCALES ACROSS GROUPS

	Intrinsic Motivation	Identified Regulation	External Regulation	Amoti-vation
Mann-Whitney U test	1238.5	1518.0	1580.0	1293.5
Z	-2.284	-0.733	-0.388	-1.981
Asymp. Sig. (2-tailed)	0.022*	0.464	0.698	0.048*
Effect size (r)	-0.2	-0.06	-0.03	-0.17

V.   DISCUSSIONS

The present study examines the nature of student motivation during The Hour of Code^TM activities across two different contexts: in a high school class and in a first-year University course. Both groups rated their level of self-determined type of motivation pretty high. Intrinsic motivation and identified regulation were dominant in both cases while external regulation and amotivation also exist. High school students found the activities more intrinsically motivated. This is due to the fact that the level of the educational activities is better suited to their lower age level. It is worth mentioned also that both age groups found the activities valuable for their educational and career goals, reporting high level of identified regulation. External motivation and amotivation also exist. Amotivation is higher in the University group due to the fact that freshmen may be more oriented in their chosen field of studies and may not be interested much in programming. Research shows that it is important to design educational activities that boost intrinsic motivation because this can lead to better learning outcomes. The Hour of Code^TM activities is such a good example and may provide inspiring directions in designing well motivating large scale educational practices (mostly oriented towards lower ages) for the future.

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