

TOOLKIT FOR ASSESSING THE PROMOTION OF SELF- EFFICACY (O1)

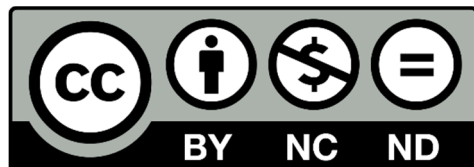
PART 1 - STEAM4U MODEL TOOLS



Co-funded by the
Erasmus+ Programme
of the European Union

The STEAM4U project has been supported by the Erasmus+ programme of the European Union (Project reference 2016-1-ES01-KA201-025633).

However, the European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



“Toolkit for assessing the promotion of self-efficacy. Part 1, STEAM4U model tools” has been created by Carme Grimalt-Álvaro and Digna Couso from CRECIM – Centre for Research in Science and Mathematics Education.

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Recommended Citation:

Grimalt-Álvaro, C.; Couso, D. (2018). *Toolkit for assessing the promotion of self-efficacy. Part 1, STEAM4U model tools*

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MODEL TOOLS FOR 10-14-YEAR-OLD TEENS

THEORETICAL PERSPECTIVE ABOUT THE OUTPUT

In the past decades, a strong concern about the absence of women, socio-economically deprived students and some ethnic collectives in the STEM (Science, Technology, Engineering and Mathematics) has been raised. Throughout the past years, several studies have been reporting inequalities among these collectives. For example, although in all Member States of the European Union there were more women among tertiary education graduates than men (58% of graduates were women at EU level), male dominated engineering, manufacturing and construction-related studies (where men accounted for 73% of the graduates in the field), as well as science, mathematics and computing studies (58%) (Eurostat Press Office, 2016). Except for the health and welfare field, in which 75% of the graduates are female (Eurostat Press Office, 2016), evidences show a strong absence of women in the STEM field, compared to the total distribution of the population (Macdonald, 2014). Moreover, at the top 40 college science and mathematics departments of the United States of America, Blacks, Hispanics, and Native Americans represent less than 5 percent of tenured faculty (Lewis, Miller, Piché, & Yu, 2015). Similar results can be found regarding the socio-economic level: students from lower socio-economic backgrounds would be under-represented in STEM fields, especially for Physical and Mathematical Sciences, and Engineering and Technology fields (Campaign for Science & Engineering, 2012). And if these factors intersect with themselves (i.e. Black girls, ethnic minorities from low socio-economic backgrounds...), resulting inequalities are worsened (Brown & Leaper, 2010; Ireland et al., 2018; Ro & Loya, 2015).

In this first part of the output, some theoretical perspectives on the state of the art are provided. Special attention has been paid to the definition of self-efficacy and its relation with other variables, such as gender and socioeconomic background. This framework is expected to contribute to the refinement of further actions, such as training and activities.

CONSEQUENCES OF AN UNBALANCED SITUATION

Three are the main consequences of this unbalanced situation: First of all, only a certain “privileged” group of people (white, male, middle-class and brainy) will mainly have access to the future STEM professional jobs. Thus, there will systematically be a group of people who will not have access to the increasing demand of STEM occupations (European Commission, 2015), endangering their employability and integration into the society. Secondly, the quality of research and innovation critically diminishes, because serious gender, ethnic and socio-economic biases go unnoticed when there is only a homogeneous group of people in charge of these processes (Commission of the Status of Women, 2014; European Commission, 2013). For example, in engineering, assuming a male default can produce errors and delays in providing reliable access to clean water in many countries. Because water procurement is women’s work,



many women have detailed knowledge of soils and their water yields. In medicine, not recognizing osteoporosis as also a male disease delays diagnosis and treatment in men. In city planning, not collecting data on caregiving work leads to inefficient transportation systems (European Commission, 2013). And thirdly, by age 14, the way most children think and position themselves about STEM, that is, their STEM stance, have become well established (Archer et al., 2010). This imply that at this age, there is a considerable number of students who consider themselves not STEM persons, refusing to engage in subsequent STEM activities. Particularly, under-represented groups in STEM are almost three times more likely than advantaged students not to attain the baseline level of proficiency in science (OECD, 2016b), which means that they will have serious problems for using their STEM skills in their daily lives. In an increasing digital society, in which crucial scientific debates are expected to involve the participation of the population in decision-making processes (e.g. renewable energies, genetics...), a poor STEM literacy will act as a severe agent of social exclusion, even if young people do not want to pursue post-obligatory studies of STEM.

Consequently, a deep understanding of which factors ultimately influence the way young people stand on STEM will give us a key to break these inequalities and provide opportunities for all.

MOVING ON FROM ATTITUDES TOWARD STEM TO STANCE ON STEM: A NEED FOR A MORE COMPREHENSIVE VIEW

In the past decades, there was a significant amount of research about students' *attitudes toward* science or other STEM subjects. This concept was defined by Osborne, Simon, and Collins (2003) as the feelings, beliefs and values a person held about an object that may be the enterprise of science, school science, the impact of science on society or scientists themselves. Other researchers have defined attitudes toward STEM as the feelings that a person has about an object, based on their beliefs about that object (Kind, Jones, & Barmby, 2007). However, in these definitions we observed some ambiguities of meaning and a lack of definition of the most fundamental research concepts, also acknowledged by Krogh and Thomsen (2005): what defined a feeling or a belief? How these feelings/beliefs about STEM are build? Is there a difference between girls or boys, students with different socio-economic or ethnic background? These aspects reveal a need to define which factors affect to students' stance on STEM and understand and research students' stance on STEM from a more comprehensive and cultural perspective, considering what the literature has said about the formation and development of significant construct such as identities and self-perceptions.

For these reasons, and in order to emphasize these considerations, we propose to move on from the concept *attitudes toward* STEM to *stance* on STEM. Hence, the aim of this paper is to provide an inclusive and summarized perspective of the impact of different factors on students' stance on STEM and the instruments used to measure them. Our ultimate desire is to contribute to the design of future actions aimed at raising equity in STEM and increase their impact.



DEFINING STANCE ON STEM

We propose to define stance on STEM as *the way a person thinks about and publicly expresses their opinions about STEM-related topics and activities based on their interests, aspirations, self-efficacy, capacity and identity about STEM*. In a first analysis of the literature to define which elements or variables were comprised, we identified and classified all factors with a proven impact on students' decisions or opinions about STEM and STEM studies into two big groups: a) *contextual factors* (which are mostly external to the individual, such as the type of STEM education received at school) and b) *personal factors* (which directly imply the subject, such as interest in STEM). Many relevant studies consider the relevance of contextual and personal factors, such as the work of Archer, Dawson, DeWitt, Seakins, & Wong (2015) and Wong (2016) defining *science capital* to predict students' aspirations in STEM, drawing in parental science qualifications among other personal and contextual factors. Although these researches have cast much new light on the issue of under-represented groups in STEM education, in our framework we believe that students' stance on STEM should be narrowed to those factors who can be targeted through direct actions and use contextual factors in a secondary level, as providers of context. However, our aim when defining stance on STEM was to provide an operational definition to facilitate the evaluation of the impact of educational initiatives on students. Thus, although we also acknowledge the influence of contextual factors, in our framework we propose to consider only those ones who could be easily targeted through direct actions with young people.

Personal factors have been approached through the study of different variables like interest, aspirations, identity, capacity or achievement in STEM (Figure 1). Recent researches point out the need to also consider the influence of a new construct: self-efficacy in STEM (Rittmayer & Beier, 2009). This construct allows to re-conceptualize the internal processes that lead to young people to express a particular stance on STEM and to consider different new strategies that can be useful for changing the positioning of young people for STEM.

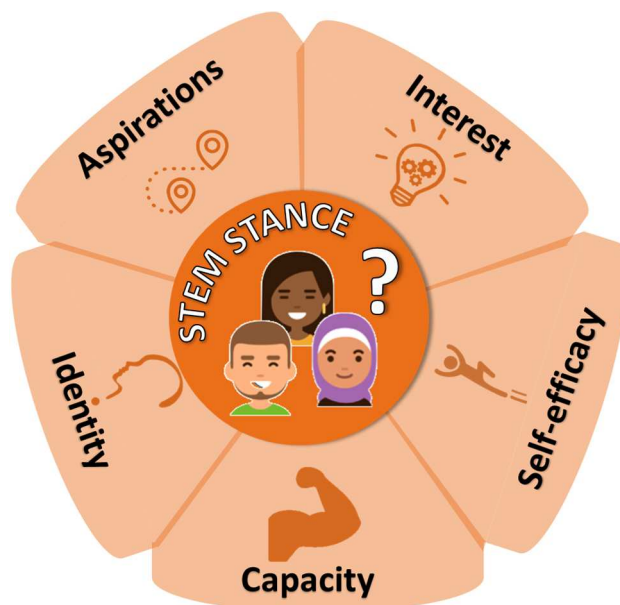


Figure 1. Representation of the considered variables influencing stance on STEM



SELF-EFFICACY IN STEM AS PART OF STEM STANCE

Self-efficacy beliefs are part of a broad non-cognitive factors, such as motivation, and support, to which attention has been recently paid for their critical role in student development of their stance on STEM (Williams & George-Jackson, 2014). Self-efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to manage prospective situations (Albert Bandura, 1995). Thus, self-efficacy in STEM refers to beliefs in one's capabilities to accomplish a particular STEM task at a one designated level, which it is different that the real capacity for accomplishing this particular STEM task. In this sense, students can value their own abilities to perform a particular STEM task despite having demonstrated the same achievement, and these self-efficacy beliefs deeply configure their perceptions about their personal value for STEM or not. In other words, self-efficacy influence students' behaviour in engaging and pursuing STEM activities. The higher students' perceived their own efficacy, the greater the interest they have in STEM activities, and the wider the career options they seriously consider pursuing (Albert Bandura, 1993). Thus, having a strong sense of self-efficacy results in people having the capacity to deal with challenges they encounter, which is highly relevant to have an actual success (Williams & George-Jackson, 2014).

People differ in the areas in which they cultivate their efficacy and in the levels to which they develop it even within their given pursuits (Albert Bandura, 2006): One can believe that he or she will be very capable of solving a particular math problem but not able to solve another one, or to explain to a big audience how he or she has managed to solve it. For this reason, self-efficacy beliefs in STEM need to be tailored to a particular domain and task (Albert Bandura, 2006), although in this article we consider them as a group, to simplify the reading. However, it is worth to note that when different spheres of activity are governed by similar sub-skills, some interdomain relation in perceived efficacy has been observed (Albert Bandura, 2006). From these perspective, educational interventions emphasizing these common competences or practices between disciplines, such as the new framework K-12 Science Education of the National Research Council (2012), would hold promising effects in stablishing positive synergies in the development of self-efficacy in STEM.

Finally, although self-efficacy beliefs are inherently future-oriented -they refer to my beliefs in my own success or failure when doing a particular task-, these expectations are in large part results of self-schemas that are created from their earlier experiences -I know I will be successful because I have successfully carried out similar tasks- (Bong & Skaalvik, 2003). These results highlight the need to provide students with not one, but multiple experiences of success when participating in STEM activities as a key strategy to shift and improve their self-efficacy in STEM (Bryant, 2017; Zimmerman, 2000). Moreover, it also points out the need to undertake these actions at early ages in which self-schemas are in initial stages of formation. The older a student is, the more informed and rooted their self-schemas will be and the more difficult will be to change their perceptions about their own capacities.

Gender differences in self-efficacy in STEM

Although differences in boys' and girls' STEM performance in international tests such as PISA are similar, especially in the science field (OECD, 2016a), it is been extensively reported that girls' self-efficacy beliefs in STEM are lower than their male peers (Albert Bandura, 1993). Girls assess their science and mathematical abilities lower than do boys with similar achievements both at



school level (Bøe & Henriksen, 2013; Hill, Catherine, Corbett, & St. Rose, Adresse, 2010) and at career or more advanced level (Glynn, Brickman, Armstrong, & Taasobshirazi, 2011). In contrast, boys and men tend to be more confident than girls and women in academic areas related to mathematics, science, and Technology. Boys tend to be more self-congratulatory in their responses whereas girls are more modest (Schunk & Pajares, 2002). Moreover, girls hold themselves to a higher standard than boys do in these STEM subjects, believing that they have to be exceptional to succeed in “male” fields (Hill, Catherine et al., 2010). Because of these high standards, females may be more likely than males to be discouraged from STEM when faced with difficulty (Bøe & Henriksen, 2013).

Differences in self-efficacy begin to emerge following children’s transition to middle or junior high school, with girls typically showing a decline in self-efficacy beliefs in STEM (Schunk & Pajares, 2002). This decline and gender differences in self-efficacy are very specific of the STEM field, as there have been found other fields in which women and girls assess their learning outcomes highly than male peers, such as the communication and teamwork skills (Ro & Loya, 2015). Moreover, the decline of girls’ self-efficacy in STEM would happen at the same time to the decline of girls’ interest in STEM, described in previous sections, pointing the relation between the different constructs of the stance on STEM.

Socioeconomic and ethnic differences in self-efficacy in STEM

Research consistently report a strong relationship between low level of socioeconomic background and lower feelings of self-efficacy across a variety of domains, such as STEM, in comparison to their high-SES counterparts (Archer et al., 2015; Albert Bandura, 1993; Becker, Kraus, & Rheinschmidt-Same, 2017). Moreover, some studies would suggest that this trend is perpetuated along time and classes: economic hardships can alter parents' perceived efficacy which, in turn, affects how they raise their children and the key messages they deliver to them (Albert Bandura, 1995). Because of this low self-efficacy, individuals from low socioeconomic background (compared to individuals from high socioeconomic background) are more likely to remain politically inactive when faced with a social disadvantage (Becker et al., 2017). In other words, individuals from high socioeconomic background would have high levels of self-efficacy and might engage in activism in order to maintain the status quo, creating and maintaining social-class differences and inequalities (Becker et al., 2017).

Regarding ethnicity, there are no concluding studies whether this variable affects separately to students’ self-efficacy rather than other variables than socioeconomic or gender issues. In general, ethnic minorities generally have been also reported to have a low sense of efficacy for STEM careers, which is also related with avoiding these kind of professional path (Albert Bandura, 1995). However, much of the research has confounded ethnicity with social class by comparing white children of middle socioeconomic levels with ethnic minorities from lower socioeconomic levels (Schunk & Pajares, 2002). For example, some researches pointed out that Asian students tend to display lower levels of academic self-efficacy beliefs than non-Asians, even though they typically demonstrate superior academic performance (Charles, Fischer, Mooney, & Massey, 2009). However, in a subsequent research, it was demonstrated that the effect of gender on self-efficacy were greater than ethnicity (Ro & Loya, 2015). In other words, the positive effect of being a man was greater for Whites than for Asians and for those from Other ethnicities, which would explain these differences in terms of self-efficacy. In the same sense, scholars have found self-ratings of engineering learning outcomes among Black





undergraduate women to be significantly lower than those of their White peers —a finding not evident for Black men (Ro & Loya, 2015). Thus, and similarly to other previous constructs considered above, ethnicity would reinforce the negative effect of other variables such as gender and/or socioeconomic level on self-efficacy.



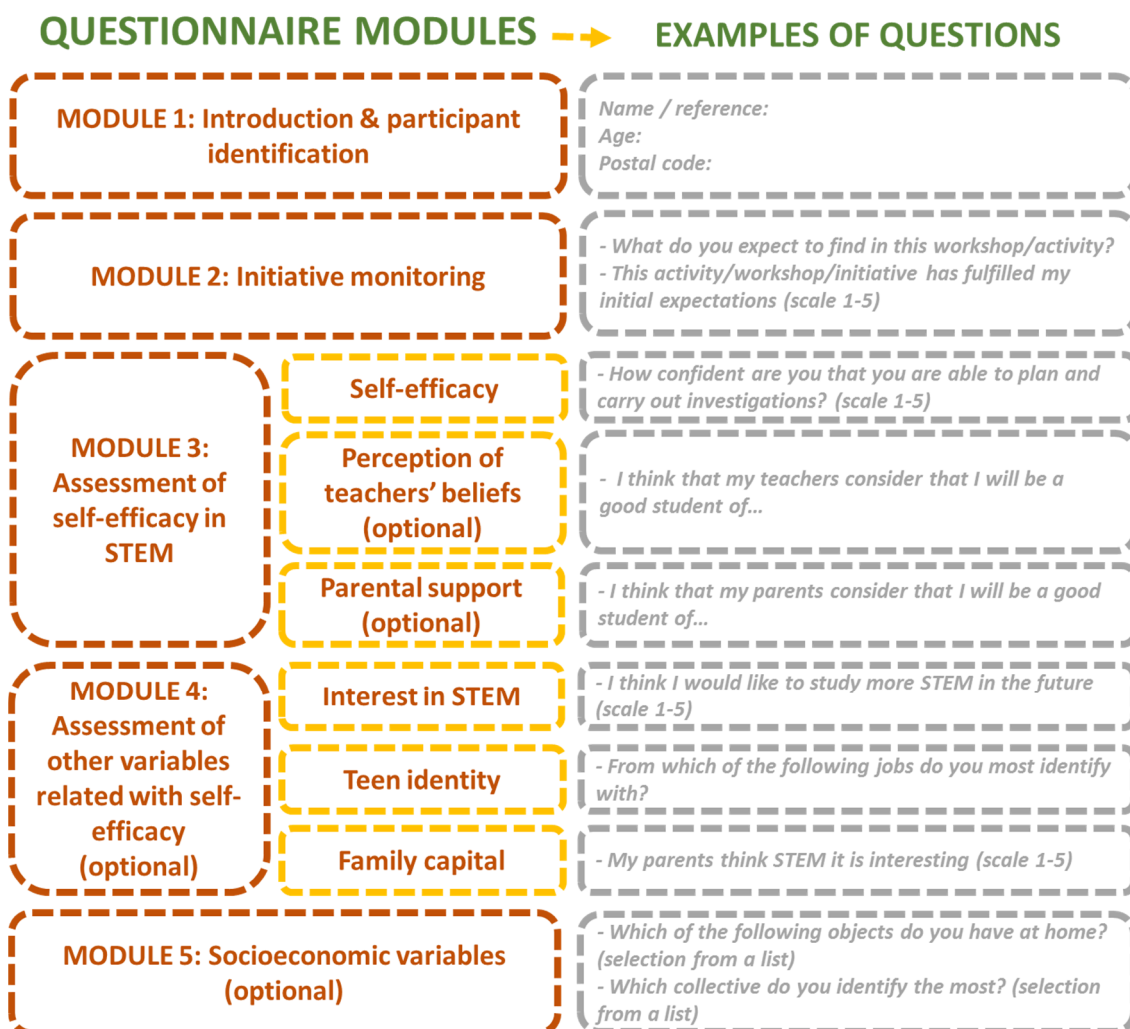
STEAM4U QUESTIONNAIRE FOR TEENS

OVERVIEW OF THE KIDS' QUESTIONNAIRES

This questionnaire is addressed to 10-14-year-old kids and it is aimed at assessing:

- Their self-efficacy in STEAM and its variation from the participation of kids in an initiative
- Other variables related with self-efficacy and STEAM awareness and their variation
- The extent in which the challenge has been implemented

The questionnaire is modular in order to fit different needs of the organisation, and the modules are the following:



A more complete explanation of the modules are given in the theoretical framework of the project.



Instructions

Organisations are expected to choose which models best fit their needs, though some general considerations must be taken:

- **These questionnaires are designed to be used with a big sample of population.** For this reason, questions are closed. We recommend to use diaries, interview guidelines and observational rating forms with a small sample of participants to have a deep insight of the evolution of participants.
- **Before use the questionnaires, read them carefully** and modify the words you need to better adapt them at your initiative.
- **Each participant must complete two questionnaires**, pre-event and post-event questionnaires, in order to gather data to assess their evolution of self-efficacy.
- **Coherence over the pre-event and post-event questionnaire must be considered.** This means that both questionnaires must have the same modules.
- **Be strategic and keep the questionnaires as short as you can.** Although the diverse questions allow you to measure different aspects of self-efficacy, they are not designed to be full used in an evaluation. A selection of the different modules should be undertaken in order to keep the questionnaire short. Typically, each questionnaire should not last longer than 10 minutes (that means an average of 30-40 items).
- **Do not forget to include the relevant parts of the questionnaire.** Some modules and questions of the proposed questionnaires should not be suppressed when it comes to evaluate self-efficacy in STEAM. We will highlight those parts in the following description.
- **Pilot the questionnaires previously.** Finally, before you use the designed questionnaire in your organisation is important to try it first with a small sample in order to make sure that: (1) participants totally understand the statements of each item and (2) data gathered from the questionnaires serves to achieve your evaluation goals.



PRE- QUESTIONNAIRE FOR PARTICIPANT CHILDREN

Introduction

All the information you provide in this questionnaire will be kept anonymous and in any case will be given to third persons, such as your teacher or your parents. Specific information about your name or your age will only be used to track your answers before and after your participation in the activity.

[Complete this paragraph with the necessary information for your initiative/organisation]

MODULE 1: Participant identification

- **What is your age? / Provide your date of birth**

- **What is your gender? (select the best option)**

Female	Male	Others
--------	------	--------

- **Provide your postal code:**

[As a way to have an approximation of the socio-economic background of the children, we can ask for the postal code]



MODULE 2: Initiative monitoring

- What do you expect to find in this workshop/activity? (select the most relevant answer)

	Meet other kids
	Use materials and tools that I do not have at school or at home
	Have fun
	Create new things
	Know how things work

[Complete with other possibilities, as well as other questions related with initial expectations, if necessary]






































MODULE 3: Assessment of self-efficacy in STEAM

[Efficacy items should accurately reflect the construct. The items should be phrased in terms of can do rather than will do (A. Bandura, 2012). Self-efficacy items usually start with “How confident are you that you can...?” “How well can you...?” or “I am confident that I will be able to...” (Bong & Skaalvik, 2003)]

[Self-efficacy scales must be tailored to activity domains and assess the multifaceted ways in which efficacy beliefs operate within the selected activity domain (Albert Bandura, 2006). Although an efficacy scale with the 0-100 is considered a stronger predictor (Albert Bandura, 2006), this questionnaire uses a 5-point Likert-type scale response format. We believe that this 5-point scale is easier to be used by teens than the 0-100 gradation, especially for those younger ones.]

- Please, answer the following questions circling the best option

How confident are you that you are able to ask questions a phenomenon or define a problem that needs to be solved?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to plan and carry out investigations ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to analyse and interpret data ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to use mathematics and computational thinking ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to build explanations about a phenomenon or design solutions for a problem ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to find evidences that helps you to reason and argument when finding the best explanation to a phenomenon or the best solution to a problem?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to obtain, evaluate, and communicate information ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 



					
How confident are you that you will be successful carrying out an experiment/build a new thing in this activity/workshop?	Not confident at all	Only a little confident	Fairly confident	Very confident	Totally confident
					

[The question is adapted from (Baldwin, Ebert-May, & Burns (1999), and the items are adapted from the National Research Council (2012)]

- **Think about your science, technology and mathematics subjects. To which extent do you feel capable of studying these type of subjects in the future?**

Biology/Geology (from 1 to 10)

Physics/Chemistry

Technology

Informatics

Mathematics

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

Perception of teacher's beliefs about oneself (Optional question)

- **I think that my teachers consider that I will be a good student of... (select the best option)**

	A career related with humanities and/or social sciences
	A career related with science, technology, engineer and mathematics
	A career related with other type of studies
	They think I am no good for studying

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

Parental support (optional question)

- Select your level of agreement for each statement (circle your answer)

It is important to my family that I try my best at school	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
My parents/tutors know I am doing well at school	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]

- I think that my parents consider that I will be a good student of... (select the best option)

	A career related with humanities and/or social sciences
	A career related with science, technology, engineer and mathematics
	A career related with other type of studies
	They think I am no good for studying

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

MODULE 4: Assessment of other variables related with self-efficacy (variable module)
















Interest in STEAM

To which extent do the following subjects interest you?

Subject	0 (It does not interest me at all)	1	2	3	4	5	6	7	8	9	10 (I am very interested in)
Biology/Geology											
Chemistry											
Physics											
Technology											
Informatics											
Mathematics											

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

Select your level of agreement for each statement (circle your answer)

I think I would like to study more about why things happen	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think I would like to study more about how to invent, design or build, things	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think I would like to study more about numbers, counting, measuring and describing the shapes of objects	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]

From the following occupations, select those ones in which you think you would enjoy working in. You can choose a maximum of 4





















	Engineer
	Athlete or sportsman/ sportswoman
	Artist



	Businessman/ businesswoman
	Scientist/ researcher
	Mathematician
	Writer/ journalist
	Politician or public servant
	Security forces (firefighter or policeman/ policewoman)
	Doctor or nurse
	Mechanics/ building/ electricity technician
















[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

- Select your level of agreement for each statement (circle your answer)

I like to do science, engineering and/or mathematics activities outside the school (for example: build a kite, do nature walks, program a game, visit a science museum, build models...)	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I like to read a book or magazine about science, technology, engineer or mathematics	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I like to visit websites about science, technology, engineer or mathematics	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I like to watch TV programs about science, technology, engineer or mathematics	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]

- Select your level of agreement for each statement (circle your answer)

We learn interesting things in science, technology and/or mathematics lessons	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
Science, technology and/or mathematics lessons are exciting	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I look forward to my science, technology and/or mathematics, lessons	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 





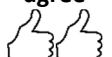









Science, technology and/or mathematics are one of my best subjects	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
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[Adapted from DeWitt et al., (2011)]

- Select your level of agreement for each statement (circle your answer)

It is important for my school that we have a good level of Science, Technology and Mathematics	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
Science, technology and/or mathematics lessons are exciting	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]




























Teen identity

- From which of the following jobs do you most identify with?

	Engineer
	Athlete or sportsman/ sportswoman
	Artist
	Businessman/ businesswoman
	Scientist/ researcher
	Mathematician
	Writer/ journalist
	Politician or public servant
	Security forces (firefighter or policeman/ policewoman)
	Doctor or nurse
	Mechanics/ building/ electricity technician

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

- Select your level of agreement for each statement (circle your answer)

I get good marks at science, technology and/or mathematics	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I learn things quickly in science, technology and/or mathematics lessons	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I understand everything in my science, technology and/or mathematics lessons	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I find science, technology and/or mathematics difficult	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I feel helpless in science, technology and/or mathematics	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]











































- **Think about a person who works in a Science, Technology, Engineering or Mathematics in terms of economic and job stability, etc. To which extent do you like this life style?** (choose a number from 1 to 10)

	0 (I do not like it at all)	1	2	3	4	5	6	7	8	9	10 (I love it)
STEM lifestyle											

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

- **Select your level of agreement for each statement (circle your answer)**

I think that scientists, engineers and/or mathematicians can make a difference in the world	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that scientists, engineers and/or mathematicians can make a lot of money	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that scientists, engineers and/or mathematicians have exciting jobs	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that scientists, engineers and/or mathematicians are brainy	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that scientists, engineers and/or mathematicians are respected by people in their country	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that scientists, engineers and/or mathematicians are odd	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that scientists, engineers and/or mathematicians spend most of their time working by themselves	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that scientists, engineers and/or mathematicians do not have other interests	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]

- **Have you received any orientation and/or counseling in your school to help you choose your next studies by your teachers and/or other staff?** (select your answer)
















Any



	Little
	Quite
	A lot


























[Adapted from Obra Social “la Caixa,” FECYT, & Everis (2015)]

- **Select your level of agreement for each statement (circle your answer)**

For my future job it is important to me to earn a lot of money	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
For my future job it is important to be my own boss	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
For my future job it is important to become famous	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]











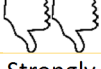



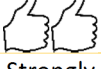





- **Select your level of agreement for each statement (circle your answer)**

For my future job it is important to me to work with others instead of myself	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
For my future job it is important to me to take care of people	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
For my future job it is important to me to work with people rather than things	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
For my future job it is important to me to have time for a family	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
For my future job it is important to me to have time for hobbies and other interests	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]

Family capital

- Select your level of agreement for each statement (circle your answer)

For my parents it is important that I get good marks in school	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
My parents expect me to go to the university	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
My parents want me to get a good job when I grow up	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
My parents want me to make a lot of money when I grow up	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 





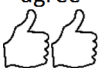










[Adapted from DeWitt et al., (2011)]

- I think that my parents consider that I will be a good student of... (select the best option)

<input type="checkbox"/>	A career related with humanities and/or social sciences
<input type="checkbox"/>	A career related with science, technology, engineer and mathematics
<input type="checkbox"/>	A career related with other type of studies
<input type="checkbox"/>	They think I am no good for studying

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

- Select your level of agreement for each statement (circle your answer)

My parents think science, engineering and/or mathematics are interesting	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
My parents think it is important for me to learn science	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
My parents would be happy if I became a scientist when I grow up	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]

MODULE 5: Socioeconomic variables (optional module)

[This module is highly recommended if you wish to evaluate the impact of your initiative in students of different socioeconomic background]

- Which of the following objects do you have at home? You can select various options

	A desk/ table to study
	A room only for me
	An smart TV
	Artwork (pictures, sculptures...)
	Dictionaries
	A washing machine
	Classic literature
	Video-cameras
	A computer you can use to do school homework
	Books that help you to do the homework
	DVD player
	Internet connexion
	Home cinema
	Technical books (of any subject)
	Videogames or other educational software
	Poetry books
	A quiet place to study

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

Academic data
















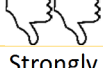



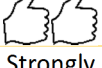





- What is your average marks of the following subjects...?

Subject	Average grade
Biology/Geology	
Physics/Chemistry	
Technology	
Informatics	
Mathematics	



[Adapted from Obra Social “la Caixa,” FECYT, & Everis (2015)]

- To what extent do you agree with the following statement?

I am a good Biology/ Geology student	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I am a good Physics/ Chemistry student	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I am a good Technology student	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I am a good Informatics students	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I am a good Mathematics student	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Alternative wording]

Other modules of EVERIS questionnaire:

Other related variables to cross-match data with socio-economic background can be accessed at Obra Social “la Caixa,” FECYT, & Everis (2015), like the professional level of parents, the academic level of parents, the number of books at home, the number of devices (TVs, computer, etc.)



POST-QUESTIONNAIRE FOR PARTICIPANT CHILDREN

MODULE 1: Participant identification

- **What is your age? / Provide your date of birth**

- **What is your gender? (select the best option)**

Female	Male	Others
---------------	-------------	---------------

- **Provide your postal code:**

[As a way to have an approximation of the socio-economic background of the children, we can ask for the postal code]



MODULE 2: Initiative monitoring

- To what extent you have meet your initial expectations? Rate them from 1 to 10

	Meet other kids
	Use materials and tools that I do not have at school or at home
	Have fun
	Create new things
	Know how things work

[Complete with other possibilities, as well as other questions related with initial expectations, if necessary]

- Is there that you found in this workshop/activity that you did not expected previously? Explain it:












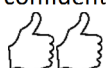




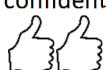




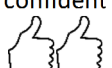




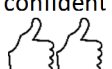





MODULE 3: Assessment of self-efficacy in STEAM





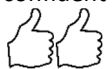




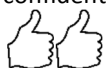
[Efficacy items should accurately reflect the construct. The items should be phrased in terms of can do rather than will do (A. Bandura, 2012). Self-efficacy items usually start with “How confident are you that you can...?” “How well can you...?” or “I am confident that I will be able to...” (Bong & Skaalvik, 2003)]

[Self-efficacy scales must be tailored to activity domains and assess the multifaceted ways in which efficacy beliefs operate within the selected activity domain (Albert Bandura, 2006). Although an efficacy scale with the 0-100 is considered a stronger predictor (Albert Bandura, 2006), this questionnaire uses a 5-point Likert-type scale response format. We believe that this 5-point scale is easier to be used by teens than the 0-100 gradation, especially for those younger ones.]

- Please, answer the following questions circling the best option

After doing the activity...

	Not confident at all	Only a little confident	Fairly confident	Very confident	Totally confident
How confident are you that you are able to ask questions a phenomenon or define a problem that needs to be solved?					
How confident are you that you are able to plan and carry out investigations ?					
How confident are you that you are able to analyse and interpret data ?					
How confident are you that you are able to use mathematics and computational thinking ?					
How confident are you that you are able to build explanations about a phenomenon or design solutions for a problem ?					
How confident are you that you are able to find evidences that helps you to reason and argument when finding the best explanation to a phenomenon or the best solution to a problem?					

How confident are you that you are able to obtain, evaluate, and communicate information?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you will be successful carrying out an experiment/build a new thing in this activity/workshop?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 

[The question is adapted from (Baldwin, Ebert-May, & Burns (1999), and the items are adapted from the National Research Council (2012)]

- **Think about your science, technology and mathematics subjects. To which extent do you now feel capable of studying these type of subjects in the future?**

Subject	1	2	3	4	5	6	7	8	9	10
Biology/Geology										
Physics/Chemistry										
Technology										
Informatics										
Mathematics										

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

- **Overall, and after participating in the workshops, do you feel now more capable of doing STEM activities? (circle the best option)**
 - Yes, I feel that I am much more capable of doing science activities
 - Yes, I feel I am only a little more capable of doing science activities
 - No, I feel I am as capable as before of doing science activities
 - No, I feel I am less capable as before of doing science activities
- **In case you have answered a or b in the previous question, which of the following characteristics of the workshop have made you feel more capable of doing science activities**
 - Knowing a real scientist
 - Doing science in a different way than in the school (experimental, inquiry-based... different methodology)
 - Feeling successful doing science
 - The way the scientist addressed to me made me feel I could do science
 - Doing science with new materials
 - Having the opportunity to create new things
 - Others (please, specify):

[Complete with the necessary items]



Perception of teacher's beliefs about oneself (Optional question)

- **After participating in the activity, I think that my teachers consider that I will be a good student of... (select the best option)**

	A career related with humanities and/or social sciences
	A career related with science, technology, engineer and mathematics
	A career related with other type of studies
	They think I am no good for studying

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

Parental support (optional question)

- **After participating in the activity, I think that my parents consider that I will be a good student of... (select the best option)**

	A career related with humanities and/or social sciences
	A career related with science, technology, engineer and mathematics
	A career related with other type of studies
	They think I am no good for studying

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

- **Why do you think have they made change their opinion?**



**MODULE 4: Assessment of other variables related with self-efficacy
(variable module)**















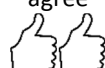
Interest in STEAM

- After participating in the activity, to which extent do the following subjects interest you?

Subject	0 (It does not interest me at all)	1	2	3	4	5	6	7	8	9	10 (I am very interested in)
Biology/Geology											
Chemistry											
Physics											
Technology											
Informatics											
Mathematics											

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

- Select your level of agreement for each statement (circle your answer)

After participating in this activity, I think I would like to study more about why things happen	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity, I think I would like to study more about how to invent, design or build, things	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity, I think I would like to study more about numbers, counting, measuring and describing the shapes of objects	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]

- From the following occupations, select those ones in which you think you would enjoy working in. You can choose a maximum of 4





















	Engineer
--	----------



	Athlete or sportsman/ sportswoman
	Artist
	Businessman/ businesswoman
	Scientist/ researcher
	Mathematician
	Writer/ journalist
	Politician or public servant
	Security forces (firefighter or policeman/ policewoman)
	Doctor or nurse
	Mechanics/ building/ electricity technician





[Adapted from Obra Social “la Caixa,” FECYT, & Everis (2015)]

- **Select your level of agreement for each statement (circle your answer)**

After participating in this activity, I like to do science, engineering and/or mathematics activities outside the school (for example: build a kite, do nature walks, program a game, visit a science museum, build models...)	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity, I like to read a book or magazine about science, technology, engineer or mathematics	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity, I like to visit websites about science, technology, engineer or mathematics	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity, I like to watch TV programs about science, technology, engineer or mathematics	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]

- **Select your level of agreement for each statement (circle your answer)**

We learn interesting things in science, technology and/or mathematics lessons	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
Science, technology and/or mathematics lessons are exciting	Strongly disagree	Disagree	Undecided	Agree	Strongly agree





I look forward to my science, technology and/or mathematics, lessons	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
Science, technology and/or mathematics are one of my best subjects	Strongly disagree	Disagree	Undecided	Agree	Strongly agree

[Adapted from DeWitt et al., (2011)]

- **Select your level of agreement for each statement (circle your answer)**

After participating in this activity, I think that science, technology and/or mathematics lessons are exciting	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
After participating in this activity, I will look forward to my science, technology and/or mathematics, lessons	Strongly disagree	Disagree	Undecided	Agree	Strongly agree

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

- **Is there anything that made you change your opinion about your capacities doing STEM?**

- Knowing a real scientist
- Knowing more what science can be for
- Seeing different uses of science in my life
- Doing science in a different way than in the school (experimental, inquiry-based... different methodology)
- Doing science in a different environment rather than the school
- Doing science with my family/parents (if applicable)
- Doing science with my peers
- Feeling successful doing science in this activity
- The way the teacher/tutors addressed to me made me feel I could do science
- Doing science with new materials
- Doing science in a funnier way
- Having the opportunity to create new things
- Having the opportunity to try things on my own
- Doing science with more professional materials/instruments
- Others (please, specify):
- Nothing, I have not changed my opinion

[These items need to be adapted to your initiative]






















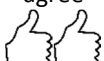
Teen identity

- From which of the following jobs do you most identify with?

	Engineer
	Athlete or sportsman/ sportswoman
	Artist
	Businessman/ businesswoman
	Scientist/ researcher
	Mathematician
	Writer/ journalist
	Politician or public servant
	Security forces (firefighter or policeman/ policewoman)
	Doctor or nurse
	Mechanics/ building/ electricity technician

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

- Select your level of agreement for each statement (circle your answer)

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
After participating in this activity I think now that I learn things quickly in science, technology and/or mathematics lessons					
After participating in this activity I think now that I understand everything in my science, technology and/or mathematics lessons					
After participating in this activity I think now that I find science, technology and/or mathematics difficult					
After participating in this activity I think now that I feel helpless in science, technology and/or mathematics					











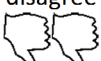



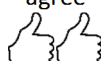
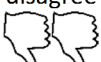



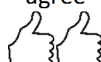




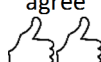




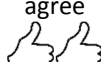
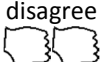




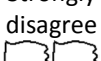



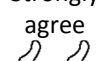
[Adapted from DeWitt et al., (2011)]

- **Think about a person who works in a Science, Technology, Engineering or Mathematics in terms of economic and job stability, etc. After participating in this activity, to which extent do you like this life style?** (choose a number from 1 to 10)

	0 (I do not like it at all)	1	2	3	4	5	6	7	8	9	10 (I love it)
STEM lifestyle											
















[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

- **Select your level of agreement for each statement (circle your answer)**

After participating in this activity I think now that scientists, engineers and/or mathematicians can make a difference in the world	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that scientists, engineers and/or mathematicians can make a lot of money	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that scientists, engineers and/or mathematicians have exciting jobs	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that scientists, engineers and/or mathematicians are brainy	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that scientists, engineers and/or mathematicians are respected by people in their country	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that scientists, engineers and/or mathematicians are odd	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that scientists, engineers and/or mathematicians spend most of their time working by themselves	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that scientists, engineers and/or mathematicians do not have other interests	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 


























[Adapted from DeWitt et al., (2011)]

- **Select your level of agreement for each statement (circle your answer)**

After participating in this activity I think now that for my future job it is important to me to earn a lot of money	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that for my future job it is important to be my own boss	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that for my future job it is important to become famous	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]

- **Select your level of agreement for each statement (circle your answer)**

After participating in this activity I think now that for my future job it is important to me to work with others instead of myself	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that for my future job it is important to me to take care of people	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that for my future job it is important to me to work with people rather than things	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that for my future job it is important to me to have time for a family	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that for my future job it is important to me to have time for hobbies and other interests	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]

- **Is there anything that made you change your opinion about your capacities doing STEM?**

- Knowing a real scientist
- Knowing more what science can be for
- Seeing different uses of science in my life
- Doing science in a different way than in the school (experimental, inquiry-based... different methodology)












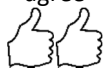












- Doing science in a different environment rather than the school
- Doing science with my family/parents (if applicable)
- Doing science with my peers
- Feeling successful doing science in this activity
- The way the teacher/tutors addressed to me made me feel I could do science
- Doing science with new materials
- Doing science in a funnier way
- Having the opportunity to create new things
- Having the opportunity to try things on my own
- Doing science with more professional materials/instruments
- Others (please, specify):
- Nothing, I have not changed my opinion

[These items need to be adapted to your initiative]

Family capital

- Select your level of agreement for each statement (circle your answer)

After participating in this activity I think now that for my parents it is important that I get good marks in school	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that my parents expect me to go to the university	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that my parents want me to get a good job when I grow up	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I think now that my parents want me to make a lot of money when I grow up	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]















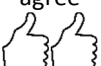
- After participating in the initiative, now I think that my parents consider that I will be a good student of... (select the best option)

<input type="checkbox"/>	A career related with humanities and/or social sciences
<input type="checkbox"/>	A career related with science, technology, engineer and mathematics
<input type="checkbox"/>	A career related with other type of studies
<input type="checkbox"/>	They think I am no good for studying

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]



- **Select your level of agreement for each statement (circle your answer)**

After participating in this activity I see now that my parents think science, engineering and/or mathematics are interesting	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I see now that my parents think it is important for me to learn science	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
After participating in this activity I see now that my parents would be happy if I became a scientist when I grow up	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]

- **Is there anything that made you change your opinion about your capacities doing STEM?**

Knowing a real scientist

Knowing more what science can be for

Seeing different uses of science in my life

Doing science in a different way than in the school (experimental, inquiry-based... different methodology)

Doing science in a different environment rather than the school

Doing science with my family/parents (if applicable)

Doing science with my peers

Feeling successful doing science in this activity

The way the teacher/tutors addressed to me made me feel I could do science

Doing science with new materials

Doing science in a funnier way

Having the opportunity to create new things

Having the opportunity to try things on my own

Doing science with more professional materials/instruments

Others (please, specify):

Nothing, I have not changed my opinion

[These items need to be adapted to your initiative]

INTERVIEW GUIDELINES FOR TEENS (POST-EVENT INTERVIEW)

INTERVIEW GUIDELINES

Interviews are aimed at providing more information about participants' self-efficacy in STEM. They can be fast than the diaries, but direct interaction between interviewee and interviewed can hinder participants' beliefs if there is not a close link between both.

These questions are designed for a post-event interview. Questions for a pre-event interview would need to be adapted from these ones.

INTERVIEWING PARTICIPANT CHILDREN

Introduction and initiative monitoring

- **What have you done in the activity?**
- **What did you expect to find in this activity?**
- **How did you imagine a scientist/engineer/... before coming to the activity?**
- **Has your image changed? Why?**

[Other questions about monitoring the initiative and/or ice-breaking can be added]

Assessment of self-efficacy in STEM

- **What did you think at the beginning of the activity while the tutor/monitor was presenting you the activity? Was it appealing? Why?**

[Question aimed at assessing teens' Level of Motivation, Outcome expectancies]

- **At the beginning, did you feel that you were able to do the proposed activity? Why?**

[Question aimed at assessing teens' retrospective initial self-efficacy beliefs]

- **Are you satisfied with what you have done? Why?**

[Question aimed at assessing teens' self-satisfaction, how they value their achievements]



- **Do you feel you have been able to do this STEAM activity successfully?**

[Question aimed at assessing teens' retrospective self-efficacy beliefs]

- **What do you think has helped you to feel successful at the activity?**

[Question aimed at identifying which elements have helped teens to feel capable of doing STEM]

- **Has your level of confidence in STEAM activities changed from before? What has made it change?**

[Question aimed at identifying which elements have helped teens to feel capable of doing STEM]

- **How confident are you that you will be successful doing STEM activities in the future? Why?**

[Question aimed at assessing teens' prospective self-efficacy beliefs]

- **What would you say to other children who do not feel capable of doing these type of activities?**

[Question aimed at identifying which elements have helped teens to feel capable of doing STEM]

Teen identity (optional)

- **Do you think you get good marks at science, technology and/or mathematics? Why?**

[Question aimed at assessing teens' prospective self-perception beliefs]

- **Do you think you are good at science, technology and/or mathematics? Why?**

[Question aimed at assessing teens' prospective self-perception beliefs]

- **Do you think this activity has allowed you to show how good you are doing STEM? In which sense?**

[Question aimed at identifying which elements have helped teens to feel capable of doing STEM]

[If necessary, other questions can be gathered from the kids' questionnaire]



Interest in STEM (optional)

- **After participating in the activity, do you feel you would like to study more about why things happen? Why?**

[Question aimed at assessing teens' interest in STEM]

- **After participating in the activity, do you feel you would like to study more about how to invent, design or build things? Why?**

[Question aimed at assessing teens' interest in STEM]

- **After participating in the activity, do you feel you would like to study more about numbers, counting, measuring and describing the shapes of objects? Why?**

[Question aimed at assessing teens' interest in STEM]



DIARY MODEL FOR TEENS

Diaries are aimed at providing a more information about participants' self-efficacy in STEAM over an activity. Though as they are more open, they should be used with a small sample compared to the sample of the questionnaires. However, as diaries are more demanding when it comes to analyse participants' answers, they do not include other elements such as awareness or interest in STEAM or roles of STEAM in society as questionnaires do.

In this toolkit, we propose three possible diary models addressed to 10-14-year-old-kids, parents and teacher/tutors/volunteers/experts. Diaries should be periodically written over the course of an event in order to identify possible variations of participants' beliefs regarding self-efficacy.

DIARY MODEL FOR PARTICIPANT KIDS

- **(Name initials/Nickname/Date of birth/Age:)**

- **Date:**

- **Explain what you have done today in the space below**

- **Explain how you felt **before** doing the activity: how the teacher made you feel when he/she was explaining the activity, if you felt you were capable of doing it successfully, your willingness to do the activity, your feelings related with topic he/she was talking about...**



- Explain how you felt **during** the activity: did you had doubts? Did you feel capable of doing it? How did your colleagues make you feel?

- Record the **difficulties** you had during the activity

- Record your **best achievements** during the activity



- Explain how you feel **after** the activity: Do you feel capable of doing something similar again? Would you like to know more about what you have done today? Would you like to know more about STEM?

- If you feel different after the activity compared to before, what did you **make change your feelings?**



MODEL TOOLS FOR TEACHERS, EXPERTS AND VOLUNTEERS

STEAM4U QUESTIONNAIRE FOR EDUCATORS

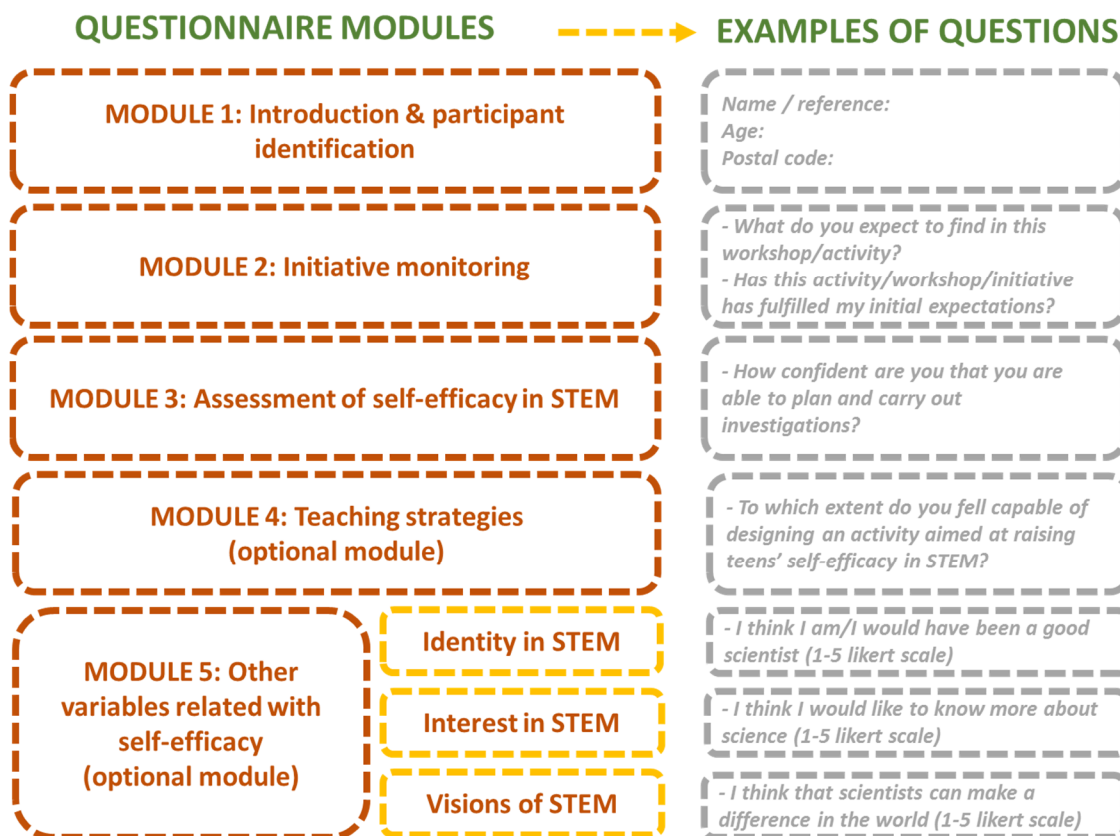
OVERVIEW OF THE TEACHERS' QUESTIONNAIRES

This questionnaire is addressed to teachers, volunteers or STEM experts who participate in STEAM activities or initiatives. In particular, the teachers' questionnaire is aimed at assessing:

- Teachers' self-efficacy in STEM and its variation from their participation in the activity/initiative
- Collective self-efficacy in STEM and its variation from their participation in the activity/initiative
- Parents' perception of the variation of their teens' self-efficacy in STEM
- Other variables related with self-efficacy and STEAM awareness and their variation
- The extent in which the challenge has been implemented

To fit different needs of the organisation, parents' questionnaire has been designed as modular, as follows:





A more complete explanation of the modules are given in the theoretical framework of the project.

Instructions

Organisations are expected to choose which models best fit their needs, though some general considerations must be taken:

- **These questionnaires are designed to be used with a big sample of population.** For this reason, questions are closed. We recommend to use diaries and interview to gather a more in-depth and qualitative perspective with a small sample of participants.
- **Before use the questionnaires, read them carefully,** modify the words you need to better adapt them at your initiative and/or adapt it to your own national language.
- **Each participant must complete two questionnaires,** pre-event and post-event questionnaires, in order to gather data to assess their evolution of self-efficacy.
- **Coherence over the pre-event and post-event questionnaire must be considered.** This means that both questionnaires must have the same modules.
- **Be strategic and keep the questionnaires as short as you can.** Although the diverse questions allow you to measure different aspects of self-efficacy, they are not designed to be full used in an evaluation. A selection of the different modules should be undertaken in order to keep the questionnaire short. Typically, each questionnaire should not last longer than 10 minutes (that means an average of 30-40 items).
- **Do not forget to include the relevant parts of the questionnaire.** Some modules and questions of the proposed questionnaires should not be suppressed when it comes to evaluate self-efficacy in STEAM. We will highlight those parts in the following description.
- **Pilot the questionnaires previously.** Finally, before you use the designed questionnaire in your organisation is important to try it first with a small sample in order to make sure that: (1) participants totally understand the statements of each item and (2) data gathered from the questionnaires serves to achieve your evaluation goals.





PRE QUESTIONNAIRE FOR PARTICIPANT TEACHERS, VOLUNTEERS AND/OR STEM EXPERTS

Aimed at measuring changes in perceived self-efficacy of teachers, volunteers and STEM experts doing STEAM activities.

Introduction

All the information you provide in this questionnaire will be kept anonymous and in any case will be given to third persons, such as your teacher or your parents. Specific information about your name or your age will only be used to track your answers before and after your participation in the activity.

[Complete this paragraph with the necessary information for your initiative/organisation]

MODULE 1: Introduction & participant identification

- **Provide your name initials**
- **What is your age? / Provide your date of birth**
- **What is your gender? (select the best option)**

Female	Male	Others
--------	------	--------

- **Provide the postal code of your school:**

[As a way to have an approximation of the socio-economic background of the teens being taught, we can ask for the postal code]



MODULE 2: Initiative monitoring

[Add this module if you are planning to perform a training course for teachers/ volunteers/ STEM experts and/or at the beginning of an STEAM activity]

- **What do you expect to find in this workshop/activity? (select the most relevant answer)**

<input type="checkbox"/>	Meet other teachers, volunteers, STEM experts...
<input type="checkbox"/>	Develop my STEM competences
<input type="checkbox"/>	Instructions about what to do in my classes/ workshops with teens
<input type="checkbox"/>	Use materials and tools that I do not have at school or at home
<input type="checkbox"/>	Knowing more about science, technology, mathematics...
<input type="checkbox"/>	Strategies to manage the class/ group of teens, especially in difficult moments
<input type="checkbox"/>	Strategies to encourage students to feel able to do STEM activities.
<input type="checkbox"/>	I do not know
<input type="checkbox"/>	Others (please, specify): _____

[Complete with other possibilities, as well as other questions related with initial expectations, if necessary]




























MODULE 3: Assessment of self-efficacy in STEM





















[Collective self-efficacy in STEM can be measured from **an individual perspective (teachers as a unit)**, aggregating the individual member's appraisals of their personal capabilities to execute the particular functions they perform in the group; or from a **group perspective (teachers as a unit)**, aggregating members' appraisals of their group's capability operating as a whole (A Bandura, 2000). This section only considers the individual perspective of teachers' self-efficacy in STEAM. To have an insight of the collective perspective, visit the parents' questionnaire.]

[Efficacy items should accurately reflect the construct. The items should be phrased in terms of can do rather than will do (A. Bandura, 2012). Self-efficacy items usually start with "How confident are you that you can...?" "How well can you...?" or "I am confident that I will be able to..." (Bong & Skaalvik, 2003)]

[Self-efficacy scales must be tailored to activity domains and assess the multifaceted ways in which efficacy beliefs operate within the selected activity domain (Albert Bandura, 2006). Although an efficacy scale with the 0-100 is considered a stronger predictor (Albert Bandura, 2006), this questionnaire uses a 5-point Likert-type scale response format. Since, the focus of the STEAM4U project is on the teens' self-efficacy in STEM, teachers' self-efficacy is used as a complementary data]
















- Please, answer the following questions circling the best option

How confident are you that you are able to ask questions a phenomenon or define a problem that needs to be solved?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to plan and carry out investigations ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to analyse and interpret data ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to use mathematics and computational thinking ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to build explanations about a phenomenon or design solutions for a problem ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 

How confident are you that you are able to find evidences that helps you to reason and argument when finding the best explanation to a phenomenon or the best solution to a problem?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to obtain, evaluate, and communicate information ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you will be successful carrying out an experiment/build a new thing in this activity/workshop ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to use mathematics, science and/or technology concepts that you learnt in your everyday life ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 

[Question adapted from Baldwin, Ebert-May, & Burns (1999); items adapted from the National Research Council (2012)]

- Please, answer the following questions circling the best option





















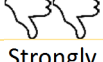



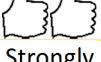
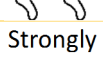



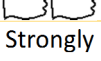
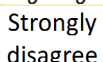



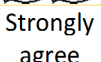
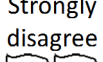



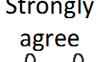
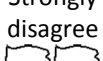



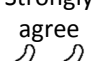
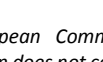




How confident are you that you are able to explain the STEM content of the subject/ project/ workshop to participant teens?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you have sufficient knowledge of STEM subjects to answer participant teens' questions during your lesson/workshop?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to use a variety of teaching approaches or strategies to develop your cognition of mathematics/ science/ technology concepts ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 






[Question adapted from Jang & Tsai (2012)]

MODULE 4: Teaching strategies – optional module

[Add this module if you wish to know the impact of your initiative on teachers/volunteers/STEM experts' teaching strategies, especially on those ones aimed at raising teens' self-efficacy in STEM.]

- Please, indicate how strongly you agree or disagree with the following statements














































I am familiar with the whole structure and directions of the lesson/ project/ workshop	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I can select effective teaching approaches to guide student/teens thinking and learning in mathematics/ science/technology	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I use a variety of teaching approaches or strategies to raise teens' confidence in their capacities to perform successfully STEAM activities	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I know how to assess student/teens performance in a classroom/ lesson/ workshop/ project	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I can adjust my teaching based on what students/teens' currently understand or do not understand	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I know how to choose effective teaching approaches to guide students' learning and thinking	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I can adapt my teaching style to different learners	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I am familiar with common student understandings and misconceptions of the STEM content I am teaching	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I know how to organize and maintain classroom management.	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
My teaching approaches make teens/ students stay interested in the content of the lesson/ project/ workshop	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

I can create a classroom setting to promote students' interest for learning STEM concepts	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
--	--	---	--	--	---

[Question adapted from Jang & Tsai (2012) and Schmidt, Thompson, Koehler, & Shin, (2009)]

- Please, indicate how strongly you agree or disagree with the following statements

[This question represents another option to test teachers' personal STEM teaching efficacy beliefs]

I will continually find better ways to teach STEM content	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
Even if I try very hard, I do not teach STEM as well as I do in most subjects	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I know the steps necessary to teach STEM concepts effectively	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I am not very effective in monitoring STEAM experiments	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I generally teach STEM content ineffectively	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I find it difficult to explain to students why STEM experiments work	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I wonder If I have the necessary skills to teach STEM contents	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
When teaching STEM, I usually welcome students/teens questions	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I do not know what to do to turn students on to STEM	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Question adapted from Bleicher, (2004)]



- **What are your strategies to make young people feel they have the capabilities to do STEAM activities?**



- Please, indicate how strongly you agree or disagree with the following statements

[This question is specifically designed for testing self-efficacy beliefs about equitable STEM teaching]

I am able to effectively teach STEM content to teens/students whose first language is not English	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree
I do not have the ability to teach STEM to teens from economically disadvantaged backgrounds	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree
I can do a great deal as a teacher to increase the achievement of STEM subjects of children who do not speak English as their first language	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree
I am able to meet the learning needs of children of other ethnicities when I teach STEM.	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree
I can help girls learn STEM at the same level as boys	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree
I am effective in teaching STEM in a meaningful way to girls	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree
I have the ability to help teens from low socioeconomic backgrounds be successful in STEM	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree
I am not able to teach STEM to teens who speak English as a second language as effectively as I am to teens who speak English as their first language	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree
I cannot help girls learn STEM at the same level as boys	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree

[Question adapted from Ritter, Boone, & Rubba, (2001)]



- **What are your strategies to make girls, young people from different ethnicities and/or low socio-economic background feel they have the capabilities to do STEAM activities?**



**MODULE 5: Other variables related with self-efficacy (STEM capital) -
Optional module**

[Add this module if you wish to have information about other variables influencing teachers' self-efficacy in STEM]





















Identity in STEM

- Are you a scientist, engineer, mathematician... or other STEM degree? (select the best option)

Yes	No	Other: _____
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[Question adapted from DeWitt et al., (2011)]

- Please, answer the following questions circling the best option

I think I am/could be/would have been a good [scientist/engineer/mathematician...] (one day)	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
Studying [scientist/engineer/mathematician...] is useful for getting a good job in the future	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I got good marks at science, technology and/or mathematics	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I learnt things quickly in science, technology and/or mathematics lessons	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]



Interest in STEM










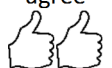









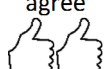




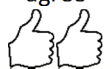




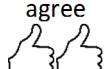




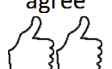




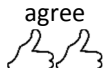
- Please, answer the following questions circling the best option

I think I would like to know more about [science /engineering/mathematics...]	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think [science /engineering/mathematics...] is interesting	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Question adapted from DeWitt et al., (2011)]

Visions of STEM

- Select your level of agreement for each statement

I think that [scientists, engineers...] can make a difference in the world	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] can make a lot of money	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] have exciting jobs	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] are brainy	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] are respected by people in their country	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] are odd	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] spend most of their time working by themselves	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] do not have other interests	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Question adapted from DeWitt et al., (2011)]

POST-QUESTIONNAIRE FOR PARTICIPANT TEACHERS, VOLUNTEERS AND/OR STEM EXPERTS

■ **MODULE 1: Introduction & participant identification** ■

- **What is your age? / Provide your date of birth**

- **What is your gender? (select the best option)**

Female	Male	Others
--------	------	--------

- **Provide the postal code of your school:**

[As a way to have an approximation of the socio-economic background of the teens being taught, we can ask for the postal code]





MODULE 2: Initiative monitoring

[Add this module if you are planning to perform a training course for teachers/ volunteers/ STEM experts and/or at the beginning of an STEAM activity]

- **To what extent you have meet your initial expectations? Rate them from 1 to 10**

	Meet other teachers, volunteers, STEM experts...
	Develop my STEM competences
	Instructions about what to do in my classes/ workshops with teens
	Use materials and tools that I do not have at school or at home
	Knowing more about science, technology, mathematics...
	Strategies to manage the class/ group of teens, especially in difficult moments
	Strategies to encourage students to feel able to do STEM activities.
	I do not know
	Others (please, specify): _____

[Complete with other possibilities, as well as other questions related with initial expectations, if necessary]

- **Is there that you found in this workshop/activity that you did not expected previously? Explain it:**







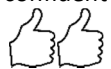




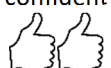




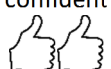




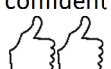




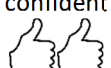




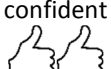
MODULE 3: Assessment of self-efficacy in STEM










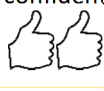




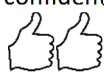
[Efficacy items should accurately reflect the construct. The items should be phrased in terms of can do rather than will do (A. Bandura, 2012). Self-efficacy items usually start with “How confident are you that you can...?” “How well can you...?” or “I am confident that I will be able to...” (Bong & Skaalvik, 2003)]

[Self-efficacy scales must be tailored to activity domains and assess the multifaceted ways in which efficacy beliefs operate within the selected activity domain (Albert Bandura, 2006). Although an efficacy scale with the 0-100 is considered a stronger predictor (Albert Bandura, 2006), this questionnaire uses a 5-point Likert-type scale response format. Since, the focus of the STEAM4U project is on the teens’ self-efficacy in STEM, teachers’ self-efficacy is used as a complementary data]

- Please, answer the following questions circling the best option

After doing the activity...










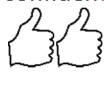




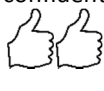
How confident are you that you are able to ask questions a phenomenon or define a problem that needs to be solved?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to plan and carry out investigations ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to analyse and interpret data ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to use mathematics and computational thinking ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to build explanations about a phenomenon or design solutions for a problem ?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to find evidences that helps you to reason and argument when finding the best explanation to a phenomenon or the best solution to a problem?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 

	Not confident at all	Only a little confident	Fairly confident	Very confident	Totally confident
How confident are you that you are able to obtain, evaluate, and communicate information?					
How confident are you that you will be successful carrying out an experiment/build a new thing in this activity/workshop?					
How confident are you that you are able to use mathematics, science and/or technology concepts that you learnt in your everyday life?					

[Adapted from Baldwin, Ebert-May, & Burns (1999), and the National Research Council (2012)]

- **Please, answer the following questions circling the best option**

After doing the activity...

	Not confident at all	Only a little confident	Fairly confident	Very confident	Totally confident
How confident are you that you are able to explain the STEM content of the subject/ project/ workshop to participant teens?					
How confident are you that you have sufficient knowledge of STEM subjects to answer participant teens' questions during your lesson/workshop?					
How confident are you that you are able to use a variety of teaching approaches or strategies to develop your cognition of mathematics/ science/ technology concepts?					

[Question adapted from Jang & Tsai (2012)]

- **Overall, and after participating in the workshops, do you feel that your STEM competences have increased? (circle the best option)**

- e. Yes, I feel that my STEM competences have increased a lot
- f. Yes, but I feel that my STEM competences have only increased a little
- g. No, I feel that my STEM competences remain the same as before
- h. No, I feel that my STEM competences have decreased

-
-



- **In case you have answered a or b in the previous question, which of the following characteristics of the workshop have made you feel that your STEM competences were increasing?**

Knowing a real scientist

Doing science in a different way than I was taught (experimental, inquiry-based... different methodology)

Feeling successful doing science

The way the scientist addressed to me made me feel I could do science

Doing science with new materials

Doing science with my family

Having the opportunity to create new things










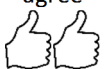




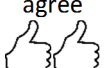




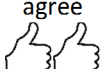




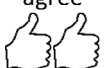









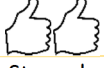




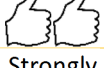
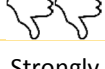



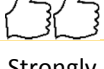
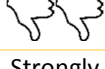



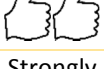





Others (please, specify):

[Complete with the necessary items]



MODULE 4: Teaching strategies – optional module

- Please, indicate how strongly you agree or disagree with the following statements, after participating in the workshop/ seminar... [Complete with the necessary wording]
















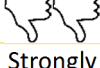




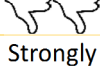




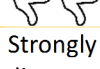




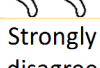




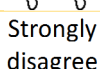




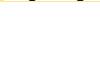



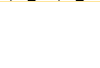
I am familiar with the whole structure and directions of the lesson/ project/ workshop	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I can select effective teaching approaches to guide student/teens thinking and learning in mathematics/ science/technology	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I use a variety of teaching approaches or strategies to raise teens' confidence in their capacities to perform successfully STEAM activities	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I know how to assess student/teens performance in a classroom/ lesson/ workshop/ project	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I can adjust my teaching based on what students/teens' currently understand or do not understand	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I know how to choose effective teaching approaches to guide students' learning and thinking	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I can adapt my teaching style to different learners	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I am familiar with common student understandings and misconceptions of the STEM content I am teaching	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I know how to organize and maintain classroom management.	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
My teaching approaches make teens/ students stay interested in the content of the lesson/ project/ workshop	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I can create a classroom setting to promote students' interest for learning STEM concepts	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Question adapted from Jang & Tsai (2012) and Schmidt, Thompson, Koehler, & Shin, (2009)]



- Please, indicate how strongly you agree or disagree with the following statements, after participating in the workshop/ seminar... *[Complete with the necessary wording]*

[This question represents another option to test teachers' personal STEM teaching efficacy beliefs]

I will continually find better ways to teach STEM content	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
Even if I try very hard, I do not teach STEM as well as I do in most subjects	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I know the steps necessary to teach STEM concepts effectively	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I am not very effective in monitoring STEAM experiments	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I generally teach STEM content ineffectively	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I find it difficult to explain to students why STEM experiments work	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I wonder If I have the necessary skills to teach STEM contents	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
When teaching STEM, I usually welcome students/teens questions	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I do not know what to do to turn students on to STEM	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Question adapted from Bleicher, (2004)]



- **What are your strategies to make young people feel they have the capabilities to do STEAM activities?**

- **Overall, and after participating in the workshops, do you feel that your abilities to promote STEM competences in your students have increased? (circle the best option)**

- Yes, I feel that my STEM competences have increased a lot
- Yes, but I feel that my STEM competences have only increased a little
- No, I feel that my STEM competences remain the same as before
- No, I feel that my STEM competences have decreased

- **Overall, and after participating in the workshops, do you think you are more capable of making your students feel they are able to successfully carry out STEAM activities? (circle the best option)**

- Yes, I feel I am much more capable of making my students feel they are able to successfully carry out STEAM activities
- Yes, I feel I am slightly more capable of making my students feel they are able to successfully carry out STEAM activities
- No, I feel as capable as before of making my students feel they are able to successfully carry out STEAM activities
- No, I feel less capable as before of making my students feel they are able to successfully carry out STEAM activities

- Answer this question in case you have answered a or b in the question immediately preceding this one. **Which of the following characteristics of the workshop have been more relevant when making you feel more capable of raising your students' self-efficacy in STEM?**

Knowing a real scientist

Doing science in a different way than I was taught (experimental, inquiry-based... different methodology)

Feeling successful doing science

The way the scientist addressed to me made me feel I could do science

Doing science with new materials

Doing science with my family





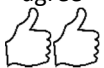




















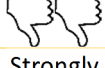



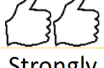














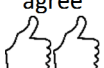


Having the opportunity to create new things
Others (please, specify):

[Complete with the necessary items]

- Please, indicate how strongly you agree or disagree with the following statements, after participating in the workshop/ seminar... [Complete with the necessary wording]

[This question is specifically designed for testing self-efficacy beliefs about equitable STEM teaching]

I am able to effectively teach STEM content to teens/students whose first language is not English	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I do not have the ability to teach STEM to teens from economically disadvantaged backgrounds	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I can do a great deal as a teacher to increase the achievement of STEM subjects of children who do not speak English as their first language	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I am able to meet the learning needs of children of other ethnicities when I teach STEM.	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I can help girls learn STEM at the same level as boys	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I am effective in teaching STEM in a meaningful way to girls	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I have the ability to help teens from low socioeconomic backgrounds be successful in STEM	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I am not able to teach STEM to teens who speak English as a second language as effectively as I am to teens who speak English as their first language	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I cannot help girls learn STEM at the same level as boys	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Question adapted from Ritter, Boone, & Rubba, (2001)]





- **What are your strategies to make girls, young people from different ethnicities and/or low socio-economic background feel they have the capabilities to do STEAM activities?**

- Overall, and after participating in the workshops, **do you think you are more capable of making your students feel they are able to successfully carry out STEAM activities, especially those one from disadvantaged backgrounds in STEM? (circle the best option)**

- e. Yes, I feel I am much more capable
- f. Yes, I feel I am slightly more capable
- g. No, I feel as capable as before
- h. No, I feel less capable as before

- Answer this question in case you have answered a or b in the question immediately preceding this one. **Which of the following characteristics of the workshop have been more relevant when making you feel more capable of raising self-efficacy in STEM of students from disadvantaged backgrounds?**

Knowing a real scientist

Doing science in a different way than I was taught (experimental, inquiry-based... different methodology)

Feeling successful doing science

The way the scientist addressed to me made me feel I could do science

Doing science with new materials

Doing science with my family

Having the opportunity to create new things

Others (please, specify):

[Complete with the necessary items]













**MODULE 5: Other variables related with self-efficacy (STEM capital) -
Optional module**

Identity in STEM

- Please, answer the following questions circling the best option

After doing the activity...

<p>I think I could have been a good [scientist/engineer/mathematician...] one day</p>	<p>Strongly disagree </p>	<p>Disagree </p>	<p>Undecided </p>	<p>Agree </p>	<p>Strongly agree </p>
<p>I think studying [scientist/engineer/mathematician...] is useful for getting a good job in the future</p>	<p>Strongly disagree </p>	<p>Disagree </p>	<p>Undecided </p>	<p>Agree </p>	<p>Strongly agree </p>

[Adapted from DeWitt et al., (2011)]

- Is there anything that made you change your opinion about your STEM identity?

- Knowing a real scientist
- Doing science in a different way than I was taught (experimental, inquiry-based... different methodology)
- Feeling successful doing science
- The way the scientist addressed to me made me feel I could do science
- Doing science with new materials
- Doing science with my family
- Having the opportunity to create new things
- Nothing, I have not changed my opinion
- Others (please, specify):

[Complete with the necessary items]



Interest in STEM

- Please, answer the following questions circling the best option

After doing the activity...

I think I would like to know more about [science /engineering/mathematics...]	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think [science /engineering/mathematics...] is interesting	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Question adapted from DeWitt et al., (2011)]

- Is there anything that made you change your opinion about your interest in STEM?

Knowing a real scientist

Doing science in a different way than I was taught (experimental, inquiry-based... different methodology)

Feeling successful doing science

The way the scientist addressed to me made me feel I could do science

Doing science with new materials

Doing science with my family

Having the opportunity to create new things

Nothing, I have not changed my opinion









































Others (please, specify):

[Complete with the necessary items]

Visions of STEM

- Select your level of agreement for each statement

After doing the activity...

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
I think that [scientists, engineers...] can make a difference in the world					
I think that [scientists, engineers...] can make a lot of money					
I think that [scientists, engineers...] have exciting jobs					
I think that [scientists, engineers...] are brainy					
I think that [scientists, engineers...] are respected by people in their country					
I think that [scientists, engineers...] are odd					
I think that [scientists, engineers...] spend most of their time working by themselves					
I think that [scientists, engineers...] do not have other interests					

[Question adapted from DeWitt et al., (2011)]

- **Is there anything that made you change your opinion about your visions of STEM?**

Knowing a real scientist

Doing science in a different way than I was taught (experimental, inquiry-based... different methodology)

Feeling successful doing science

The way the scientist addressed to me made me feel I could do science

Doing science with new materials

Doing science with my family

Having the opportunity to create new things

Nothing, I have not changed my opinion

Others (please, specify):

[Complete with the necessary items]



INTERVIEWING GUIDELINES FOR EDUCATORS

INTERVIEW GUIDELINES

Interviews are aimed at providing more information about participants' self-efficacy in STEM. They can be fast than the diaries, but direct interaction between interviewee and interviewed can hinder participants' beliefs if there is not a close link between both.

These questions are designed for a post-event interview. Questions for a pre-event interview would need to be adapted from these ones.

INTRODUCTION AND INITIATIVE MONITORING

- **What have you done in the activity?**
- **What did you expect to find in this activity?**
- **How did you imagine a scientist/engineer/... before coming to the activity?**
- **Has your image changed? Why?**

[Other questions about monitoring the initiative and/or ice-breaking can be added]

ASSESSMENT OF SELF-EFFICACY IN STEM

- **What did you think at the beginning of the activity while the teacher/tutor/monitor was presenting you the activity? Was it appealing? Why?**

[Question aimed at assessing participants' Level of Motivation, Outcome expectancies]

- **At the beginning, did you personally feel that you were able to do the proposed activity in your class/ workshop? Why?**

[Question aimed at assessing participants' retrospective initial self-efficacy beliefs at an individual level]



- **At the beginning, did you personally feel that you were able to do the proposed activity with girls, teens of other ethnicities and/or low socioeconomically background? Why?**

[Question aimed at assessing participants' retrospective initial self-efficacy beliefs at an individual level in terms of equitable STEM]

- **Has your level of confidence in STEM changed from before? What has made it change?**

[Question aimed at identifying which elements have helped teens to feel capable of doing STEM]

- **How confident are you now that you are able to make your students feel they can carry out successfully STEAM activities? Why? And regarding students from disadvantaged backgrounds?**

[Question aimed at assessing teaching strategies to promote self-efficacy in STEM]

- **Have you changed your opinions from before? What has make it change?**

- **Which strategies do you use to make your students feel they are able to carry out successfully STEAM activities? And regarding students from disadvantaged backgrounds?**

[Question aimed at assessing teaching strategies to promote self-efficacy in STEM]

- **Have they changed from before? What has make them change?**

- **What would you say to other teachers/ tutors/STEM experts who do not feel capable of doing these type of activities?**

[Question aimed at identifying which elements have helped teens to feel capable of doing STEM]

- **Would you like to add something else?**

DIARY MODEL FOR EDUCATORS

INSTRUCTIONS

Diaries are aimed at providing a more information about participants' self-efficacy in STEM over an activity. Though as they are more open, they should be used with a small sample compared to the sample of the questionnaires. However, as diaries are more demanding when it comes to analyse participants' answers, they do not include other elements such as awareness or interest in STEAM or roles of STEAM in society as questionnaires do.

In this toolkit, we propose three possible diary models addressed to 10-14-year-old-kids, parents and teacher/tutors/volunteers/experts. Diaries should be periodically written over the course of an event in order to identify possible variations of participants' beliefs regarding self-efficacy.

DIARY MODEL FOR PARTICIPANT PARENTS

- **Name initials/Nickname**
- **Age/Date of birth:**
- **Date:**
- **Explain what you have done today in the space below**



- Explain how you felt **before** doing the activity, for example:
 - If you felt you were capable of doing it in your class/workshop (and specially with teens from disadvantaged situations)
 - Your willingness to do the proposed activity
 - Your feelings related with topic being proposed

- Explain how you felt **during** the activity: did you had doubts? Did you feel capable of doing the activity? Did you feel capable of making your students feel they were able to be successful doing STEAM?

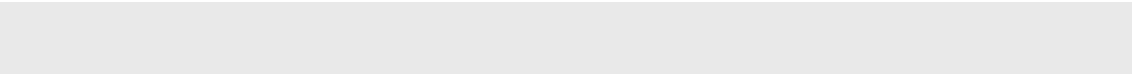


- Record the **difficulties** you had during the activity

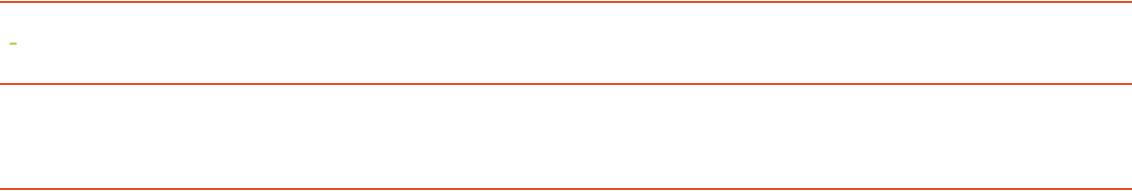
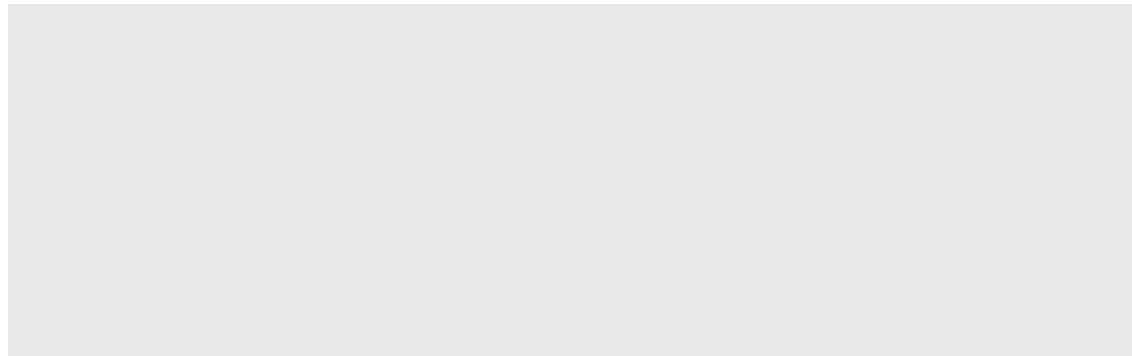
- Record your **best achievements** during the activity

- Explain how you feel **after** the activity: Do you feel capable of preparing and doing a similar activity with your students? Do you feel able to make your students feel capable of doing STEAM activities?





- **After the activity, do you feel more, equal or less capable of making your students feel they can be successful doing STEAM activities? If applicable, explain what did you make change your feelings?**



MODEL TOOLS FOR PARENTS

STEAM4U QUESTIONNAIRE FOR PARENTS

OVERVIEW OF THE PARENTS' QUESTIONNAIRES

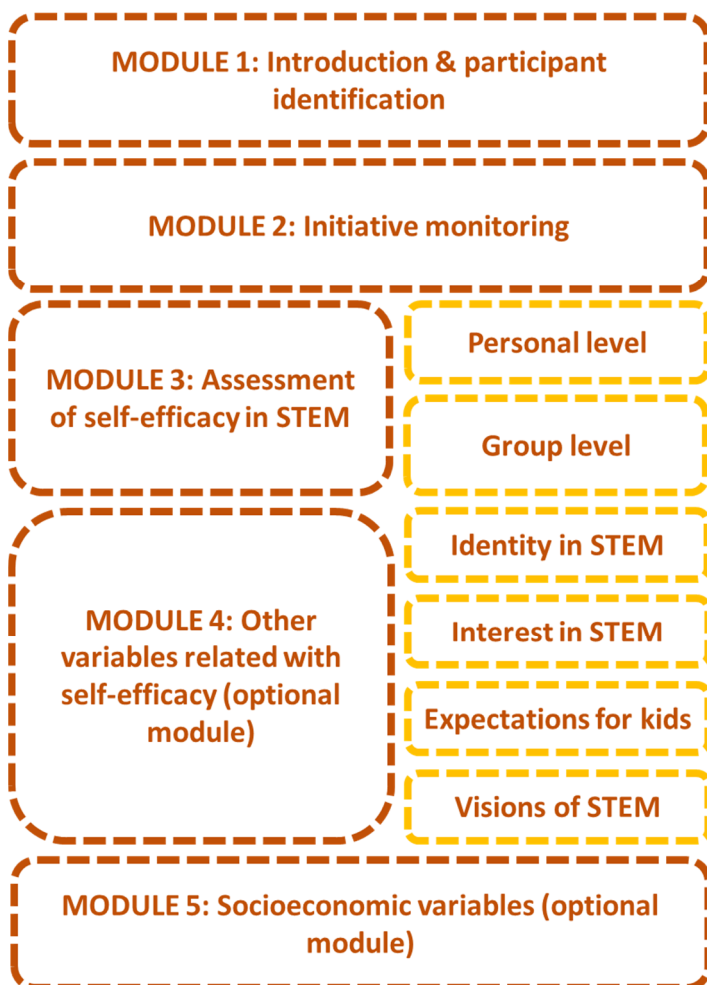
This questionnaire is addressed to parents or relatives who participate in family STEAM activities or initiatives. In particular, the parents' questionnaire is aimed at assessing:

- Parents' self-efficacy in STEM and its variation from their participation in the activity/initiative
- Family self-efficacy in STEM and its variation from their participation in the activity/initiative
- Parents' perception of the variation of their teens' self-efficacy in STEM
- Other variables related with self-efficacy and STEAM awareness and their variation
- The extent in which the challenge has been implemented

To fit different needs of the organisation, parents' questionnaire has been designed as modular, as follows:



QUESTIONNAIRE MODULES →



EXAMPLES OF QUESTIONS

Name / reference:
Age:
Postal code:

- What do you expect to find in this workshop/activity?
- Has this activity/workshop/initiative fulfilled my initial expectations?

- How confident are you that you are able to plan and carry out investigations?

- How confident are you that, as a family, you are able to obtain, evaluate and communicate information?

- I think I am/I would have been a good scientist (1-5 likert scale)

- I think I would like to know more about science (1-5 likert scale)

- I think that my kid will be a good student of...

- I think that scientists can make a difference in the world (1-5 likert scale)

- Which of the following objects do you have at home?

A more complete explanation of the modules is given in the theoretical framework of the project.

Instructions

Organisations are expected to choose which models best fit their needs, though some general considerations must be taken:

- **These questionnaires are designed to be used with a big sample of population.** For this reason, questions are closed. We recommend to use diaries and interview to gather a more in-depth and qualitative perspective with a small sample of participants.
- **Before use the questionnaires, read them carefully,** modify the words you need to better adapt them at your initiative and/or adapt it to your own national language.
- **Each participant must complete two questionnaires,** pre-event and post-event questionnaires, in order to gather data to assess their evolution of self-efficacy.
- **Coherence over the pre-event and post-event questionnaire must be considered.** This means that both questionnaires must have the same modules.





- **Be strategic and keep the questionnaires as short as you can.** Although the diverse questions allow you to measure different aspects of self-efficacy, they are not designed to be full used in an evaluation. A selection of the different modules should be undertaken in order to keep the questionnaire short. Typically, each questionnaire should not last longer than 10 minutes (that means an average of 30-40 items).
- **Do not forget to include the relevant parts of the questionnaire.** Some modules and questions of the proposed questionnaires should not be suppressed when it comes to evaluate self-efficacy in STEAM. We will highlight those parts in the following description.
- **Pilot the questionnaires previously.** Finally, before you use the designed questionnaire in your organisation is important to try it first with a small sample in order to make sure that: (1) participants totally understand the statements of each item and (2) data gathered from the questionnaires serves to achieve your evaluation goals.



PRE QUESTIONNAIRE FOR PARTICIPANT PARENTS

Aimed at measuring changes in perceived self-efficacy of parents doing STEAM-related activities with their kids.

Introduction

All the information you provide in this questionnaire will be kept anonymous and in any case will be given to third persons, such as your teacher or your parents. Specific information about your name or your age will only be used to track your answers before and after your participation in the activity.

[Complete this paragraph with the necessary information for your initiative/organisation]

MODULE 1: Introduction & participant identification

- What is your age? / Provide your date of birth
- What is your gender? (select the best option)

Female	Male	Others
--------	------	--------

- Provide your postal code:

[As a way to have an approximation of the socio-economic background of the children, we can ask for the postal code]

MODULE 2: Initiative monitoring

- What do you expect to find in this workshop/activity? (select the most relevant answer)

<input type="checkbox"/>	Meet other parents or families
<input type="checkbox"/>	Socialise my kids with other teens
<input type="checkbox"/>	Use materials and tools that I do not have at school or at home
<input type="checkbox"/>	Know more about science, technology, mathematics...
<input type="checkbox"/>	Have a good time with my kids
<input type="checkbox"/>	Create new things
<input type="checkbox"/>	Know how things work

[Complete with other possibilities, as well as other questions related with initial expectations, if necessary]



MODULE 3: Assessment of self-efficacy in STEM












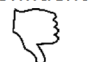




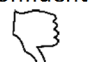




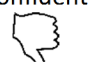



[Collective self-efficacy in STEM can be measured from **an individual perspective (parent as a unit)**, aggregating the individual member's appraisals of their personal capabilities to execute the particular functions they perform in the group; or from a **group perspective (family as a unit)**, aggregating members' appraisals of their group's capability operating as a whole (A Bandura, 2000). This section is aimed to assess both approaches]
















[Efficacy items should accurately reflect the construct. The items should be phrased in terms of can do rather than will do (A. Bandura, 2012). Self-efficacy items usually start with "How confident are you that you can...?" "How well can you...?" or "I am confident that I will be able to..." (Bong & Skaalvik, 2003)]

[Self-efficacy scales must be tailored to activity domains and assess the multifaceted ways in which efficacy beliefs operate within the selected activity domain (Albert Bandura, 2006). Although an efficacy scale with the 0-100 is considered a stronger predictor (Albert Bandura, 2006), this questionnaire uses a 5-point Likert-type scale response format. Since, the focus of the STEAM4U project is on the teens' self-efficacy in STEM, parents' self-efficacy is used as a complementary data]

Personal self-efficacy

- Please, answer the following questions circling the best option


























How confident are you that you are able to ask questions a phenomenon or define a problem that needs to be solved in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to plan and carry out investigations in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to analyse and interpret data in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to use mathematics and computational thinking in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to build explanations about a phenomenon or design solutions for a problem in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 

How confident are you that you are able to find evidences that helps you to reason and argument when finding the best explanation to a phenomenon or the best solution to a problem in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you are able to obtain, evaluate, and communicate information in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that you will be successful carrying out an experiment/build a new thing in this activity/workshop in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 

[Question adapted from Baldwin, Ebert-May, & Burns (1999); items adapted from the National Research Council (2012)]

Family self-efficacy (as a collective)

- Please, answer the following questions circling the best option

How confident are you that, as a family group, you are able to ask questions a phenomenon or define a problem that needs to be solved for this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that, as a family group, you are able to plan and carry out investigations in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that, as a family group, you are able to build explanations about a phenomenon or design solutions for a problem in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that, as a family group, you are able to obtain, evaluate, and communicate information in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident are you that, as a family group, you will be successful carrying out an experiment/build a new thing in this activity/workshop in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 

[Question adapted from Baldwin, Ebert-May, & Burns (1999); items adapted from the National Research Council (2012)]



**MODULE 4: Other variables related with self-efficacy (STEM capital) -
Optional module**

[As it is explained in DeWitt et al., (2011), STEM stance of kids (and particularly, aspirations and self-efficacy) are strongly related with the STEM capital of the family. STEM capital refers to the science-related qualifications, understanding, knowledge (about science and 'how it works'), interest and social contacts (e.g. knowing someone who works in a science-related job)]

Identity in STEM

- Are you or your husband/wife scientists, engineers, mathematicians... or other STEM careers? (select the best option)

Yes	No	Other: _____
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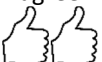









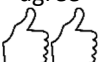
[Question adapted from DeWitt et al., (2011)]

- Are some of your closest family members or friends scientists, engineers, mathematicians... or other STEM careers? (select the best option)

Yes	No	Other: _____
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[Question adapted from DeWitt et al., (2011)]

- Please, answer the following questions circling the best option

I think I am/could be/would have been a good [scientist/engineer/mathematician...] (one day)	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
Studying [scientist/engineer/mathematician...] is useful for getting a good job in the future	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I got good marks at science, technology and/or mathematics	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I learnt things quickly in science, technology and/or mathematics lessons	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]



Interest in STEM

- Please, answer the following questions circling the best option

I think I would like to know more about [science /engineering/mathematics...]	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think [science /engineering/mathematics...] is interesting	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Question adapted from DeWitt et al., (2011)]










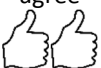
Expectations in STEM for teens

- Please, select the best option: I think that my kid/s will be a good student/s of...

<input type="checkbox"/>	A career related with humanities and/or social sciences
<input type="checkbox"/>	A career related with science, technology, engineer and mathematics
<input type="checkbox"/>	A career related with other type of studies
<input type="checkbox"/>	They think I am no good for studying

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]
















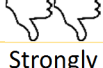



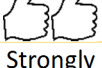
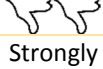



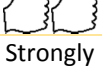
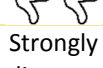



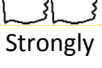
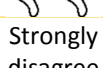



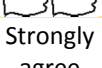
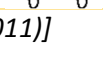



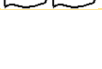
- Please, answer the following questions circling the best option

I think is important for my son/daughter to learn science/engineering...	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I would be happy if my son/ daughter became a scientists/engineer/ mathematician... (etc.) when he/she grow up	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Question adapted from DeWitt et al., (2011)]

Visions of STEM

- Select your level of agreement for each statement

I think that [scientists, engineers...] can make a difference in the world	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] can make a lot of money	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] have exciting jobs	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] are brainy	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] are respected by people in their country	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] are odd	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] spend most of their time working by themselves	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] do not have other interests	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Question adapted from DeWitt et al., (2011)]

MODULE 5: Socioeconomic variables

[This module is highly recommended if you wish to evaluate the impact of your initiative in students of different socioeconomic background]

- Please, select **your** highest level of education

<input type="checkbox"/>	Did not complete high school
<input type="checkbox"/>	High school
<input type="checkbox"/>	Vocational training
<input type="checkbox"/>	University degree
<input type="checkbox"/>	Master
<input type="checkbox"/>	Doctorate

- Please, select the highest level of education of **your husband/wife**

<input type="checkbox"/>	Did not complete high school
<input type="checkbox"/>	High school
<input type="checkbox"/>	Vocational training
<input type="checkbox"/>	University degree
<input type="checkbox"/>	Master
<input type="checkbox"/>	Doctorate

- Which of the following objects do you have at home? You can select various options

<input type="checkbox"/>	A desk/ table to study
<input type="checkbox"/>	A room only for me
<input type="checkbox"/>	An smart TV
<input type="checkbox"/>	Artwork (pictures, sculptures...)
<input type="checkbox"/>	Dictionaries
<input type="checkbox"/>	A washing machine
<input type="checkbox"/>	Classic literature
<input type="checkbox"/>	Video-cameras
<input type="checkbox"/>	A computer which your teen can use to do school homework
<input type="checkbox"/>	Books that help your kids do the homework
<input type="checkbox"/>	DVD player
<input type="checkbox"/>	Internet connexion
<input type="checkbox"/>	Home cinema
<input type="checkbox"/>	Technical books (of any subject)
<input type="checkbox"/>	Videogames or other educational software
<input type="checkbox"/>	Poetry books
<input type="checkbox"/>	A quiet place for your kid to study

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]



POST-QUESTIONNAIRE FOR PARTICIPANT PARENTS

MODULE 1: Introduction & participant identification

- What is your age? / Provide your date of birth

- What is your gender? (select the best option)

Female	Male	Others
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- Provide your postal code:

[As a way to have an approximation of the socio-economic background of the children, we can ask for the postal code]

MODULE 2: Initiative monitoring

- To what extent you have meet your initial expectations? Rate them from 1 to 10

	Meet other parents or families
	Socialise my kids with other teens
	Use materials and tools that I do not have at school or at home
	Know more about science, technology, mathematics...
	Have a good time with my kids
	Create new things
	Know how things work

[Complete with other possibilities, as well as other questions related with initial expectations, if necessary]

- Is there that you found in this workshop/activity that you did not expected previously? Explain it:



MODULE 3: Assessment of self-efficacy in STEM

[Collective self-efficacy in STEM is measured from **an individual perspective (parent as a unit)**, and from a **group perspective (family as a unit)** (A Bandura, 2000).]


























[Efficacy items should accurately reflect the construct. The items should be phrased in terms of **can do** rather than **will do** (A. Bandura, 2012). Self-efficacy items usually start with “How confident are you that you can...?” “How well can you...?” or “I am confident that I will be able to...” (Bong & Skaalvik, 2003)]















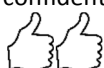
[Self-efficacy scales must be tailored to activity domains and assess the multifaceted ways in which efficacy beliefs operate within the selected activity domain (Albert Bandura, 2006). Although an efficacy scale with the 0-100 is considered a stronger predictor (Albert Bandura, 2006), this questionnaire uses a 5-point Likert-type scale response format. Since, the focus of the STEAM4U project is on the teens’ self-efficacy in STEM, parents’ self-efficacy is used as a complementary data]

Personal self-efficacy

- Please, answer the following questions circling the best option

After doing the activity...

How confident now are you that you are able to ask questions a phenomenon or define a problem that needs to be solved in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident now are you that you are able to plan and carry out investigations in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident now are you that you are able to analyse and interpret data in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident now are you that you are able to use mathematics and computational thinking in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident now are you that you are able to build explanations about a phenomenon or design solutions for a problem in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 

How confident now are you that you are able to find evidences that helps you to reason and argument when finding the best explanation to a phenomenon or the best solution to a problem in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident now are you that you are able to obtain, evaluate, and communicate information in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident now are you that you will be successful carrying out an experiment/build a new thing in this activity/workshop in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 

[Question is adapted from Baldwin, Ebert-May, & Burns (1999), and the items are adapted from the National Research Council (2012)]

- **Overall, and after participating in the workshops, do you feel now more capable of doing STEM activities? (circle the best option)**

- i. Yes, I feel that I am much more capable of doing science activities
- j. Yes, I feel I am only a little more capable of doing science activities
- k. No, I feel I am as capable as before of doing science activities
- l. No, I feel I am less capable as before of doing science activities

- **In case you have answered a or b in the previous question, which of the following characteristics of the workshop have made you feel more capable of doing science activities**

Knowing a real scientist

Doing science in a different way than I was taught (experimental, inquiry-based... different methodology)

Feeling successful doing science

The way the scientist addressed to me made me feel I could do science

Doing science with new materials

Doing science with my family

Having the opportunity to create new things

Others (please, specify):










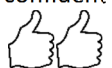




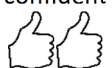




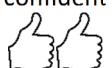




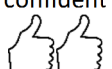
[Complete with the necessary items]



Family self-efficacy (as a collective)

- Please, answer the following questions circling the best option

After doing the activity...

How confident now are you that, as a family group, you are able to ask questions a phenomenon or define a problem that needs to be solved for this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident now are you that, as a family group, you are able to plan and carry out investigations in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident now are you that, as a family group, you are able to build explanations about a phenomenon or design solutions for a problem in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident now are you that, as a family group, you are able to obtain, evaluate, and communicate information in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 
How confident now are you that, as a family group, you will be successful carrying out an experiment/build a new thing in this activity/workshop in this activity?	Not confident at all 	Only a little confident 	Fairly confident 	Very confident 	Totally confident 

[Question adapted from Baldwin, Ebert-May, & Burns (1999); items adapted from the National Research Council (2012)]

- As a family group, and after participating in the workshops, do you feel now more capable of doing STEM activities? (circle the best option)
 - Yes, I feel that I am much more capable of doing science activities
 - Yes, I feel I am only a little more capable of doing science activities
 - No, I feel I am as capable as before of doing science activities
 - No, I feel I am less capable as before of doing science activities



- **In case you have answered a or b in the previous question, which of the following characteristics of the workshop have made you feel more capable of doing science activities**

Knowing a real scientist

Doing science in a different way than I was taught (experimental, inquiry-based... different methodology)

Feeling successful doing science

The way the scientist addressed to me made me feel I could do science

Doing science with new materials

Doing science with my family

Having the opportunity to create new things

Others (please, specify):

[Complete with the necessary items]













**MODULE 4: Other variables related with self-efficacy (STEM capital) -
Optional module**

[As it is explained in DeWitt et al., (2011), STEM stance of kids (and particularly, aspirations and self-efficacy) are strongly related with the STEM capital of the family. STEM capital refers to the science-related qualifications, understanding, knowledge (about science and 'how it works'), interest and social contacts (e.g. knowing someone who works in a science-related job)]

Identity in STEM

- Please, answer the following questions circling the best option

After doing the activity...

I think I could have been a good [scientist/engineer/mathematician...] one day	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think studying [scientist/engineer/mathematician...] is useful for getting a good job in the future	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Adapted from DeWitt et al., (2011)]

- **Is there anything that made you change your opinion about your identity in STEM?**
 Knowing a real scientist
 Doing science in a different way than I was taught (experimental, inquiry-based... different methodology)
 Feeling successful doing science
 The way the scientist addressed to me made me feel I could do science
 Doing science with new materials
 Doing science with my family
 Having the opportunity to create new things
 Nothing, I have not changed my opinion
 Others (please, specify):


[Complete with the necessary items]



Interest in STEM

- Please, answer the following questions circling the best option

After doing the activity...

I think I would like to know more about [science /engineering/mathematics...]	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think [science /engineering/mathematics...] is interesting	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Question adapted from DeWitt et al., (2011)]

- Is there anything that made you change your opinion about your interest in STEM?

Knowing a real scientist

Doing science in a different way than I was taught (experimental, inquiry-based... different methodology)

Feeling successful doing science

The way the scientist addressed to me made me feel I could do science

Doing science with new materials

Doing science with my family

Having the opportunity to create new things

Nothing, I have not changed my opinion

Others (please, specify):

[Complete with the necessary items]

Expectations in STEM for teens

- Please, select the best option: After doing the activity, I think that my kid/s will be a good student/s of...











<input type="checkbox"/>	A career related with humanities and/or social sciences
<input type="checkbox"/>	A career related with science, technology, engineer and mathematics
<input type="checkbox"/>	A career related with other type of studies
<input type="checkbox"/>	They think I am no good for studying

[Adapted from Obra Social "la Caixa," FECYT, & Everis (2015)]

- Please, answer the following questions circling the best option



After doing the activity...

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
I think is important for my son/daughter to learn science/engineering...					
I would be happy if my son/ daughter became a scientists/engineer/ mathematician... (etc.) when he/she grow up					

[Question adapted from DeWitt et al., (2011)]

- **Is there anything that made you change your opinion about your expectations in STEM?**









































- Knowing a real scientist
- Doing science in a different way than I was taught (experimental, inquiry-based... different methodology)
- Feeling successful doing science
- The way the scientist addressed to me made me feel I could do science
- Doing science with new materials
- Doing science with my family
- Having the opportunity to create new things
- Nothing, I have not changed my opinion
- Others (please, specify):

[Complete with the necessary items]

Visions of STEM

- Select your level of agreement for each statement

After doing the activity...

I think that [scientists, engineers...] can make a difference in the world	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] can make a lot of money	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] have exciting jobs	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] are brainy	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] are respected by people in their country	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] are odd	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] spend most of their time working by themselves	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 
I think that [scientists, engineers...] do not have other interests	Strongly disagree 	Disagree 	Undecided 	Agree 	Strongly agree 

[Question adapted from DeWitt et al., (2011)]

- **Is there anything that made you change your opinion about your visions of STEM?**

Knowing a real scientist

Doing science in a different way than I was taught (experimental, inquiry-based... different methodology)

Feeling successful doing science

The way the scientist addressed to me made me feel I could do science

Doing science with new materials

Doing science with my family

Having the opportunity to create new things

Nothing, I have not changed my opinion

Others (please, specify):

[Complete with the necessary items]



INTERVIEWING GUIDELINES FOR PARTICIPANT PARENTS IN STEAM ACTIVITIES

INTERVIEW GUIDELINES

Interviews are aimed at providing more information about participants' self-efficacy in STEM. They can be fast than the diaries, but direct interaction between interviewee and interviewed can hinder participants' beliefs if there is not a close link between both.

These questions are designed for a post-event interview. Questions for a pre-event interview would need to be adapted from these ones.

INTRODUCTION AND INITIATIVE MONITORING

- **What have you done in the activity?**
- **What did you expect to find in this activity?**
- **How did you imagine a scientist/engineer/... before coming to the activity?**
- **Has your image changed? Why?**

[Other questions about monitoring the initiative and/or ice-breaking can be added]

ASSESSMENT OF SELF-EFFICACY IN STEM

- **What did you think at the beginning of the activity while the tutor/monitor was presenting you the activity? Was it appealing? Why?**

[Question aimed at assessing participants' Level of Motivation, Outcome expectancies]

- **At the beginning, did you personally feel that you were able to do the proposed activity? Why?**

[Question aimed at assessing participants' retrospective initial self-efficacy beliefs at an individual level]



- **At the beginning, did you personally feel that you were able to do the proposed activity as a family group with your kids? Why?**

[Question aimed at assessing participants' retrospective initial self-efficacy beliefs at a collective level]

- **Are you satisfied with what you have done both at personal level and at family level? Why?**

[Question aimed at assessing participants' self-satisfaction, how they value their achievements]

- **Do you feel you have been able to do this STEAM activity successfully? And as a family group?**

[Question aimed at assessing participants' retrospective self-efficacy beliefs]

- **What do you think has helped you to feel successful at the activity? (at a personal level and at family level)**

[Question aimed at identifying which elements have helped participants to feel capable of doing STEM]

- **Has your level of confidence in STEM changed from before? What has made it change?**

[Question aimed at identifying which elements have helped teens to feel capable of doing STEM]

- **How confident are you that you will be successful doing STEM activities in the future? Why?**

[Question aimed at assessing teens' prospective self-efficacy beliefs]

- **What would you say to other parents who do not feel capable of doing these type of activities?**

[Question aimed at identifying which elements have helped teens to feel capable of doing STEM]

DIARY MODEL FOR PARTICIPANT PARENTS OF STEAM ACTIVITIES

INSTRUCTIONS

Diaries are aimed at providing a more information about participants' self-efficacy in STEAM over an activity. Though as they are more open, they should be used with a small sample compared to the sample of the questionnaires. However, as diaries are more demanding when it comes to analyse participants' answers, they do not include other elements such as awareness or interest in STEAM or roles of STEAM in society as questionnaires do.

In this toolkit, we propose three possible diary models addressed to 10-14-year-old-kids, parents and teacher/tutors/volunteers/experts. Diaries should be periodically written over the course of an event in order to identify possible variations of participants' beliefs regarding self-efficacy.

DIARY MODEL FOR PARTICIPANT PARENTS

- **Name initials/Nickname**
- **Age/Date of birth:**
- **Date:**
- **Explain what you have done today in the space below**



- Explain how you felt **before** doing the activity, for example:
 - How the volunteer/educator made you feel when he/she was explaining the activity,
 - If you felt you were capable of doing it (both at personal level and with your kids, as a group family)
 - Your willingness to do the proposed activity
 - Your feelings related with topic being proposed

- Explain how you felt **during** the activity: did you had doubts? Did you feel capable of doing the activity alone? Did you feel capable of being successful as a family group? How did your kids make you feel?



[Empty grey box for recording difficulties]

- Record the **difficulties** you had during the activity

[Empty grey box for recording difficulties]

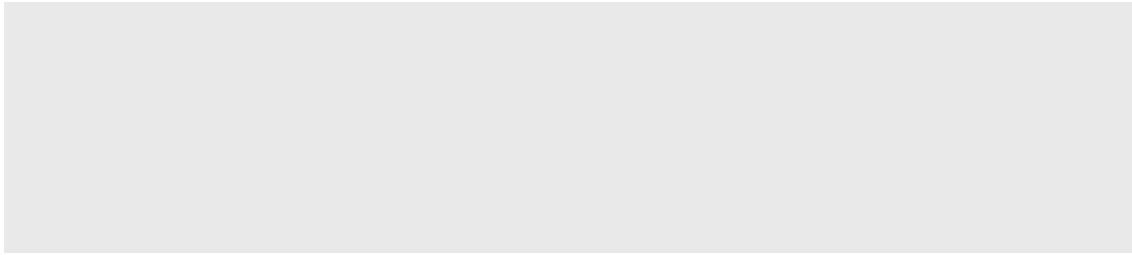
- Record your **best achievements** during the activity **individually and as a family group**

[Empty grey box for recording best achievements]

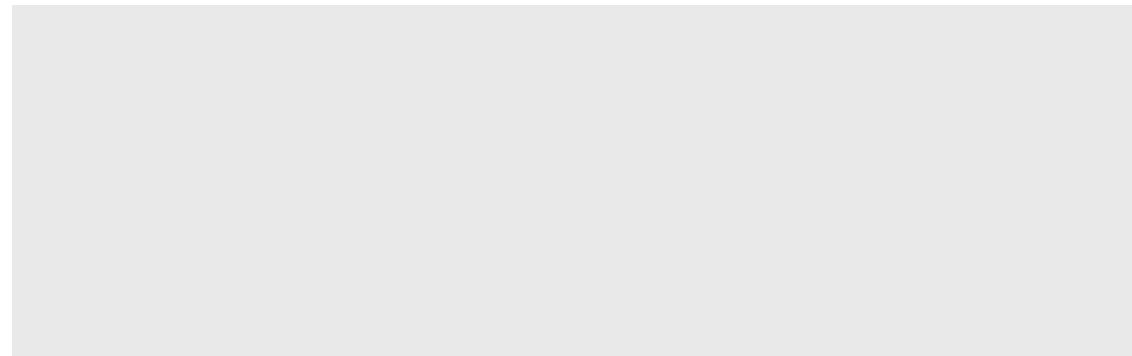
- Explain how you feel **after** the activity: Do you feel capable of doing something similar again with your kids? Would you like to know more about what you have done today? Would you like to know more about STEM?

[Empty grey box for explaining feelings after the activity]





- **After the activity, do you feel more, equal or less capable of doing STEAM activities in family? Explain what did you make change your feelings?**



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