Chapter 9
Short Stories of Educational Choice: In the Words of Science and Technology Students

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Introduction and Aims

How do science and technology[1] students describe their educational choice? In this chapter we look at responses to an open-ended question in the IRIS Questionnaire (IRIS Q) from first-year students in Norway, Denmark and England. Similar analyses of Italian students' responses to the same question are presented in Chap. 18.

Eccles et al.'s expectancy-value model presented in Chap. 2 describes how young people base their educational choice on their expectation of success and the interest and enjoyment, attainment value, utility value and cost they ascribe to various educational options. Chapter 2 further describes late-modern society as a place and time where non-materialistic values are important, where young people feel they can make their own choices, free from traditions, and where self-realisation and identity development are central in young people's lives. In Chap. 3, Holmegaard, Ulriksen and Madsen use a narrative approach to look at how students negotiate their educational choice over time, gradually reworking their narrative of the choice to make it convincing to the people it is shared with and to themselves.

[1] Most chapters in this book concern participation in science, technology, engineering and mathematics (STEM) education. The present chapter presents results from a subsample of STEM and does not include engineering. The term "STEM" is nonetheless used in some instances in the Discussion, assuming that the perspectives discussed will be generally relevant for all STEM disciplines.

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In line with late modern ideals, it is important for the students that the choice is personal and unique, and that it fits with their conception of who they are.

In the Eccles et al. model, interest-enjoyment value, along with three other value categories and expectation of success, directly influence educational choice, whereas these values are in turn related to several psychological and social/cultural variables such as self-concept, affective reactions and memories, cultural *milieu* and socializers' behaviour (Eccles and Wigfield 2002).

Interest has been found in a number of studies to be important in young people's description of their educational choice (Eccles and Wigfield 2002; Hazari et al. 2010; Maltese and Tai 2009). In particular, choices of physics seem to be largely interest-motivated (Reid and Skryabina 2002; Rødseth and Bungum 2010; Bøe and Henriksen 2013). According to Hazari et al. (2010, p. 2), "when studying students' choice of field, the development of their interests is of critical relevance. It is likely that the link between the development of interest and career choice is mediated by changes in self-perceptions (and identity)".

Krapp and Prenzel (2011), who have reviewed research and theoretical models concerning interest in science, described interest as "a phenomenon that emerges from an individual's interaction with his or her environment" (ibid., p. 31) and emphasised its dependence on cognitive as well as emotional aspects. Several chapters in this volume, and also previous research (Sjaastad 2011; Bøe and Henriksen 2013) indicate that interest in science and mathematics is related to significant persons and to engagement in out-of-school activities such as popular science, science centres or science camps.

In this chapter, we present an analysis of students' brief accounts of their educational choice, focusing on the values and expectations which emerge as important factors. In particular, we will look at respondents' expressions of subject interest and at clues concerning how this interest has arisen and developed through school and family experiences, leisure activities, science outreach and exposure to popular culture. We aim to identify the discourses that young people draw upon when they describe their choices and to relate these to expectancy-value theory as well as choice narratives and late modern ideals. Silverman (2006) describes how research can identify the broad discourses which people use to define their identities. For instance, what vocabularies and arguments do individuals use in different contexts, and how do these repertoires get invoked?

Methods

The open-ended request in the IRIS questionnaire (Appendix), "Please describe how you came to choose this course", prompts responses concerning all sorts of influences, priorities and prospects in the decision-making process. Written responses from Norwegian, Danish and English students from five disciplines – biology, physics, chemistry, mathematics, and computer science – have been included in this analysis. In total, the data set comprises 2,146 responses.

Table 9.1 Number of respondents in the data material analysed here, by nationality and discipline, and total number of IRIS Q respondents in the same categories (in *parentheses*)

	Norway	Denmark	UK
Biology	57 (234)	47 (260)	46 (300)
Physics	48 (137)	45 (95)	69 (69)
Chemistry	35 (35)	31 (31)	72 (72)
Mathematics	37 (37)	66 (103)	50 (135)
Computer science	53 (326)	57 (241)	71 (71)
Total	230 (769)	246 (730)	308 (647)
Total (all countries)	**784 (2,146)**		

Using the random number function in Excel, we reduced the amount of data, closing in on around 50 responses for each of the five disciplines for each country. This procedure was carried out partly in order to make the analysis manageable and partly because theoretical saturation was expected to be reached with a far smaller material than the full data set. In total we used 784 responses (Table 9.1).

Responses were analysed qualitatively using the NVivo 9 software to code and retrieve quotations. A thematic analysis was performed, following the recommended approach of Braun and Clarke (2006), with the aim of finding repeated patterns of meaning. An open coding process was adopted (Strauss and Corbin 1990) where codes were mainly created inductively, based on the respondents' actual expressions. However, the coding process was guided by the theoretical frameworks outlined above, notably Eccles et al's expectancy-value model, narrative psychology and perspectives on youth in late-modern societies. Several codes were assigned to the same passage where appropriate; for instance, the response "Liked the subjects. Got good results. Good job opportunities" was assigned codes "Interest and enjoyment", "Expectation of success", "Utility value", and "School experiences". Responses were reviewed in several cycles. Coding and interpretation were developed and refined as a result of this process and following discussions with colleagues until we had a coding framework and an account that were judged by the research group to be a valid representation of the students' responses. In the Results section we indicate the frequencies of the different codes assigned, in line with the recommendations of Onwuegbuzie and Daniel (2003); however, frequencies in themselves cannot be interpreted as directly indicative of the relative *importance* of various values or considerations for educational choice. Quotes given in the next sections have been translated into English (where necessary) by the authors.

Students' Interpretation of the Open-Ended Question

To help us interpret the written responses given to the open question, short, individual interviews were performed with six first-year physics students at the University of Oslo during spring 2012 (Pettersen 2012). The interviews were conducted immediately after the students had completed the questionnaire.

Such interviews can give more detailed information about how respondents interpret and respond to the question they are asked, and thus provide evidence to help establish the validity of the study (Wilson 2005). Audio-recordings from the interviews were transcribed and analysed using a similar approach as for the open-ended question. These interviews, and the results reported in the two next paragraphs, are described in more detail by Pettersen (2012).

Since the open-ended question was part of the longer IRIS questionnaire, most answers given to this question were likely to be short and influenced by the contexts and associations evoked by the previous (closed) questions. Concerning respondents' interpretation of the question, the six students who were interviewed indeed interpreted the question as intended by the researchers; for instance, as one respondent put it, "[The question concerns] what made you choose the [educational] strand that you chose (. . .) were there any particular driving forces in or around you that led to the choice".

In the interviews several students expressed that when responding to the open-ended question, they gave the first answer that came to their mind. Some said that they gave an answer resembling responses they had given to similar questions on previous occasions, when asked by friends, family, or others – they had a ready-made educational choice narrative that was recalled when prompted by the IRIS Q open question.

There are good reasons to believe that the amount of thought and reflection that was put into the answers varied a lot. In one of the interviews, the student insisted that his subject interest, and nothing else, explained his choice. However, later in the interview, he said that he enjoyed watching science television shows when he was young, ". . . but I have not really given that much thought before now". During the interview he recalled experiences that could have contributed to his present science interest. Several of the students expressed that their response to the open-ended question reflected the experiences or priorities they considered *most important* for their choice. To what extent the factors which students rate as most important, are actually the ones that best explain their choice will be discussed in the last part of the chapter.

Descriptions Related to Expectancies and Values

In the following, we present results from the thematic analysis of the 784 written responses to the open-ended question about the educational choice process. In the present section, results related to expectancies and values as described in the Eccles et al. model are presented, whereas the next section describes findings related to influence factors that shape expectancies and values. For each quote given, the nationality, gender and chosen discipline of the respondent is indicated in parentheses.

Interest and Enjoyment

On the open-ended question "Please describe how you came to choose this course", interest and enjoyment was the most frequent response given. In total, 533 of the 784 answers referred to this factor. Many responses were short, just stating that the choice was guided by interest:

> The interest for biology and chemistry (Norway, Female, Biology)
>
> Chose biology because of interests in animals and nature (Norway, Male, Biology)
>
> Chose out of interest (Denmark, Female, Mathematics)

A large proportion of the students wrote that they made their choice based on a long-lasting interest for the subject, often with roots in early adolescence. Several mentioned popular science and leisure activities in childhood as starting points for their interest in science and mathematics.

> Used to read up on astronomy (just stars and planets mainly) when I was younger. This eventually developed into a love of science particularly physics. (England, Male, Physics)
>
> ... I have always since I was young had an interest for chemistry, and have among other things in my childhood years experimented with chemistry, including fireworks, etc. that have enhanced my interest for the subject. (Norway, Male, Chemistry)

Some of the students wrote that their own interest or enjoyment of the subject (and nothing else) determined their decision.

> My own interests (Norway, Male, Chemistry)
>
> Only my own well-being. Have already been through a hard education, now I want to do something I LIKE doing (Norway, Female, Mathematics)

These quotes might indicate that these students rate interest as the most important factor in the choice process, more important than for instance job safety, income or opportunities to work or study abroad. It might also be a way to express that it is important that they made their own choice, free from other people's opinions or expectations.

Utility Value

Of the 784 responses, 135 were coded with utility value, indicating that the expected extrinsic outcomes of the choice were important for many. In general, three types of utility value were identified: high income, safe job, and (a wide variety of) study or job opportunities.

> (...) much because of the good wages, and that one is «guaranteed» a job. (Norway, Male, Biology)
>
> I chose maths as it has applications in nearly everything and would give me a wide range of career paths upon leaving university. (England, Male, Mathematics)

Expectation of Success and Cost

As many as 124 responses were coded with 'expectation of success'. Here, many students stated that they chose a course that they expected they would master, often based on previous successes in the subject, as we shall see in the next section.

> I have always been good at physics and enjoyed it, I didn't want to do anything else. (England, Female, Physics)
>
> Maths is my best subject, which I find interesting (England, Male, Mathematics)

Cost, as defined in the Eccles et al. model, concerns the potentially negative aspects of the choice, for instance what leisure activities must be limited in order to follow a specific course. This category was not identified in any of the responses to the open-ended question, which was to be expected since the open-ended question asked for what made respondents choose their course, and not for the arguments against the choice.

Attainment Value

Attainment value in the Eccles et al. model is closely related to identity and to the prospect of attaining the goals (in this case a STEM education) one has set for oneself. Attainment value is not as readily identifiable in students' answers as are, for example, interest-enjoyment or utility value; it is often expressed more indirectly, but may be identified in several of the responses analysed here. Altogether, 70 responses received codes related to attainment value. For instance, some students wrote that their choice fitted well with how they perceived themselves.

> (. . .) at the 'open house' at [Copenhagen University], I thought chemistry sounded exciting and like something I could see myself studying (Denmark, Female, Chemistry)
>
> Because I was the nerd of the family (Denmark, Female, Computer science)

Responses expressing values such as idealism, prestige, and self-development have also been interpreted as expressions of attainment value in our analysis.

> Wish to contribute to more equitable distribution between rich and poor, and/or work with climate issues. (Norway, Female, Biology)
>
> I wanted to study something that I am personally interested in and that would impress people, and just generally sound good on a CV (England, Male, Physics)
>
> I felt that by choosing this course I would face increasing challenges and improve myself as a person. (England, Male, Physics)

The last quote is an example of students describing their chosen subject as offering positive opportunities for self-development through challenges, and illustrates the close connection between attainment value, interest-enjoyment value and expectation of success.

Influence Factors Shaping Expectancies and Values

In the Eccles et al. model, interest/enjoyment, attainment value, utility value and expectation of success are considered to directly influence educational choice, whereas a range of personal and cultural influence factors in turn shape expectations and values. Do IRIS respondents' brief accounts of their educational choice tell us something about these influence factors that lie behind expectations and values; notably, do they tell us what brought about and supported the strong interest that many respondents cite as the primary driving force behind their choice? In this section we present findings related to influence factors that shape expectancies and values.

School Experiences and Teachers

School experience was the source of influence most widely referred to. In total, 120 responses described school science and mathematics as an important influence and 99 of these responses were also coded *interest and enjoyment*, indicating that many relate their subject interest to experiences from school.

> This was what I found most interesting in upper secondary school, and what sounded most exciting to work with in the future. Biotechnology is the new oil! (Norway, Female, Biology)
>
> I liked the subject in school, and thought the programme appeared good at the [university]. (Norway, Female, Mathematics)

School experiences were related to expectation of success by some students. Thirty-five responses were coded into both the 'school experience' and the 'expectation of success' category. The students typically wrote that they chose a study programme containing subjects they previously had success in and thus expected to master in higher education.

> It was my favourite subject at high school and college, and the area where I did the best. (England, Male, Chemistry)

Perhaps unsurprisingly, many of the students who described school experiences as important also mentioned good teachers. Teachers are mentioned in 56 of the 784 responses analysed, which makes them the most frequently mentioned group of persons. They are described as skilled in the subject matter, good at teaching, they engage in discussions with the students, praise students' efforts, and provide advice about educational choice. Most frequently, teachers are related to subject interest and enjoyment (41 responses), and expectation of success (15 responses).

> Was fascinated with the concepts at A-Level, and had very good teachers who loved their subject. (England, Female, Chemistry)
>
> (...) was praised by my teachers a lot so gave me the courage and motivation to continue with it. (England, Female, Biology)

> I was much in doubt about whether I should start this year at all, and whether [it should be] mathematics. Upon leaving upper secondary, I talked to my mathematics teacher about it, and the next morning I woke up and knew that this was my calling. (Denmark, Female, Mathematics)

People's Influence on Interest and Enjoyment

Family was mentioned in 27 of the open responses, and 20 of these also received the *interest and enjoyment* code. Family members were said to have influenced respondents in three slightly overlapping ways: through having a STEM degree or working in the field; by giving recommendations, encouraging or discussing the choice with the respondent; or by having done (or encouraged) science and mathematics activities with the respondent.

> Had a long running interest in the natural world since I was young, maybe influenced by my mum who has a biology degree and taught biology for a while. (England, Female, Biology)
>
> (. . .) discussed it with parents and teachers and decided to go for it. (England, Male, Chemistry)
>
> (. . .) not to mention that I've always been encouraged at home and school to attempt to solve problems. (England, Male, Physics)

Like family members, *friends* were also described as having given recommendations, discussed the choice, and engaged in science or technology activities. Also, some respondents wrote that they chose where to study based on where their boy/girl-friend or friends studied, in some cases in order to study at a place where they already had friends, but also based on the information that the peers provided. Compared to parents, friends might be in a better position to provide up-to-date reports and information about the educational institutions and student life.

> I have a friend who has studied in this programme before, and therefore knew how it was built up. (Norway, Female, Biology)
>
> (. . .) boyfriend who was going to study in the same city (Norway, Female, Physics)

One student was captivated by her boyfriend's mathematics exercises in upper secondary school. Originally, language was her chosen subject of specialization; however, pondering on these exercises resulted in her rating mathematics as more fun than language. Another student wrote that many social and fun group discussions when doing chemistry homework developed into an interest for the subject.

A few students wrote that they had received information and recommendations from STEM students or researchers.

> Talked to a Master student from the [university] who presented what she was doing in a very interesting way. Found out that this must be something for me, since I have always liked biology. . . (Norway, Female, Biology)

Only three students wrote that they had received guidance from career advisors. In all three responses it was visible that the students had made their own assessment

of how well the option fitted with their own values and priorities, after having received information and suggestions from the career advisor.

> I was made aware of it by a career advisor. I had never heard of it before, but all this about being creative and working in groups sounded quite exciting, so therefore I applied. (Denmark, Male, Computer science)

Popular Science and Leisure Activities Influencing Interest and Enjoyment

Articles, books, TV programmes, magazines, films and documentaries were all mentioned as sources of inspiration by IRIS respondents. Popular science was usually related to subject interest, and was often referred to as a trigger of interest. For many, popular science books or TV programmes (including fiction with science and/or technology content) functioned as a starting point for their interest in the subject. In several cases popular science was mentioned alongside having a long-lasting interest for the subject, often from an early age.

> I am a die-hard Star Wars-fan and have seen all 210 episodes of the 10 year long Stargate SG1 series . . . To say that this has determined my choice would be to exaggerate – but it has kindled dreams. (Denmark, Female, Physics)
>
> Ever since I was very small I've been in love with astronomy. I first started reading simple astronomy textbooks at age 8. By the time I finished school I had three different telescopes, had read hundreds of books on the subject and had even gotten excellent grades in 2 astronomy classes at a local community college . . . Last summer I found myself in the position to start at [University] and took it. (England, Female, Physics)

One student expressed that an experience with a particularly difficult popular science text propelled his wish to understand the subject:

> I started reading about physics, first popular science literature and then more advanced material. Unavoidably, I came across topics that I had no preparation to understand, and it was the desire to understand that made me choose this study (Norway, Male, Physics)

For some, popular science provided motivation for understanding how nature works:

> When I was around 15, I got the idea (from a colourful Hawking book) to become an astrophysicist. It stuck through upper secondary school, and I think I reached a point where I could not live without getting the answers to how the world had come to look like it does = how things work, which forces have created our universe – and not the least, how can we use it? That is why I chose physics, even if I think it surprised many. (Denmark, Female, Physics)

Popular science books, magazines and TV programmes were broadly represented, particularly in the quotes from physics students. On the other hand, computer science students in particular referred to leisure activities. These students referred to programming and other computer usage as a hobby that contributed to their interest for computer science.

> Spend my leisure time on computers and that has created an interest for it (Denmark, Male, Computer science)

A few of the chemistry students referred to experiments they had performed at home with friends or family as adolescents. A handful of the biology students also referred to leisure activities, particularly outdoor activities, as important for boosting their interest in biology.

> An interest from when I was a child. All sailing trips and hiking trips that were filled with experiences of animals and nature, that I was very curious about. The fish books on the shelf. The birds on the window sill. Nature in general. (Norway, Female, Biology)

Outreach Activities Related to Interest and Enjoyment

Popular science was mentioned by respondents as stimulating interest across all age periods. In upper secondary school it was also described as contributing to the decision of what to study by confirming that the education would be interesting.

> Of the A-levels I did the physics lessons were the most inspiring, thought provoking and ultimately the most enjoyable. I was also fascinated by developments within physics that I read about in New Scientist. So I choose the course because it was the area of my lessons and additional reading I found most interesting and enjoyable. (England, Female, Physics).

The outreach activities mentioned in response to the open question – competitions, educational fairs, open day events, information brochures, etc. – were mostly mentioned as important in the year or so before applying for tertiary education. Although some students reported that outreach activities had stimulated their interests, they were most often referred to as helpful in making sure that the respondent was making the right educational decision.

> Interest from an early age, Kennedy Space Centre in Florida and other Science museums e.g. Air & Space Museum in Washington. Good teachers in High School and College kept me interested and open days at Universities cemented my choice and moved me away from Forensic Science. Also the promise of the skills being transferable to the workplace was very important. (England, Male, Physics)

Six students wrote that they gained inspiration from science and mathematics competitions. One participated in a Danish mathematics competition, five participated in the physics or chemistry Olympiads.

> I master chemistry quite well and have found out that (ha-ha) the chemistry is right. Since the start of secondary school I have known that it should be a STEM subject, much thanks to a very skilled teacher. During my participation in the chemistry Olympiads I decided to study chemistry. (Norway, Male, Chemistry)

Guttersrud and Angell (2002) investigated the career paths of Norwegian students who had participated in the physics, chemistry or mathematics Olympiads finals. They found that the majority later chose tertiary STEM education at universities and university colleges, and approximately 60 % of the participants answered that the Olympiads had (some) influence on their choice of education.

Open day events at universities were mentioned by some students. These events give useful information, making it easier to narrow down and settle on a decision.

In particular, a Danish initiative called "Student for a day" was mentioned in a handful of responses. As the title suggests, secondary students can follow a tertiary STEM student for a day, attending lectures, labs, etc. Some students referred to lectures they had attended in open days and similar events. Typically, these students wrote that these lectures confirmed their interest for the subject. Two such outreach events, CERN master class and "The girls' day" at a technological university, are described in some detail in Chap. 12 in the present volume.

> My Love and interest in Mathematics was confirmed after a mathematics lecture and my ability to analyse and solve any mathematical problem easily during my A levels. (England, Male, Mathematics)

Expositions, fairs, brochures and web pages provide information about education and career opportunities. Five students mentioned expositions. Here, they found information that guided them to courses resonating with their wishes, such as interest and enjoyment, an appealing student life or guaranteed employability.

> I went to a fair and had explained to me which educations suited my interests. And then I chose this one. (Denmark, Male, Computer science)

The Internet in general, and in particular websites provided by educational institutions as well as a few specific pages provided by ministries of education, were the most frequently mentioned sources of information.

> I was certain that I wanted to study something to do with science, but was very uncertain about what and where. Spent much time on the Internet, and I would say that I made my final decision based on what I read on the Net. (Norway, Female, Biology)

In the Norwegian *Lily* study, Schreiner et al. (2010) found that first year tertiary students primarily had visited the higher education institutions' own web pages, whereas a range of campaign websites (provided by industry and other stakeholder organisations) were far less visited.

Discussion

In the descriptions of educational choice analysed in this chapter, expressions of interest and intrinsic motivation dominated the responses, but utility value, expectation of success and attainment value were also among the motivations described. Concerning the sources of influence on the choice, respondents referred to school experiences, family and friend influence, popular science and outreach. These sources of inspiration were more often linked to subject interest and enjoyment than to utility value or expectation of success. The Eccles et al. model of educational choice (Chap. 2) emphasises the mutual interaction between interest and enjoyment value, expectation of success, and a range of factors such as cultural setting, childhood experiences, socialisers such as parents and teachers, and so on, in line with what we have seen in the present chapter.

The strong predominance of references to personal interest in responses to the IRIS Q open-ended question was also found for Australian IRIS Q respondents (Lyons et al. 2012), and is also in line with a number of previous studies (Osborne and Collins 2001; Bøe and Henriksen 2013; Maltese and Tai 2009). The analysis of Italian IRIS Q results presented in Chap. 18 has many similarities with the frameworks and results presented here: Also for the Italian data set it was found that intrinsic value (interest and enjoyment) dominated the responses. Chapter 18's category "cultural features" largely covers the findings presented here under the heading "Influence factors shaping expectancies and values" (influence from school, family members, popular science and outreach, etc.). An interesting difference is the category "Innate (natural) features" in the analysis of the Italian data. This category expresses students' belief that a predisposition or innate aptitude is necessary to study STEM. This perception may be related to the idea discussed in Chap. 6 and elsewhere in this volume that only the most dedicated (the brightest and most interested) can study STEM.

Interest, Enjoyment, Identity and Late Modern Ideals

An aim of the present chapter was to identify the discourses – the shared repertoire of common arguments and vocabularies – which students draw on when describing their educational choice.

The students' accounts indicate that there is not a single story about STEM choice; a broad range of direct and indirect influences on the decision are described. However, interest and enjoyment is undoubtedly the single most referred to priority. In the late-modern youth culture of which IRIS Q respondents are arguably a part, the ideal is to choose an education that is rewarding and fulfilling. Students expect to be passionate about their chosen education; tediousness is perceived as betraying their identity (Illeris et al. 2002; Ulriksen 2003). Many respondents wrote that they chose their course according to a subject interest they have had for a long time, often from early adolescence, and thus as something that is part of who they are. As described in Chap. 3 in this volume, each individual student has to find the criteria for what is a right educational choice within themselves, and the choice needs to appear as "true" to their identity. Many of the respondents in the study by Holmegaard et al. (2012) held the idea that there is a "right choice", and that their choice of education should therefore be *authentic* in the sense that it should correspond with who they really are. The choice should be individual, personal and special. In line with these perspectives, it makes sense to choose a subject based on a long-lived and well matured interest. In the present chapter, we have seen that in students' accounts of their choice, interest is linked to external influences on the choice – school experiences, leisure activities, etc. – in such a way that these influences contribute to a coherent, authentic and convincing choice description that fits with the student's identity.

The findings in this chapter indicate that choosing something that one is interested in and expects to enjoy is perceived by many to be "the right answer" to the question of which education to choose, and is thus central in young people's discourses about educational choice. It is important to bear in mind that the findings reported here emerge from students' self-reports and that these short narratives are constructed retrospectively by the students in a process of constructing a coherent choice-narrative (see Chap. 3). In order to understand the mechanisms underlying educational choices, there may be other factors that are less visible in students' accounts, but that are nonetheless powerful explanatory factors (for instance influence from parents; see below). However, the present study shows that such impact of parental background is only to a limited extent visible in students' own account of their educational choice. The students themselves are likely to report that they made their own decision, free from the expectations and opinions of others.

Sources of Inspiration for Educational Choice

Family members (notably parents) were described by some IRIS Q respondents as having influenced choice of a science or technology education either directly (through discussing the choice) or indirectly (for instance through having engaged in science-related activities). Family influence on educational choice has been thoroughly documented. For example, several studies suggest that the family's socio-economic background is, to some extent, reproduced by their children and thus predicts educational attainment and choices (e.g. Dustmann 2004; Schnabel et al. 2002; Werfhorst et al. 2003). Based on data from the first 7 years of the British Household Panel Study, Ermisch and Francesconi (2001) wrote that "Parents' educational attainments are found to be very strongly associated with their children's educational attainments" (p. 137). The impact of parent educational level on students' risk of leaving STEM education without graduating is described in Chap. 14.

Teachers were mentioned more frequently than family members in the responses analysed here, in line with a large body of literature describing teachers' role in forming attitudes to science and contributing to educational choice (Cerinsek et al. 2012; Bøe et al. 2011; Hazari et al. 2010). Drawing upon questionnaire responses from 5,007 Norwegian science, technology, engineering and mathematics (STEM) students in their first year of higher education, Sjaastad (2011) investigated significant persons' influence on educational choices. He suggested that teachers are key factors in inspiring and motivating STEM choices. In his study, teachers were most frequently mentioned by girls, and he suggested that this may be because girls, more than boys, depend on other people to build self-efficacy (Zeldin et al. 2008; Zeldin and Pajares 2000). Furthermore, teachers were more frequently mentioned by students in theoretical STEM disciplines such as mathematics or physics than by students in more applied disciplines such as engineering. This may indicate that teachers are best at inspiring choices of higher education in

the subject they teach, and not as good at showing how a mathematics or science interest may be pursued in more practice-oriented educations and professions.

Sjaastad (2011) suggested that persons who have a personal relationship to young people (notably teachers and parents) are in a particular position to support young people in choosing a STEM education through displaying and defining the subjects and their applications, through modelling a STEM identity, and through helping young people in their identity work and with identifying their own interests and abilities. Interventions aimed at helping parents and teachers support young people's educational choice process thus appears as a promising way of improving[2] STEM participation.

Popular science was mentioned in the responses analysed here as stimulating interest across all age periods. In upper secondary school it was also described as contributing to the decision of what to study by confirming that the education will be interesting. Based on their descriptions, it seems that students relate differently to popular science and outreach activities during different age periods. Maltese and Tai (2009) found that the majority of their sample of chemistry and physics graduate students and scientists reported that their interest in science began before middle school. Moreover, 45 % reported that 'intrinsic self-interest' was the source of their interest, whereas an additional 40 % related their interest to a school or education-based experience such as a science competition or science camp. The remaining 15 % referred to a family member as having initiated their interest. In early adolescence, most people are open-minded and show interest in a wide variety of subjects (Krapp and Prenzel 2011), while in the last part of upper secondary school, many make educational choices based on interests that are narrowed down and well matured. In this period of time, they are perhaps more receptive to information or input that can support or help them make their decision (school visits, educational fairs, universities' websites etc.).

Concerning the impact of popular science on interest development and educational choice, Jidesjö (2012) pointed to media's influence on youth's identity project and documented similarities between young people's interest in science (as expressed through the ROSE questionnaire study) and the programmes broadcast on an international popularising TV channel. Astronomy has been found to be high on young people's list of science-related interests (Angell et al. 2004; Osborne and Collins 2001; Schreiner and Sjøberg 2007), and this is visible also in the stories about popular science inspiration in the present chapter. The influence of television programmes on young people's image of science and scientists has also been discussed by Dhingra (2003) who wrote that "Particularly for students who do not have personal knowledge about science through family members or friends, such television role models may be especially significant."

[2] For a definition of what we mean by "improved participation", please refer to Chap. 1, Introduction.

Conclusion

Interest and enjoyment dominates as an explanation for educational choice in students' own accounts. This may be interpreted as an expression of the late-modern ideal of making an authentic educational choice, true to one's identity. Inspiration and influence from school, family influence, popular science and outreach was also described by respondents, mainly in terms of having created interest. In order to improve participation in STEM tertiary education, it is important to kindle and maintain interest and create opportunities for students to develop "STEM identities" through school as well as out-of-school settings. This is in line with Osborne et al.'s (2003) emphasis on providing positive STEM experiences from an early age, for instance through popular science and outreach activities. In later school years, it becomes important to maintain students' interests by providing contents and contexts that are perceived as interesting and relevant. In late adolescence, popular science and, in particular, outreach activities and recruitment efforts may work as important influences in connection with educational decision points. It might be worth encouraging cooperation between STEM participation stakeholders and popular media in order to strengthen the public image of STEM and its practitioners. Parents and teachers might be included in the target groups for efforts to improve STEM participation because of their opportunity to support young people in their educational decision-making process.

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