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ROSES Handbook

Introduction, guidelines and underlying ideas

Anders Jidesjö, Magnus Oskarsson & Anna-Karin Westman

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Redaktionens förord

See next page for an English version.

Tidskriften *Utbildningsvetenskapliga studier* har som syfte att erbjuda skribenter möjligheter att publicera vetenskapliga texter inom forskningsfälten utbildningsvetenskap, pedagogik och didaktik. Ambitionen med tidskriften är att texterna ska komma till användning för en bred läsekrets med intresse för de frågor och områden som tas upp i respektive text eller temanummer. Samtliga bidrag som publiceras har behandlats i seminarieform och granskats av en eller flera forskare, samt redaktionsrådet.

Syftet med att publicera den här texten i *Utbildningsvetenskapliga studier* är att göra det möjligt för intresserade att ta del av grunderna för projektet *Relevance Of Science Education – Second (ROSES)*. I projektet undersöks 15-åriga elevers erfarenheter och attityder till naturvetenskap och teknik i och utanför skolan. Data insamlas genom en enkät där ett urval av elever dels får ta ställning till ett stort antal påståenden och dels besvara en del öppna frågor. Handboken beskriver bakgrunden till projektet, hur genomförandet går till, och hur samarbetet mellan forskare i olika länder organiseras. Forskare från över 50 länder har anmält intresse att delta i projektet (september 2020).

Texten i föreliggande nummer bygger på en *Handbook* som gjordes av Svein Sjøberg och Camilla Schreiner vid Oslo Universitet till ROSE-projektet år 2003. Inför publiceringen har denna handbok reviderats av Anna-Karin Westman, Magnus Oskarsson från Mittuniversitetet och Anders Jidesjö från Linköpings universitet.

Målgruppen är dels forskare i andra länder som planerar delta i ROSES-projektet, dels andra intresserade av forskningsmetodik med utgångspunkt i hur data i ROSES-projektet samlats in och analyserats. Rapporten skulle kunna användas i sammanhang där forskningsmetodik behandlas.

Redaktionen

Editorial preface

Educational Science Studies aim to offer writers opportunities to publish scientific texts in the research fields of educational science, pedagogy, and didactics. The ambition of the journal is that the articles will be useful for a broad readership with interest in the topics and areas addressed in each issue. All contributions that are published have been discussed in seminar form and reviewed by one or more researchers and the editorial board.

The purpose of publishing the following text in *Educational Science Studies* is to enable those interested to partake in the fundamentals of the project *Relevance Of Science Education - Second* (ROSES). This project examines 15-year-old students' experiences and attitudes toward science and technology in and outside school. Data are collected through a survey in which a sample of students work through both a large number of closed-ended statements and a small number of open-ended questions. This handbook describes the background of the project, how the implementation takes place, and how the collaboration between researchers in different countries is organized. Researchers from more than 50 countries have expressed interest in participating in the project (September 2020).

The text in this issue builds upon a Handbook written by Svein Sjøberg and Camilla Schreiner at the University of Oslo for the ROSE project in 2003. Prior to publication, this handbook has been revised by Anna-Karin Westman and Magnus Oskarsson from Mid Sweden University, and Anders Jidesjö from Linköping University.

The target audience of this Handbook is both researchers in other countries who plan to participate in the ROSES project, and others interested in research methodology based on how data in the ROSES project were collected and analyzed. The report could be used in contexts where research methodology is discussed.

Editorial board

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ROSES Handbook

Introduction, guidelines and underlying ideas

ANDERS JIDESJÖ, MAGNUS OSKARSSON AND ANNA-KARIN WESTMAN

From ROSE to ROSES

The Relevance of Science Education-Second (ROSES) is an international comparative research project intended to shed light on factors of importance to the learning of Science and Technology in school, and outside of school. It is based on the ROSE-project carried out by Svein Sjøberg and Camilla Schreiner at Oslo University, Norway. Due to the interest expressed by many around the world, ROSES is offered as a continuation in order to update the empirical evidence, and to learn more.

This document is a handbook providing participating researchers with a short background framework, and with practical guidelines. It should be used together with the ROSES questionnaire. The handbook also sets out guidelines for collaboration when taking part in the study, the rationale and the underlying ideas. It describes the development of the ROSES instrument as well as the target population, sampling procedures and data collection.

ROSES Research coordinators

Anders Jidesjö

PhD in Science Education

Linköping University

anders.jidesjo@liu.se

Magnus Oskarsson

PhD in Science Education

Mid Sweden University

magnus.oskarsson@miun.se

Anna-Karin Westman

PhD in Science Education

Mid Sweden University

anna-karin.westman@miun.se

Introduction: ROSES in brief

The Relevance of Science Education – Second (ROSES) is an international comparative project intended to shed light on factors of importance in the learning of Science and Technology (S&T). The basis for this work was developed by Svein Sjøberg and Camilla Schreiner at the beginning of the 21st century in the ROSE project. Research groups all over the world, and on every continent, took part in ROSE. It is a project which had a huge impact on both research, policy debates and development work. The empirical evidence has been used in discussions about learning S&T in school and outside it, but also for recruitment to S&T programs.

There is continued interest in the results, and researchers in many countries have expressed a desire to update the evidence to check for changes or new aspects and trends, which is the purpose of ROSES. In 2016 Professor Svein Sjøberg coordinated a Round table discussion at the XVII IOSTE conference (International Organisation for Science and technology Education). Researchers from Norway, Sweden, Malaysia, Estonia, Italy and Brazil participated. The seminar agreed to work for a second collection of ROSE data.

Magnus Oskarsson from Mid Sweden University and Anders Jidesjö at Linköping University in Sweden took responsibility for this work, which is called the ROSES research study.

Just like ROSE, ROSES is an explorative study. The evidence should be interpreted and adapted to cultural considerations and prerequisites. Empirical evidence in ROSES can be used to understand aspects of youth culture, modernity, identity and what it means to learn S&T related issues in different cultures. It is based on the idea of shedding light on the relevance of S&T in different settings, from a student point of view.

In ROSES a wide range of countries from every continent is involved. Research groups in institutions, and individuals, work jointly within the academic context to develop theoretical perspectives, research instruments, data collection and appropriate analyses. The target population is students at the end of their compulsory education. This is because they can look back on their education and reflect on what they have learned of S&T, and how. It is also a time in educational systems where important choices for further studies are made. In many countries this means students in late secondary education (age 15+).

ROSES is low-budget, and less rigorous in its logistics compared with other international studies. Countries will cover their own expenses, but combined efforts to apply for funding both nationally and internationally are made. It is also of great value to engage students in teacher training programs, masters or PhD student work in the project, thereby enabling them to become involved in collaborative research.

Rationale

A broad public understanding of S&T is important for many reasons. Common arguments are democratic and cultural aspects, economic reasons and in everyday life, the independence and autonomy of everyone. The world faces many different challenges.

Scientific and technological literacy has importance for citizenship, and for participation in a world where many challenges are S&T-related. Lack of relevance in the science curriculum and in the experience of S&T are barriers to good learning, as well as to interest in the subject. The ambition of the ROSES project is to provide empirically based insight into factors relating to the relevance of experiencing S&T content, and also into the contexts of S&T curricula. The outcomes of the research are findings framed by theoretical perspectives, that can become part of informed discussions on how to improve learning and curricula, to enhance interest in S&T in a way that:

- Respects cultural diversity and gender equity
- Promotes personal and social relevance
- Empowers people for participation and citizenship

ROSES is not the same as ROSE. There has been a development, but the core values and rationales are the same, as are many items in the master questionnaire. The endorsement document "*From ROSE to ROSES. Endorsement and Conditions for using the ROSE project as basis for ROSES*" is attached to this publication. We encourage everyone to acquaint themselves with the conditions agreed upon (see Appendix A). Five key points in this agreement are:

- The ROSES project has both permission and endorsement from the organiser of ROSE. They may use the ROSE instrument as the basis for its revised instrument. The copyright remains as stated in the

original, with new names added, such as: © Svein Sjøberg <svein.sjoberg@ils.uio.no> modified by Anders Jidesjö <anders.jidesjo@liu.se>, Magnus Oskarsson <magnus.oskarsson@miun.se> and Anna-Karin Westman <anna-karin.westman@miun.se>.

- The ROSES project may also use the modified ROSE logo.
- The ROSES project builds on the original ROSE project, its underlying educational rationale, values and beliefs. These values should be spelt out in some detail whenever ROSES is presented.
- The ROSES organisers will be given full access to use ROSE data files as well as publications from the ROSE study, as well as the graphs and presentations produced by the ROSE organisers. These may be used in presentations and articles, always with correct reference to their origin.
- In articles and publications, the ROSES project should clearly state its legacy from ROSE, also with correct reference(s) to proper article(s) from ROSE.

ROSES Objectives

The main objectives of the ROSES project are:

- To develop theoretical perspectives sensitive to the diversity of backgrounds of students (cultural, social, gender etc.) for initiated discussions related to S&T education.
- To develop the ROSES instrument as a continuation and as a follow up of the ROSE project. The instrument is intended for collection of data on students' (aged 15) experiences, interests, priorities, images and perceptions that are of relevance for their learning of S&T, and their attitudes towards the subjects.
- To collect, analyse, discuss, present and publish results on students' voices in science education, from a wide range of countries and cultural contexts, using the master instrument in ROSES.
- To make comparisons between ROSE and ROSES.

- To contribute empirically based recommendations for the improvement of curricula, textbooks and classroom activities based on findings. To raise critical issues related to the relevance and importance of S&T and S&T education in public debates, as well as in scientific and educational fora.

The ROSES advisory group

An international advisory group has been established. The advisory group has taken an active part in the development, mainly in the revision of the ROSE instrument and the pilot testing of the revised ROSES instrument, but also with contributions and suggestions on critical matters. The group members are:

- Prof. Nélío Bizzo, Brazil, e-mail: bizzo@usp.br
- Dr. Ayelet Baram-Tsabari, Israel, e-mail: ayelet@technion.ac.il
- Dr. Harald Bjar, Norway, e-mail: Harald.Bjar@usn.no
- Dr. Ilona Iłowiecka-Tańska, Poland, e-mail: ilona.tanska@kopernik.org.pl
- Dr. Elin Leirvoll Aschim, Norway, e-mail: elin.aschim@usn.no
- Dr. Giuseppe Pellegrini, Italy, e-mail: pellegrini@observanet.it
- Prof. Svein Sjøberg, Norway, e-mail: svein.sjoberg@ils.uio.no

The ROSES instrument

Early discussions with the advisory group, and with several other colleagues around the world, showed that there was an interest in developing the ROSE questionnaire. Many wanted a shorter questionnaire without loss of validity, and to include new items to capture some of the developments since the early years of 2000. At a meeting in Milan 2017 we agreed to begin this work. Statistical treatment with factor analyses in each category in the old international ROSE data file was carried out. Constructs were identified with items measuring the same latent variable. The number of items in each construct was reduced to four to six items, and about 100 items were cut out. New items concerning climate change, sustainable development, digital and social media together with the experiences of informal science were included. In spring 2019 the new version of the questionnaire was piloted in Sweden, Norway, Italy and Brazil, and the master version was compiled from this pilot.

The questionnaire

The base of the ROSES questionnaire is the previous ROSE questionnaire which is comprehensively described in earlier publications. All comments below refer to the ROSES questionnaire. Although many questions are self-explanatory, some clarifications are made to explain why they are included, and what evidence they can contribute.

Background questions

The first page contains a short introduction as well as a few background questions (sex, age and nationality). These are the only variables that we will use in the international data collection. In addition, national teams can decide to use further specification that they find useful in order to contrast groups they may find interesting (e.g. region, type of school, family education, religion etc.). Some of these background variables are offered as options (see Appendix B)

Educational research shows the importance of ‘out-of-school’ variables such as family, neighbourhood, and the wider community in which the students live. We have received comments regarding our question about whether to include more background variables. Many have suggested that we should include more questions about the social background of the

students. We are hesitant to ask for more personal background than we already do. One reason being that the ROSES study covers such a wide variety of cultures that it may well be impossible to ask certain questions about family background because of the cultural context. It may also cause problems in making meaningful comparisons. However, such background variables may be important in the national analyses in some countries. Each country is free to add more national questions at the end of the questionnaire. You are free to add the necessary supplementary variables to the code book, in order to meet your requirements.

We suggest that no such variables are added unless you actively want to use them in your analyses.

What I want to learn about (A, C and E)

78 items in ROSES (108 in ROSE)

This is a rather lengthy category. Because of the number of items, it is divided into three domains, A, C and E in the questionnaire. Data from this category have been used in many publications, so it could be considered to be a key part of the questionnaire. The idea is to get empirical evidence on the sort of content students are interested in learning about, and to examine variation between groups. Such information can give insight into how science content might be structured to meet the perceived needs or interests of different groups of students. The international setting can help us in the interpretation of evidence. Variation between countries and cultures can sometimes assist us in understanding national situations and settings.

Subject content taught in school is often classified by a traditional set up of scientific concepts from Chemistry, Biology Physics, Geo science and Technology. Such content often shows up in curricula and textbooks and is part of A, C, E categories, together with other content which is not always part of classic S&T education. There are also contextual items such as natural phenomena, spectacular phenomena, frightening examples, human life and the body, technological ideas and inventions, philosophical aspects, science versus non- science or quasi-science, religious and belief-oriented matters, and aesthetic aspects and beauty. Some of these contexts have been inspired by earlier research and have been shown to be important in sociological and psychological theories about identity, youth culture, modernity etc. Some of the items may be controversial and unusual in a S&T

educational context, e.g. items regarding ghosts, horoscopes, mind-reading etc. The inclusion of these items does not mean that we are arguing for these contexts as legitimate parts of a S&T curriculum. They are included in order to explore variety in the students' interests in different contexts.

My future job (B)

23 items in ROSES (26 in ROSE)

This category provides information about students' priorities and their motivations for the future. Data from the items in this section can be analysed and connected with data from other parts of the questionnaire to show interesting correlations. Thoughts about the future can relate to what you want to learn about, ways of approaching environmental challenges, how you experience S&T lessons in school, or how you understand the scientific work.

Some of the items are not directly connected with S&T but are included in order to create the opportunity to analyse variations between students, and countries.

Me and the environmental challenges (D)

13 items in ROSES (18 in ROSE)

This category explores students' views about environmental challenges. The data can be used to analyse whether young people consider these challenges to be serious or not, whether they feel personally involved and to what extent they feel empowered to influence any possible solutions. Many environmental challenges are global in character, but people live in local realities. In an international comparative research study like ROSES, we assume the items in this category will generate data with the capacity to produce differing results which will have relevance for a variety of discussions, such as differences between countries, the role of experts and worries about the future.

Teaching about environmental challenges can be done in many subjects since environmental challenges are contextual in character and have relevance for different subjects in school. Many environmental challenges relate to S&T and for this reason data and results in this category have implications for S&T teaching. There is one specific item about the contribution of S&T.

My science classes (F)

12 items in ROSES (16 in ROSE)

This category provides information about different aspects of students' perceptions of their science classes, how they value science in school, its relation to everyday life, working life, and their perceptions of the need for science education. We know from the literature that aspects such as self-confidence, self-concept, attitudes, interest and motivation are key factors associated with learning, and are therefore interesting perspectives to connect with data in this category. The evidence will make it possible to contribute student data from different countries to such discussions.

The terms 'school science' and 'science at school' refer to science education (biology, physics, chemistry, geology, geophysics, astronomy, etc.). Since countries treat technology differently, there are also items specifically asking students about the technology they get at school. When translating the items, we encourage everyone to consider carefully which terms are most appropriate in their country, and perhaps make some substitutions in the wording about "science" and "technology".

My opinions about science and technology (G)

13 items in ROSES (16 in ROSE)

This category is directed towards different aspects of how the students perceive the role and function of S&T in society. The data can be used to explore students' views on S&T as disciplines, on its relationship with poverty, the environment, climate change and with sustainability. Since ROSE was conducted, we suspect that much has happened in the world that could influence students' attitudes towards S&T. Because of these developments there is also similar data from the adult population in many countries, which creates a basis for interesting comparisons. Probably, data in this category could also be used to create constructs with relations to other data in the questionnaire.

My experiences of social and digital media (H)

16 new items in ROSES

This category asks about the students' use of social and digital media, at home and in school, and how they value the information found there. All these items are new, this development coming about because many collea-

gues pointed out that much has happened in this area, and little is known about the effects on learning S&T. For this reason, the old category H was deleted and replaced with this one. This category is rather differently structured compared with the others, mainly due to the first two questions about time spent on social and digital media in and outside school. Data from these questions can be used as background variables with relation to data found in other parts of the questionnaire. The development of this category took some time, and compromises were needed along the way. Since there are several other investigations in this area, the focus in ROSES is on the relation between social and digital media, and the learning of S&T.

My informal science experiences (I)

14 new items in ROSES

This category consists of items about students' out of school experiences of S&T. From the literature we know that students engage with S&T when visiting museums, science centres, festivals and zoos. This kind of data in ROSES offers the possibility of comparing such experiences with other constructs in the questionnaire, and of learning about differences in students' experiences in various cultures. The items complement the H category, with additional items about science magazines, TV, computer games and the use of resources on the Internet. Some of the items in this new category are similar to items in the old H category in ROSE, which also created possibilities for comparisons and analysis of the importance of experiences for learning S&T, in relation to societal development.

Myself as a scientist (J)

Same as in ROSE

This is an open question, where students are invited to write down their opinions in their own words. The question is divided into two parts. The first aspect asks what they would like to work with, the other asks for the reasons behind their choice. The first part may be analysed in terms of classification in problem areas or subject matter areas (e.g. medicine, space exploration, computer technology etc.). The second part may be analysed in terms of personal motivation and values (e.g. helping others, personal interest or curiosity, seeking money and success etc.). There are several dif-

ferent classification codes and constructs in the literature that can be explored using data from this category.

Differences between girls and boys and in different cultures could be of interest. Clustering students' answers and analysing connections with other parts of the questionnaire is suggested. The explorative research design of ROSES could also inspire a search for new approaches to what aspects might be important for learning S&T.

How many books are there in your home? (K)

Same as in ROSE

This item is used widely as a background question and is considered to approximate social- economic status. Even though reading is done more and more online today, the pilot studies indicated that the number of books remains a valid question. In the questionnaire translation, countries using non-metric measurements may need to convert the term "40 books per meter" to their non-metric equivalents.

What occupation would you like to have in the future? (L)

New open question in ROSES

This is the final question in the questionnaire. Just like "Myself as a scientist" this is an open- ended question divided into two parts, but here the students are asked about what occupation they would like in the future, and why. Results from this question can be treated the same way as the "Myself as a scientist" category. Theoretical perspectives such as identity, youth culture and modernity can be relevant for these data, as are the connections with other parts of the questionnaire.

Considering response categories

Most of the ROSES categories present a set of items. For each item the students are asked to indicate their response by ticking an appropriate box. Likert scales are used with expressed response categories for Disagree-Agree, Not interested – Very interested, Not important – Very important, etc.

A Likert scale with an odd number of response categories can be understood to be offering a neutral middle point, if you do not want to take a stand. To avoid this, four response categories have been used throughout the ROSES questionnaire. We have also omitted a 'Do not know' category.

However, in the introduction it is stated that respondents may refrain from ticking a box if they do not know what to answer.

The method aspect behind this is that it can be convenient for many people not to take a stand, by ticking a neutral middle point or a 'Do not know' category. Consequently, that can generate too many scores for neutral boxes. With the arrangement used in the ROSES questionnaire, in a way, respondents are forced to take a stand which can then be debated. On one hand, people should have the right to remain neutral. However, on the other hand, the neutral middle point often differs markedly from the regression line in correlation analysis, causing complexities in the data analysis.

Likert scales in the ROSES questionnaire have headings only for the outermost categories, while the two in the middle of the scale are untitled. There are reasons for this. Firstly, coming up with good and balanced titles is difficult, and they can be understood differently by respondents. Secondly, the translation into other languages of a few relatively easy words in titles, is made more straightforward. In interviews with respondents, the lack of titles was not pointed out as problematic. Instead, the interviews indicated that respondents understood the space between the outside boxes as a continuous scale, with the untitled boxes dividing the scale into four equal sized intervals.

Considering reliability & validity

The ROSES instrument is designed for exploring variations in students' interest, experience, empowerment, priorities, perceptions, attitudes, etc. However, there is no definition for measuring affective dimensions such as those that exist in science, for measurement of length, weight, etc. In the ROSES instrument there are indirect means, consisting of several items that can be selected to serve as indicators of more complex constructs. Such constructs can be created using statistical data treatment. They can vary between countries and can be interpreted in different ways due to the cultural context.

Regarding validity, there are no constructs given in advance, to test in different countries. ROSES is designed to use an explorative approach, being sensitive to empirical evidence and pointing out cultural diversity. The documentation in the previous ROSE indicates variability in the prerequisites for learning S&T, since educational systems are embedded in

cultural contexts and societal interests. However, there were also similarities between countries, indicating that there are larger cultural contexts crossing national borders, with an impact on the way students answer the questionnaire. Several of these circumstances can be deepened and discussed with new evidence.

With support in empirical results, ROSES aim to contribute to various discussions about learning and teaching S&T in diverse cultures. The research design is chosen to generate hypotheses, to come up with ideas and to test angles of approach with theoretical perspectives, rather than to confirm or reject a hypothesis stated beforehand.

In large international studies, the use of defined constructs is common. They are often measured through many items building up the same underlying idea. When the number of items was reduced to create the new questionnaire, factor analysis was used on the international ROSE data file, revealing several underlying constructs. Some overlapping items measuring the same construct could be cut out without losing validity. We know that the design of the ROSES questionnaire contains constructs. The purpose in the ROSES research design is not to test students against a set of predetermined standards. What is measured in the ROSES questionnaire, the reliability and validity dimensions, should be adapted and discussed from national and cultural aspects.

Negative statements are avoided in the wording of the items. Even for adult respondents it becomes difficult to interpret what it means to disagree with a negative statement. In some countries, for instance in Africa, respondents may get the questionnaire in a language that is not their mother tongue. This is an additional reason for keeping the language simple.

Some items might be perceived as strange or odd for some, but they might be relevant for others. During the development and construction of the questionnaire we have made several compromises to comply with different preferences. Test-theoretical and psychometrical demands have been carefully balanced against practical requirements, based on the nature of the study (exploring, not ranking), the limited material resources and the wide spread of cultures and so on. If we were in any doubt during test development, we have relied more on the face validity as judged by the advisory group of international experts, than on statistical correlation coefficients.

Participation, guidelines and practicalities

This part of the document describes details for participation, with some practical matters as well as rights and duties. When work started on a second ROSE study, information was spread throughout various networks. Out of this a new international network has been created. Participation is founded on research interest from colleagues and groups all over the world. There is no central funding to share. The work is administered and coordinated from Sweden. Researchers in each respective country are responsible for carrying out the studies and for using national data for their research interest. The international network can be used for sharing work, gatherings at conferences, learning from each other, for joint publication, for funding applications, and to learn about the national in an international setting. If national data do not meet the requirements to be part of the international data file, they can still be used in national studies.

Translations of the ROSES questionnaire

The original master version of the ROSES questionnaire is in English. It is provided to participating researchers as formatted rtf-document, word-file in A4 paper size or as a pdf- file. An online master version in English is also available as an example of how to adapt the paper-questionnaire to an online digital version. There is also a Swedish digital version that can be shared.

For data collection, use the questionnaire in the language that is used for instruction. When translation is required, please follow the format given (layout, page breaks etc), and replace the original English text. If you use an online digital version try to follow the structure of the English online master version. The structure should be followed because of method considerations. If the text in your language needs more space than the English original, you may adjust the margins to avoid changes in page breaks.

The font in the questionnaire is Arial, and the boxes for students' responses are also in Arial. If your word processor does not support this font, you may find that the squares are transformed into other symbols. Try to avoid this!

If you need to translate the questionnaire to another language, you can contact the ROSES organisers to avoid duplicate translations in the same language. Please aim at making the meaning in your language identical to that of the English items.

Additional national items

The items in the questionnaire are designed to be used in a large variety of cultures this being a key purpose. Nevertheless, it may be desirable for some nations to include additional national items, or even to add new categories. To keep data collection and coding as simple as possible is important to make sure the international section works well, but this must be balanced against local adaptations.

If you want to add items or even categories, you may do so. To avoid problems of method we strongly recommend that this is done at the end of the questionnaire. This also concerns additional background variables, such as family background, religion, urban vs rural etc.

In the development of the ROSES questionnaire, we have received several suggestions for additional categories and background variables. In the pilot studies some of these did not work well internationally. To address the desires and demands of collaboration, we offer some of these omitted elements to be included as options. They consist of some additional background variables, and a category with items about evolution (see Appendix B). If these are included in the survey, they should be placed at the end of the questionnaire.

Target population(s)

In principle, the ROSES target population is pupils at the end of compulsory level of education. In many countries this implies the cohort of all 15-year-old pupils in the nation or more precisely, the grade level that most 15-year old students are likely to be part of. The point being that pupils ending their compulsory education can look back at the S&T they had in school and reflect about what they learned.

The vast variation of countries and cultures has implications for the definition of the target population. Some countries are more homogeneous and 'mono-cultural'. Here it makes sense to talk about national averages. Other participating countries have large variations due to geography, population size, differences in culture or ethnicity, level of education, level of economic development etc. In such cases it may not make sense to calculate national averages. In such countries, the target population could be defined as a more homogeneous subgroup, for instance a 'state', an administrative area or another clearly identifiable unit.

Consequently, in such countries it may also be preferable to define more than one target population, or to define identifiable strata in the national population.

Furthermore, the researcher's economic and human resources differ between participating countries. Based on local national circumstances, an accessible target population that is smaller than the whole national pupil cohort may be defined, for example as a cultural or geographically defined group as indicated above.

Whatever choice is made, care should be taken to be explicit in the definition of the target population. This is important in order to avoid confusion, or unwarranted conclusions. If there are uncertainties about how to define a target population, please discuss this with the organisers.

Sampling

The sample should be drawn to represent the target population as defined above. The sampling unit is likely to be at school level, not individual. This implies that whole classes are expected to take part in the study. However, using classes does reduce the variability and the 'effective sample size'. As a rule, only one class should be used in each school to avoid further reduction of the effective sample size. The use of probability sampling, in a way that the number of eligible students in each school decides the probability for that school to be sampled, is also recommended.

Sampling procedure and stratification

- ✦ Compile all schools with the appropriate grade level.
- ✦ Prepare a list with all schools containing:
 - ✦ The number of students at that grade level at each school.
 - ✦ The school student characteristics (language, region, SES, grading etc.).
 - ✦ Any other information necessary for making stratification.

Stratification consists of arranging the schools in the target population into groups, or strata, that share common characteristics such as geographic region, language or school type. For example, strata could be states or provin-

ces, the language of instruction, the level of urbanisation, socio-economic indicators, or school performance at national examination.

- ✦ In explicit stratification, a separate school list or sampling frame is constructed for each stratum, and a sample of schools is drawn from that stratum. For example, in order to produce equally reliable estimates for each region or language in a country, explicit stratification may be used.
- ✦ Implicit stratification consists of sorting the schools by one or more stratification variable within each explicit stratum, or within the entire sampling frame. The combined use of implicit strata and systematic sampling is an effective and simple way to ensure a proportional sample allocation of students across all implicit strata.

A recommended procedure

- ✦ Sample 50 schools and one class in each school with about 25-30 students. This would ensure a minimum of 1000 students.
- ✦ If you want to compare sub-groups within your national population, you should aim for larger samples and use some kind of stratification.
- ✦ Take your list(s) of schools and make sure that you carried out appropriate stratification.
- ✦ The number of eligible students at each school, is the Measure of Size (MOS) and determines the probability of being sampled. Each school can be assigned an interval of number that represents their MOS.
- ✦ The first school on the list covers the numbers from 1 to the schools' MOS, for example 1 to 120. The second school covers all numbers from the following number according to its MOS. If this school has 70 students, the sum of MOS will be 190.
- ✦ Do the same for all schools
- ✦ The last school will cover numbers up to the sum of MOS for all Schools, which is the whole population.

- ✦ Divide the sum by the number of classes that you want to sample (e.g. 50 in this recommended example). This is your STEP.
- ✦ Use a software tool to create a random number between 0 and 1. This is your PROB.
- ✦ The first school to be selected is found by multiplying the PROB with the STEP. This is the START.
- ✦ All other schools will be selected by adding STEP until you reach the end of your list.
- ✦ This procedure creates a list of random sampled schools.
- ✦ The number you have chosen to select the schools, could also indicate a random sampled class at each selected school.

If you want to discuss sample procedure, please contact the organisers. We can provide you with more examples and find a solution together.

Preparations take time!

Be aware that preparations for the actual data collection can be time-consuming. Data collection should take place at your earliest convenience. The international data analysis will start in 2020. We have not decided on any definite time limit for data collection.

In many countries you may need official permission to gain access to schools and students in order to collect data. In some places you may even need such permission on a regional level. Sometimes permission is needed at each school, possibly at the 'top' level, but certainly at the classroom level. Some countries also require permission from the students' parents together with ethical permission.

These practical and legal constraints vary from country to country, and each research group must determine the best way forward. Do not underestimate the time this might require. In the planning process, it is likely that many decisions have had to be taken. Please describe these as clearly as possible when your data are submitted.

We have provided several researchers with a letter of intent and we hope this can help in getting the necessary permissions. It is a good idea to start preparing for data collection at the earliest opportunity.

Administration of questionnaire

The ROSES study is not a test, and there are no correct answers. Hence, there is no need to be strict in the guidelines for administration and data collection. The important thing is to get reliable data, which implies that the students understand the questions. The students should be given enough time to complete the questionnaire. Pilot testing has indicated that one normal lesson (about 40 min) is enough time. The average time in the pilot test was 25 minutes and no student needed more than 35 minutes. In case of additional items or technical problems, or because of language, the time taken to finish may be longer. Please ensure that the students get enough time to answer all the questions. The administrator can even explain questions where they are not fully understood. If necessary, the possibility of completing the questionnaire as homework could be considered.

As a guiding principle, the questionnaire should be presented by the normal class teacher, but the researcher may assist in introducing the questionnaire and explaining why the study is being carried out. After the completion and collection of the questionnaire, the researcher or teacher fills in the necessary school code or other information on the front page for later identification. At a later stage during data entry, all the questionnaires from each country should be given a unique identification number for easy retrieval in case of corrections. The open-ended questions may be coded later, hence the identification number is essential. If data are collected in a digital tool the procedure is the same, unless the data are compiled directly in the tool.

Coding of data

Each participating researcher (or group) must follow the common guidelines for data entry. We will use Statistical Programme for the Social Sciences (SPSS) as the instrument for analysis, but Excel may be used for data entry if SPSS is not available. Empty data files in SPSS and Excel format will be provided. The corresponding code book with the necessary information for data entry will also be made available.

The first page in the questionnaire contains a few background variables of each respondent. Additional information might be added by the researcher or the teacher administrating the questionnaire. Each research group must decide what background information is needed.

The ROSES instrument and data file can be supplemented with extra items. These may be the name of school, type of school, region etc.

The coding will be made as simple as possible. Details will be apparent in the code book and will also appear as values in the empty data file that is provided. As a rule, the actual *position* of the respondents' tick will be the value to be entered. A tick in the first box will be entered as 1, a tick in the second box will be coded as 2 and the next 3 and 4. No response will be coded as 9.

The open questions at the end need interpretations before coding, and details will be provided. Since these data might be coded at a later stage, it is important that each questionnaire is identified by a running number, as indicated above.

Cleaning of data

Since only the coded data files (and not the questionnaires) are returned to the ROSES organisers, it is essential that the data are properly cleaned to avoid mistakes, since these cannot be traced and corrected by the organisers. In any case, we ask you to keep the original questionnaires to be able to check things at a later stage.

There are many ways of cleaning data to ensure quality. If you use SPSS for data entry, you may for instance run frequency tables for all variables to search for values outside the stipulated range. Some details and suggestions for data cleaning and proof-reading will be provided in the code book.

Return of data files

When you return data, please include as detailed information as possible about the definition of the target population and the sample. Describe the underlying considerations, whether these are of a practical nature based on educational or other concerns. You may upload the file to our site or send us the data file as an attachment via e-mail. The preferred format is SPSS or, as an alternative, Excel.

Rights and duties

ROSES has grown into a research collaboration between countries. The current network has been established through personal contacts, meetings at conferences all over the world, and through the spread of information. All are welcome to participate and contribute. If several researchers in a country contact us, we will encourage you to have contact with each other to resolve collaboration. There should be enough data available for many to take part.

Everyone should feel invited to make international contacts for comparisons and joint publication. Participating researchers own their national data, and are free to conduct research on the material, given the following guidelines:

- ♦ All *national* reporting should give proper credit to the project with a suitable reference to the ROSES project and its organisers.
- ♦ *International* reporting by the organisers should give credit to the ROSES project and the participating researchers who have contributed to the international data file.
- ♦ Researchers in the network get access to use of the main instrument: The ROSES questionnaire for a national study.
- ♦ A national data file should be sent back the ROSES Coordinators in Sweden.
- ♦ Research Coordinators will present descriptive international comparisons but will only do deeper analyses of national data together with national teams.

The ROSES Coordinators will not share any data from participating countries. Joint publication is decided upon by the researchers in each respective country. Everyone is free to use their own data in the way they want to, with proper references to the project given.

A ROSES web site is established. www.miun.se/ROSE It will be a node in the project, containing relevant information about the project, and at a later stage it will contain publications.

Additional qualitative data?

With a standardised questionnaire, responses from large groups and from widely different cultures can be compared. However, the data have limitations. It is not always easy to interpret what students have in mind when they simply tick boxes in a pre-determined questionnaire. Although many of the items have grown out of interviews with young people and have been tested in pilot studies, this is an important limitation. We have two open questions for free written responses. In order to give additional perspectives to the data from the questionnaire, researchers could complement the ROSES data with interviews. This approach can assist in understanding the reasons behind a particular way of answering.

Such information is of value when interpreting results, and in attempts to draw conclusions.

Funding

There is no central funding for ROSES. Each country is responsible for their own costs. The ROSES project is seeking additional funding from a variety of sources, and participating researchers are requested to apply for local funding to support their own participation. The ROSES Coordinators can assist in this process, for instance by writing letters of support. In some countries there are already established groups, sometimes with PhD candidates.

Participation in an international research project may enhance the possibility of securing national funding. Several possibilities for funding of the international part of the project are being explored. If resources become available, the intention is to arrange workshops and/or training seminars, sometimes in connection with international conferences. We are quite optimistic about these possibilities.

Involving students

Many of the researchers involved in ROSES are also involved in teacher training and/or degree work in science education at Master or PhD-level of education. It might be a good idea to involve participation in ROSES in connection with this kind of work, as many countries have already indicated that they intend to do. Of course, students can be involved in different

aspects of the study, in data collection, or through writing essays, articles or thesis work based on the results.

Time schedule

The start for the ROSES project was at the IOSTE conference 2016 when Svein Sjøberg organised a round table discussion. This discussion indicated the need for a new study of ROSE, and the Swedish team with Magnus Oskarsson and Anders Jidesjö took responsibility for the development.

A call for second Relevance of Science Education (ROSES) study was made at the ESERA conference in 2017. In 2017 a workshop was organised in Milan with the advisory group.

Theoretical and methodological issues were developed by the organisers, with the help of colleagues around the world. At the IOSTE conference 2018 presentations were made, together with a workshop. A draft ROSES questionnaire was presented, and the new name the Relevance of Science Education - Second (ROSES) was launched.

In spring 2019 the new questionnaire was piloted in Italy, Brazil, Norway and Sweden. The results were discussed in a workshop in Norway, in Oslo in June 2019. Results from this work were presented at the ESERA conference in August 2019, together with another workshop.

Data collection will begin in Sweden and Norway in late 2019 and early 2020. In connection with this, the master version of the ROSES questionnaire will be sent out to the whole international network, together with this technical guide.

We greatly appreciate the patience shown by all colleagues in the international network. Completing the work of planning and development took several years. We are now filled with anticipation as we begin the interesting work of collecting data, and we are keen to meet, to share work, and to hear about interesting ROSES results.

Selected references

- Alsop, S. & Watts, M. (2003). Science education and affect. *International Journal of Science Education*, 25 (9), 1043-1047.
- Blalock, C. L., Lichtenstein, M. J., Owen, S., Pruski, L., Marshall, C. & Toepferwein, MA. (2008). In pursuit of validity: A comprehensive review of science attitude instruments 1935-2005. *International Journal of Science Education*, 30(7), 961-977.
- DeWitt, J., & Archer, L. (2015). Who Aspires to a Science Career? A comparison of survey responses from primary and secondary school students. *International Journal of Science Education*, 37(13), 2170-2192.
- DeWitt, J., & Archer, L. (2017). Participation in informal science learning experiences: the rich get richer? *International Journal of Science Education*, Part B, 7(4), 356–373.
- Durant, J. R., Evans, G. A. & Thomas, G. P. (1989). The public understanding of science. *Nature*, 340(6228), 11-14.
- Gardner, P. L. (1975). Attitudes to science: A review. *Studies in Science Education*, 2 (1), 1-41.
- Gardner, P. L. (1995). Measuring attitudes to science: Unidimensionality and internal consistency revisited. *Research in Science Education*, 25(3), 283-289.
- Gardner, P. L. (1996). The dimensionality of attitude scales: a widely misunderstood idea. *International Journal of Science Education*, 18(8), 913-919.
- Gibbons, M. (1999). Science's new social contract with society. *Nature*, 402(6761), C81-C84.
- Gunter, H. & Thomson, P. (2007). Learning about student voice. *Support for Learning*, 22(4), 181-188.
- Henriksen, E., Dillon, J., & Ryder, J. (2014) *Understanding student participation and choice in science and technology education*. Dordrecht: Springer.
- Jenkins, E. W. (2006). The student voice and school science education. *Studies in Science Education*, 42(1), 49-88.
- Jenkins, E. W. & Nelson, N. W. (2005). Important but not for me: students' attitudes towards secondary school science in England. *Research in Science & Technological Education*, 23(1), 41-57.

- Jidesjö, A. (2008). Different content orientations in science and technology among primary and secondary boys and girls in Sweden: Implications for the transition from primary to secondary school? *NorDiNa*, 4(2), 192-208.
- Jidesjö, A. & Danielsson, Å. (2016). Student experience and interest in science: Connections and implication for further education. *NorDiNa*, 12(1), 36-55.
- Jidesjö, A., Oscarsson, M., Karlsson, K-G. & Strömdahl, H. (2009). Science for all or science for some: What Swedish students want to learn about in secondary science and technology and their opinions on science lessons. *NorDiNa*, 5(2), 213-229.
- Kind, P., Jones, K. & Barmby, P. (2007). Developing attitudes towards science measures. *International Journal of Science Education*, 29(7), 871-893.
- Krapp, A. (2002). Structural and dynamic aspects of interest development: theoretical considerations from an ontogenetic perspective. *Learning and Instruction*, 12(4), 383-409.
- Krapp, A. (2005). Basic needs and the development of interest and intrinsic motivational orientations. *Learning and Instruction*, 15(5), 381-395.
- Krapp, A. (2007). An educational-psychological conceptualisation of interest. *International Journal for Educational and Vocational Guidance*, 7(1), 5-21.
- Lyons, T. (2006). Different countries, same science classes: Students' experiences of school science in their own words. *International Journal of Science Education*, 28 (6), 591-613.
- Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. *International Journal of Science Education*, 25(9), 1049-1079.
- Oscarsson, M., Jidesjö, A., Karlsson, K. G., & Strömdahl, H. (2009). Science in society or science in school: Swedish secondary teachers' beliefs about science and science lessons compared with what their students want to learn. *NorDiNa*, 5(1), 18-34.
- Oskarsson, M., & Karlsson, K. G. (2011). Health Care or Atom Bombs. Interest profiles in science among 15-year old students in Sweden. *NorDiNa*, 7(2), 190-201.
- Perry, B. L., Link, T., Boelter, C., & Leukefeld, C. (2012). Blinded to science: gender differences in the effects of race, ethnicity, and socioeconomic status on academic and science attitudes among sixth graders. *Gender and Education*, 24(7), 725-743.

- Potvin, P. & Hasni, A. (2014). Interest, motivation and attitude towards science and technology at K- 12 levels: a systematic review of 12 years of educational research. *Studies in Science Education*, 50(1), 85-129. <http://dx.doi.org/10.1080/03057267.2014.881626>
- Reid, N. (2006). Thoughts on attitude measurement. *Research in Science & Technological Education*, 24(1), 3-27.
- Roberts, D. A. (2007). Scientific Literacy/Science Literacy. In Abell, S. & Ledermann, N. (eds.). *Handbook Of Research On Science Education* (pp 729-780). New Jersey: Lawrence Erlbaum Associates Publishers.
- Robson, C. & McCartan, K. (2016). *Real world research. A resource for users of social research methods in applied settings*. 4th ed. Wiley, John Wiley & Sons Ltd: UK.
- Chang Rundgren, S-N, Sun, Y-l & Jidesjö, A. (2019). Examining Gender Differences in Students' Entrance into and Persistence in STEM Programs in Swedish Higher Education. *European Journal of Educational Sciences*, EJES, 6(1), 66-94.
- Schreiner, C. & Sjøberg, S. (2019). ROSE (*The Relevance of Science Education*) *Western youth and science*. Final ROSE Report part 2. University of Oslo. https://www.researchgate.net/publication/336253209_ROSE_The_Relevance_of_Science_Education_Final_Report_part_2_Western_youth_and_science
- Schreiner, C., & Sjøberg, S. (2004). *Sowing the seeds of ROSE. Background, Rationale, Questionnaire Development and Data Collection for ROSE (The Relevance of Science Education) - a comparative study of students' views of science and science education*. No. 4/2004. Oslo: University of Oslo. <https://www.duo.uio.no/bitstream/handle/10852/32303/AD0404.pdf?sequence=1&isAllowed=y>
- Schreiner, C. & Sjøberg, S. (2005). Empowered for action. How do young people relate to environmental challenges? In Alsop, S. (2005). *Beyond Cartesian Dualism. Encountering Affect in the Teaching and Learning of Science*. Dordrecht: Springer, Science and Technology Education Library. <https://folk.uio.no/sveinsj/Springer-ROSE-Schreiner-Sjoberg.pdf>
- Schreiner, C. (2006). *Exploring a ROSE garden: Norwegian youth's orientations towards science - Seen as signs of late modern identities. Based on ROSE (The Relevance of Science Education), a comparative study of 15 year old students' perceptions of science and science education*. Dr.scient theses Oslo University : Unipub. https://www.duo.uio.no/bitstream/handle/10852/32331/schreiner_thesis.pdf?sequence=1&isAllowed=y

- Schreiner, C., & Sjøberg, S. (2007). Science education and youth's identity construction: Two incompatible projects? In D. Corrigan, J. Dillon, & R. Gunstone (Eds.). *The re-emergence of values in science education*. (pp. 231–248). Rotterdam: Sense Publishers. <https://folk.uio.no/sveinsj/Values-ROSE-Schreiner-Sjoberg.pdf>
- Sjaastad, J. (2012). *No man is an island. Significant persons' influence on young people's attitudes towards and choice of educations within science, technology, engineering and mathematics*. Doctoral Dissertation. Faculty of mathematics and natural sciences. University of Oslo 2012 No 1234.
- Sjøberg, S. & Schreiner, C (2019). *ROSE (The Relevance of Science Education) The development, key findings and impacts of an international low-cost comparative project*. ROSE Final Report, Part 1. University of Oslo. https://www.academia.edu/40272545/The_ROSE_project_The_development_key_findings_and_impacts_of_an_international_low_cost_comparative_project_Final_Report_Part_1_of_2
- Sjøberg, S. (2002). Science for the children? Report from the Science and Scientists-(SAS) project. *Acta Didactica*, 1/2002. University of Oslo. https://folk.uio.no/sveinsj/sas_report_new%20.pdf
- Sjøberg, S., & Schreiner, C. (2006). How do learners in different cultures relate to science and technology? Results and perspectives from the project ROSE (the Relevance of Science Education). *APFSLT: Asia-Pacific Forum on Science Learning and Teaching*, 7(1). <https://folk.uio.no/sveinsj/APFLT-foreword-Sjoberg-schreiner.pdf>
- Sjøberg, S. & Schreiner C. (2012). Results and Perspectives from the ROSE Project. In Jorde, D. and Dillon J. (eds) (2012). *Science Education Research and Practice in Europe*. Rotterdam: Sense Publishers. https://link.springer.com/chapter/10.1007/978-94-6091-900-8_9
- Sjøberg, S. & Schreiner, C. (2012). A Comparative View on Adolescents' Attitudes towards Science. In Bauer, Shukla and Allum (eds) (2012). *The Culture of Science - How the Public Relates to Science Across the Globe*. New York: Routledge.
- Stuckey, M., Hofstein, A., Mamlok-Naaman, R., & Eilks, I. (2013). The meaning of "relevance" in science education and its implications for the science curriculum. *Studies in Science Education*, 49(1), 1–34.
- Thurstone, L. L. (1929). Theory of attitude measurement. *Psychological review*, 36(3), 222-241.

- Tytler, R., & Osborne, J. (2012). Student Attitudes and Aspirations Towards Science. In B. J. Fraser,
- K. Tobin, & C. J. McRobbie (Eds.), *Second International Handbook of Science Education* (pp. 597– 625). Dordrecht: Springer Netherlands.
- Vetleseter Bøe, M. (2012). *What's in it for me? Norwegian students' choices of post-compulsory science in an expectancy-value perspective*. Doctoral Disseration. Faculty of Educational Sciences. University of Oslo 2012 No 152.

Appendix A

From ROSE to ROSES

Endorsement and Conditions for using the ROSE project as basis for ROSES



ROSE (The Relevance of Science Education), was a cross-cultural comparative project on young peoples' views and perceptions, attitudes, values, experiences, interests, plans, etc. related to science and technology – in schools and in their lives. The ROSE project and its results received wide international attention and acclaim, also outside the international science education community. Details of rationale, development, impact and influence is given in Sjöberg and Schreiner (2019), more detailed and comprehensive data analysis is provided in Schreiner and Sjöberg (2019). (both published as open access).

As organizer of the ROSE project, I am happy that a revised and updated project is planned, under the leadership of Magnus Oskarsson and Anders Jidesjö from Sweden, who both based their PhDs on ROSE. It is great to note that the previous ROSE international network has been used as the basis for the new ROSES project, and that new partners have also been added. The emerging ROSES project will make it possible to identify possible changes over time – in addition to shedding light on the research questions that were at the core of ROSE, where the data collection took place about fifteen years ago.

It has been a pleasure to take part in the planning phase of ROSES up its current stage, with a revised ROSES instrument and a large network of researchers from some 50 countries.

This document sets out the principles for how the emerging ROSES project relates to ROSE. The intention is to provide a clear platform for development and cooperation and to avoid confusion and conflict at a later stage.

.....


The organizers of ROSES are hereby given the permission to go forward with the project as the responsible leaders, based on the following

Principles that also should be made clear to the participating partners and in presentations and articles:

1. The ROSES project has the permission and endorsement from the organizer of ROSE. They may use the ROSE instrument as the basis for its revised instrument. The copyright remains as stated in the original, with new names added, like © Svein Sjöberg <svein.sjoberg@ils.uio.no> , modified by Anders Jidesjö <anders.jidesjo@liu.se>, Magnus Oskarsson <magnus.oskarsson@miun.se> and Anna-Karin Westman anna-<karin.westman@miun.se>.
2. The ROSES project may also use the modified ROSE logo.
3. The ROSES project builds on the original ROSE project, its underlying educational rationale, values and beliefs. These values should be spelt out in some detail whenever ROSES is presented.
4. The ROSES organizers will be given full access to use ROSE data files as well as publications from the ROSE study, and also the graphs and presentations produced by the ROSE organizers. These may be used in presentations and articles, always with a proper reference to the origin.
5. In articles and publications, the ROSES project should clearly state its legacy from ROSE, also with concrete reference(s) to proper article(s) from ROSE.

(A brief presentation of ROSE is provided as Appendix of this document -- as a suggestion, also with possible references).

Oslo 16th October 2019



Svein Sjöberg (organizer of ROSE)

Appendix 1 ROSE in brief

A possible presentation of ROSE/ROSES could be like the following:

The basic philosophy, values and concerns of ROSES are essentially the same as for the original ROSE study. Here are some main points, describing ROSE:

The lack of perceived relevance of the S&T curriculum is probably one of the greatest barriers for good learning as well as for interest in the subject. ROSE therefore aimed at providing empirical evidence directly from the learners on how they relate to S&T.

The ROSE study was initiated in 2001 by Professor Svein Sjøberg, with support from the Research Council of Norway. It was built on a previous study, called SAS (Science And Scientists)

An advisory group of science educators from all continents was established. Through a long process of discussions, workshop, drafting and piloting, the ROSE instrument was constructed. It consisted of some 200 items. The items were grouped under different themes. Examples are: A variety of S&T-related out-of-school experiences, interests in learning different S&T topics in different contexts, prior experiences with and views on school science, views and attitudes to science and scientists in society, future hopes, priorities and aspirations as well as young peoples' feeling of empowerment with regards to environmental challenges.

Over the years ROSE involved research partners from around 80 countries. Key international research institutions and individuals worked jointly on the development of theoretical perspectives, research instruments, data collection and analysis.

The ROSE instrument was translated and used for data collection in the participating countries according to common guidelines. Data files were later submitted to the ROSE organizers in Norway for cleaning and merging into a larger file for comparative analysis. National as well as international reports have been published, and several PhDs and other thesis have over the years been based on ROSE data.

The ROSE project resulted in empirical findings and theoretical perspectives that have been used for informed discussions on how to improve curricula and enhance the interest in S&T in a way that

- respects cultural diversity and gender equity
- promotes personal and social relevance
- empowers the learner for democratic participation and citizenship

The results from ROSE received considerable interest from a wide variety of national and international stakeholders and has had a remarkable impact. An overview of this is given in Sjøberg, S. & Schreiner, C. (2019). A more in-depth data analysis is provided in Schreiner, C., & Sjøberg, S. (2019).

Many years have passed since the ROSE data collection, and it will be most interesting to note possible changes and developments in young people's values, attitudes and perceptions. It is therefore encouraging that a new, revised and updated version of the ROSE project is under way.

App 2. Possible references to be used in presentations of ROSE in ROSES publications

Sjøberg, S. & Schreiner, C. (2019). *ROSE (The Relevance of Science Education) The development, key findings and impacts of an international low cost comparative project. ROSE Final Report, Part 1*. University of Oslo
https://www.academia.edu/40272545/The_ROSE_project._The_development_key_findings_and_impacts_of_an_international_low_cost_comparative_project_Final_Report_Part_1_of_2

Schreiner, C. & Sjøberg, S. (2019). *ROSE (The Relevance of Science Education) Western youth and science. Final ROSE Report part 2*. University of Oslo
https://www.researchgate.net/publication/336253209_ROSE_The_Relevance_of_Science_Education_Final_Report_part_2_Western_youth_and_science

****Papers, chapter, articles – sorted by year

Sjøberg, S. (2002). Science for the children? Report from the Science and Scientists-(SAS) project -- *Acta Didactica*. - (1/2002) University of Oslo https://folk.uio.no/sveinsj/sas_report_new%20.pdf

Schreiner, C., & Sjøberg, S. (2004). *Sowing the seeds of ROSE. Background, Rationale, Questionnaire Development and Data Collection for ROSE (The Relevance of Science Education) - a comparative study of students' views of science and science education* (No. 4/2004). Oslo: University of Oslo.
<https://www.duo.uio.no/bitstream/handle/10852/32303/AD0404.pdf?sequence=1&isAllowed=y>

Schreiner, C. & Sjøberg, S. (2005). Empowered for action. How do young people relate to environmental challenges? In Alsop, Steve. (2005) *Beyond Cartesian Dualism. Encountering Affect in the Teaching and Learning of Science* Dordrecht: Springer, Science and Technology Education Library. <https://folk.uio.no/sveinsj/Springer-ROSE-Schreiner-Sjoberg.pdf>

Schreiner, C. (2006). Exploring a ROSE garden: Norwegian youth's orientations towards science—Seen as signs of late modern identities. Dr.scient theses Oslo University : Unipub.
https://www.duo.uio.no/bitstream/handle/10852/32331/schreiner_thesis.pdf?sequence=1&isAllowed=y

Sjøberg, S., & Schreiner, C. (2006). How do learners in different cultures relate to science and technology? Results and perspectives from the project ROSE (the Relevance of Science Education). *APFSLT: Asia-Pacific Forum on Science Learning and Teaching*, 7(1) <https://folk.uio.no/sveinsj/APFLT-foreword-Sjoberg-schreiner.pdf>

Schreiner, C., & Sjøberg, S. (2007). Science education and youth's identity construction: Two incompatible projects? In D. Corrigan, J. Dillon, & R. Gunstone (Eds.), *The re-emergence of values in science education* (pp. 231–248). Rotterdam: Sense Publishers. <https://folk.uio.no/sveinsj/Values-ROSE-Schreiner-Sjoberg.pdf>

Sjøberg, S. & Schreiner, C. (2007). Perceptions and images of science and science education. M. Claessens (Ed.) *Communicating European Research*. Dordrecht: Springer. <https://folk.uio.no/sveinsj/Values-ROSE-Schreiner-Sjoberg.pdf>

Sjøberg, S. & Schreiner C. (2012). Results and Perspectives from the ROSE Project. In Jorde, D. and Dillon J. (eds) (2012). *Science Education Research and Practice in Europe*. Rotterdam: Sense Publishers
https://link.springer.com/chapter/10.1007/978-94-6091-900-8_9

Sjøberg, S. & Schreiner, C. (2012). A Comparative View on Adolescents' Attitudes towards Science. In Bauer, Shukla and Allum (eds) (2012) *The Culture of Science - How the Public Relates to Science Across the Globe*, New York: Routledge.

Appendix B

Optional category M

M. My views about Biological Evolution

There are different views about science and religion in different countries. Some people agree with evidence presented by scientists, showing that species have been, and are being, evolved. However, some people do not agree with such evidence.

To what extent do you agree with the following statements?

(Give your answer with a tick on each row. If you do not understand, leave the line blank.)

	Disagree		Agree	
1. Life on earth appeared more than 4 billion years ago	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Living species of animals and plants originated from ancient extinct ones	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Humans exist today in essentially the same form in which they always have.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. All living things on the planet share a common ancestor that lived long ago.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Human beings originated in the same way as other species.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Plants and animals exist today in essentially the same form in which they always have.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Humans and apes share a common ancestor that lived long ago	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Preservation of individuals with favorable variations plays a role in evolution.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Extinct species can reappear naturally if past environmental conditions come back as before.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Injurious variations can reduce reproduction and lead to species extinction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Natural species will never be permanently extinct.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. An extinct species of the past will never reappear on earth.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. The theory of evolution is incapable of being scientifically tested.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Disagree		Agree	
14. Modern humans are the product of evolutionary processes which have occurred over millions of years ..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Fossils of animals and plants show evidence of extinct species of the far past ..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. With few exceptions, organisms on earth came into existence at about the same time not long ago ..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Fossils show forms of organisms which are similar but not identical to the living ones.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. The theory of evolution cannot be correct since it disagrees with Sacred Books.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. There are scientists who are religious and knowledgeable in biological evolution..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Life was originally breathed into one or a few forms by the Creator.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Optional background variables

Your family and religion

Many families around the world share religious beliefs, others do not. What about your family?
(Please tick only one box.)

I belong to a family:

- with no religious tradition ☐
- Roman Catholic ☐
- Cristian, non Roman Catholic ☐
- with other religious tradition ☐

Your family and education

You attend school and previous generations of your family may have had the same experience. Let us know which level your parents, or the adults with which you live with, and their parents reached. Tick the box which shows the highest level reached, even if not completed with a diploma.
(Please tick only one box.)

At least one of my parents reached:

- Both had no schooling at all ☐
- Primary level ☐
- High-School level ☐
- University level ☐

At least one of my grandparents reached:

- Both had no schooling at all ☐
- Primary level ☐
- High-School level ☐
- University level ☐

Utbildningsvetenskapliga studier

Mittuniversitetet Sundsvall (Härnösand t.o.m. 2016)

Institutionen för utbildningsvetenskap

Olofsson, Anders (Red). Entreprenörskapsutbildning i skola och samhälle –
Formering av en ny pedagogisk identitet? 2009:1

Olofsson, Anders. Entreprenörskap som lokal skol- och samhällsförändring

From, Jörgen. Entreprenörskapsutbildning

Karlsson, Håkan. Utbildning i, om och för entreprenörskap: Fallstudier i
gymnasieskolan

Holmgren, Carina. Open for Business?

Nyström, Camilla och Wikström, Anneli. Etablerade och potentiella entreprenörer
om entreprenörskap och företagsamhet

Augustsson, Gunnar Konstnärers kompetens uppskattas i arbetslivet – Utvärdering av åtta konstnärers bidrag till meningsskapande reflektioner inom fyra arbetsplatser. 2010:1

Sandin, Lars Några grundskollärares uppfattningar om kulturell mångfald, värden och kunskap tolkade som ideologi. 2010:2

Eriksson, Linda & Bostedt, Göran Elevinflytande i spänningsfältet mellan skolans kunskapsuppdrag och demokratiska uppdrag – En studie av fyra skolor. 2011:1

Augustsson, Gunnar Kulturell mångfald är inte detsamma som kulturell pluralism – En intervjurapport om lärandemiljöer med både formell och dold inkludering, segregering och exkludering på ett sjukhus och i en bilfabrik. 2011:2

Karlsson, Håkan & Olofsson, Anders Ung företagsamhet i E-länet; Betydelsen av samhällsentreprenörer och utbildningsinsatser för regional utveckling. 2012:1

Johansson, Ida Skolinspektörers uppfattningar om sitt arbete – en enkätstudie om inspektion som styrning. 2012:2

Snyder, Kristen & Cooper, Karen "What's going on here"? : A frame analysis of a pilot project to examine why the use of appreciative inquiry, storytelling, and painting is difficult to integrate into the culture of schooling. 2012:3

Novak, Judit De styrdas röster – rektorers berättelser om Skolinspektionens regelbundna tillsyn. 2013:1

Norberg, Malin "Det är för att det ska bli lite svårare?" – Om illustrationer i matematikläroböcker i grundskolans tidiga år och elevers handskande med dessa. 2014:1

Strzelecka, Elzbieta & Boström, Lena Lärares strategier i grammatikundervisning i svenska. 2014:2

Perselli, Jan Redovisning av projektet E-lärande vid biblioteket : En något utökad och varsamt reviderad version. 2015:1

Berg, Gunnar; Andersson, Fia; Bostedt, Göran; Perselli, Jan; Sundh Frank, & Wede, Christer Skolans Kommunalisering och de professionellas frirum. 2015:2

Boström, Lena Ungdomarnas röster i Mittregionen : Om studieresultat, kompetensflykt och bevekelsegrunder för att flytta eller stanna kvar. 2016:1

Jidesjö, Anders; Oskarsson, Magnus & Westman, Anna-Karin ROSES Handbook : Introduction, guidelines and underlying ideas. 2020:1