

# Outcome of a Pilot Course in Science Communication Highlights the Relevance of Student Motivation

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## 1 Introduction

The diffusion of free social communication channels has led to a popularization of science-narrative often unaccompanied by science-fact checking. Sound scientific achievements are being challenged by ‘common sense’ preconceptions. Climate, vaccines, evolution, GMO, to name but the most popular keywords, are spoken, mis-spoken and over-spoken across more than 15% of all existing web pages [1].

Scientists learn by experience to present their results to peer communities and to funding agencies. Throughout the 13+ years of school education and the 8+ years of academic training, growing up scientists are seldom fertilized by non-specialist communication challenges. With the notable exception of a few brilliant scientists who are also renowned writers or media entertainers, the vast majority of them simply fail to perform properly when it comes to public speaking and interaction on social media [2].

Acquisition of skills in science communication (SC) is strongly recommended by international and national panels, both at graduate and undergraduate levels [3]. However, there are very few master’s degrees in Science Technology Engineering and Medicine (STEM) courses in Italy, and even fewer undergraduate ones, that include mandatory Credit Points (CP) associated with knowledge and skills in the art of being comprehensible to the general public. Higher level (PhD and 2<sup>nd</sup>-level master courses) courses provide a larger educational offer, mostly oriented to scientific journalism and history of science.

On the basis of these considerations and leveraging on their professional experiences, the authors devised a lecture series about the common principles making the core of SC, irrespective of specialist disciplines. The aim of the initiative was to engage STEM students, curious about communication of science, into a mostly practical activity, evaluating their degree of satisfaction and the sustainability of the course schedule during the running semester. The course content was originally designed and advertised as an interactive living learning experience. It was then adapted last minute to remote teaching because of the Covid-19 semester, with a significant impact on both the actual interactions and the students’ satisfaction, with respect to expectations. Nonetheless, a follow-up analysis shows that 90% of students declared to have realized, in full or in part, their expected achievements. A high degree of global satisfaction (3.7/5) was acknowledged, despite 77% of students declared a Perceived Study Effort (PSE) greater

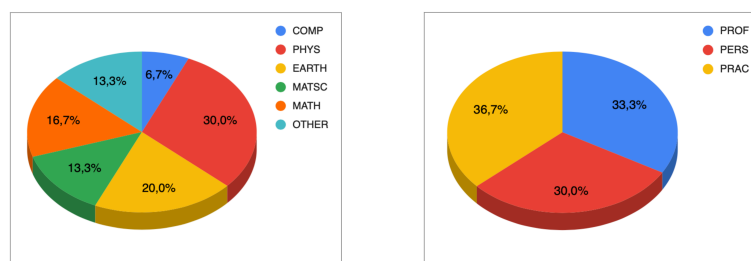
than expected. Final grades correlate positively with students Motivation, whereas they are not correlated with any specific Degree Course.

## 2 Method

The lecture series was commissioned by the School of Sciences and Technologies and scheduled to run from March through May 2020. The course was offered as elective classes to thirty students enrolled in STEM degree courses of the University of Bari. The number was originally limited by available seats in the classroom and was maintained also when the classes had to be moved on Distance Teaching platforms because of the Covid-19 lockdown.

The content of the lecture series [4] was organized to broadly address the 3x3 matrix: entries *communication to* (general public – stakeholders – peers) crossed with *communicating in* (writing – speaking – sketching). Sixty hours in twenty seminars were delivered together with three meetings with *special guests*. Individual and group projects took up about 50% of time and were mostly assigned as homework.

The motivations declared by the students at the time of enrollment were grouped into three categories: *Professional* for those who already have experience with some kind of SC, *Personal* for those who declared curiosity or passion for the argument of SC, *Practical* for those mostly interested in acquiring self-confidence in public speaking and CP balance. The distribution of enrolled students by the Degree Course of origin and by the primary Motivation is reported in Fig. 1.



**Fig. 1.** Left – distribution of enrolled students by Degree Course of origin: COMP – Computer Sc., PHYS – Physics, EARTH – Earth and Natural Sc., MATSC – Materials Sc. and Technology, MATH – Mathematics, OTHER – Medicine (1), Biotechnology (1), Philosophy (1), Psychology (1). Right – distribution of student by primary Motivation: PROF – Professional, PERS – Personal, PRAC – Practical.

Individual homework was assigned on a biweekly basis and graded as insufficient, fair, good and excellent. A final team project to be completed over a four-week period was assigned to the class as a whole, consisting in the organization, production, communication and making of a scientific broadcast event on social media. The event was held on May 16<sup>th</sup>, 2020 on the facebook® page *Luminescienza* [5] and registered on the International Day of Light (IDL2020) agenda coordinated by UNESCO [6]. The event hosted about 20 contributions in the form of videos, photos, comics, collecting altogether more than 1300 *Likes* and 13000 visualizations.

A feedback form, consisting in both open and closed questions was given at completion of the first half of the course, to be returned by the end of the course, either signed or anonymous. Only the signed modules (57%) were considered in the correlation analysis of results, whereas all returned forms (100% of students) were included in the averaged degree of Satisfaction analysis.

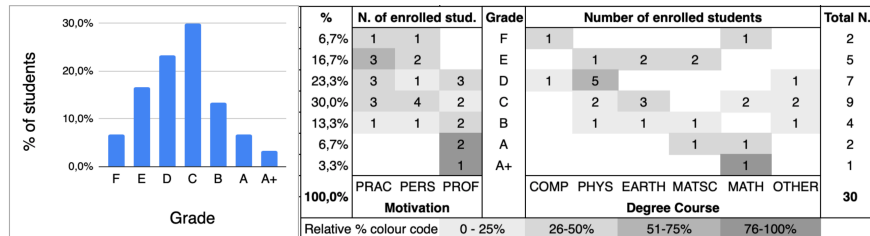
### 3 Results

The heterogeneity of the class population reported in Table 1 allows for two preliminary considerations. First, the content of the lecture series, as detailed in the syllabus made available since the first call, was equally appealing for students of all STEM Degree Courses, with a slight dominance of physics students, possibly because two of the lecturers also hold teachings in the Department of Physics. Second, students' primary Motivation for enrolling is mostly Practical and Personal for Physics and Earth students, 89% and 83%, respectively, mostly Professional for Mathematics and Other students, 60% and 75%, respectively.

**Table 1.** Distribution of enrolled students by Degree Course and prevailing Motivation.

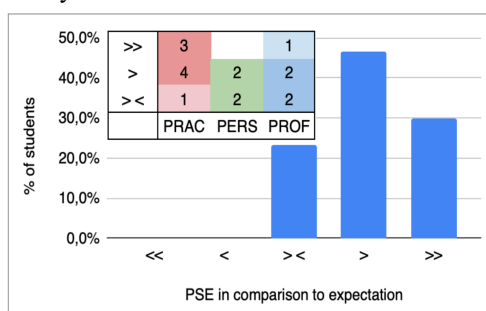
Relative %	Colour code			Motivation	Number of enrolled students						Total %	
0 - 25%				PROF	1	1	2	3	3			33,3%
26% - 50%				PERS	4	2	1	1	1			30,0%
51% - 75%				PRAC	2	4	3	1	1			36,7%
76% - 100%												
				<b>Degree Course</b>	COMP	PHYS	EARTH	MATSC	MATH	OTHER		<b>100,0%</b>
				<b>Motivation</b>	PROF	PERS	PRAC					
				<b>Total N.</b>	2	9	6	4	5	4		<b>30</b>

Homework Assignments were completed and consistently returned in 93% of cases. Grades were assigned as mentioned in Section 2 and rescaled to fit the standard English grading system (see Fig. 2). Grades do not show significant correlation with Degree Course of origin. On the other hand, grades are significantly correlated with primary Motivation: practically motivated students performed on average D, whereas professionally motivated students performed on average B and were the only ones reaching A and A+ grade. The latter result is also consistent with the background skills of students whose motivation is classified as Professional (see Section 2).



**Fig. 2.** Distribution of students by Grade (left panel) and correlation with primary Motivation (center panel) and with Degree Course of origin (right panel).

One of the major and most constantly reported concerns by STEM students of the University of Bari is the disproportionate study effort required to pass many, if not most, of the examinations in their courses [7]. The same concern was raised by 78% of the students on this pilot study, as reported in Fig. 3. However, in accordance with the data discussed before, primary Motivation marks the difference between practically and professionally motivated students, who report the largest and the lowest disproportion with expectations, respectively.



**Fig. 3.** Perceived Study Effort – PSE at the end of the course with respect to Expected Study Effort prior to enrollment. Inset shows the student distribution against primary Motivation.

In conclusion, given the small population sampled in this pilot study, CP in science communication are likely to be welcomed by STEM students of the University of Bari. Motivation appears to be a major discriminant for the learning outcomes, suggesting that this course should remain an elective course. The disproportionate PSE compared with the initial expectation could demotivate students and calls for a substantial reorganization of the course content and calendar.

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