Portrayals of Technology Education in Swedish Upper Secondary Education

Louise Björlin Svozil
Department of Learning in Engineering Sciences
KTH Royal Institute of Technology
Stockholm, SWEDEN
louisebs@kth.se

Arnold Pears
Department of Learning in Engineering Sciences
KTH Royal Institute of Technology
Stockholm, SWEDEN
pears@kth.se

Lena Gumaelius
Department of Learning in Engineering Sciences
KTH Royal Institute of Technology
Stockholm, SWEDEN
lenagu@kth.se

***Abstract*—In this Research Full Paper we contribute to the research on constructions of technology education. Why are women and minority groups often under-represented in student cohorts in STEM programmes? Many studies have addressed this question, and much is known about the impact of representations of technology studies on the choices and motivations of these demographic groups in many countries. Many of the recent studies published in the English language address the North American education system. This paper investigates if perpetuation of gender norms might be evident in recruitment materials for Swedish upper secondary education. This research question is addressed through an analysis of how upper secondary education schools use images in presenting their university preparatory programs to prospective students. Swedish post-compulsory school education comprises a number of specialised upper secondary school programmes in Technology, Natural science, Social science and Economy. A significant display area of the web content regarding these programmes is pictorial information. In this study Technology Education is viewed as a societal construction and images representing the technology program are here used as a way of discovering both perceptions about them, and underlying themes that the choice of images might communicate. Three themes, Environment, Pedagogical approach and Human presence, emerge and serve as a foundation from which similarities and differences in the visual messages associated with these programs are investigated. Our major finding is that images used in association with Technology Education portray a paucity of social relations and a dominant culture of working/studying alone. These findings are of concern, as this type of profile has been shown to reduce motivation of women and minority groups to pursue such a career.**

***Index Terms*—technology education, upper secondary education, stereotyping, gender balance, thematic analysis**

I. Introduction

Why are women and minority groups often under-represented in student cohorts in STEM programmes? Many studies have addressed this question, and much is known about the impact of representations of technology studies on the choices and motivations of these demographic groups in many countries. Many of the recent studies published in the English language address the North American education system. This paper investigates if perpetuation of gender norms might be evident in recruitment materials for Swedish upper secondary education. To explore how technology education in Swedish gymnasium schools is represented we selected images collected from a selection of school web sites.

In Sweden young people select their trajectories for further study at the age of 15 to 16. Up to that point, all pupils have followed the same curriculum. This crossroads in the educational paths of young people will determines both the content of the next three years of their school education as well as laying the foundation of their future higher education profile and professional careers. The importance of this choice is accentuated by the culturally dominant ideas of free choice in our late modern society and how every person is responsible for creating her/his own identity [1], [2].

In recent decades, it has been noted that STEM education, in particular technology education, is not inclusive for all. This study focuses on culture, stereotypes and attributes of Technology Education, in particular in relation to the national upper secondary program Teknikprogrammet (TE), that can appear as gatekeepers, discouraging some groups from entering the field. We take a social constructionist approach, viewing technology education as a societal discourse that is both created within and a constitutive part of society [3]. Images are chosen as a bearer of discourse, arguing that this is analogous to the claim that postmodernist culture can be seen as 'post-linguistic' [4].

II. Background

A. Recruitment Diversity

Science, Technology, Engineering and Mathematics (STEM) education have been vastly researched due to the field's inability to include and educate people with various backgrounds, including parents educational background, socioeconomic factors, ethnicity and gender. The perspectives adopted and presented in this field include science capital [5], social role congruity [6], expectancy value theory [2],

[7], stereotype influence [8], (focusing on social background, social roles, competence beliefs, interest, relative cognitive strengths, gender related preferences, stereotype impact etc.). Even though there has been research on both biological and sociocultural factors responsible for the gender imbalance in STEM, Wang and Degol conclude that the dominating factor is 'cultural pressures to pursue traditionally masculine or feminine interests' [9].

Gender participation varies between different STEM fields. To synthesize research using the STEM acronym has it's challenges. Our focus in this article is on representation and inclusiveness in some fields where there is a lack of certain social groups. Sometimes the fields is termed STEM, sometimes more specified like computer science, engineering and physics. It all depends on what the subject field is contrasted to. In Sweden the gender gap in STEM tertiary education is big for computer science and some engineering fields (excluding chemistry and biology). For upper secondary school the gender gap is big for Technology (17 percent women) but nonexistent for Natural science (54 percent women) [10].

B. Stereotyping and Belonging

It has been shown that there is a relation between women's higher enrollment in tertiary science education and weaker gender-science stereotypes [11]. Women who read (fabricated) newspaper articles about computer scientists no longer fitting the stereotype expressed more interest in computer science (CS) than women reading about stereotypical computer scientists [12].

Women who encounter a person embodying and expressing CS stereotypical features are more likely to experience a loss in success beliefs in CS. This is mediated by a perceived dissimilarity from the stereotypical role model. Male students are unaffected by the encounter, why this might be a gendered phenomenon. The gender of the role model had no effect, implying that the gender of the role model is less important than the extent to which the role model embodies stereotypical features [13].

The importance of the experience of belonging together with other people in the field was similarly tested by Tellhed et al. They evaluated expectations of social belongingness and competence beliefs as mediators for interest in STEM and HEED (Health care, Elementary education and the Domestic spheres) and found that social belongingness acted as a mediator for both women's lower interest in STEM and men's lower interest in HEED [14].

Ottemo [15] showed how the co-production of technology and gender occurs in the Computer Science and Engineering (CSE) and Chemical Engineering (CE) programs at a Swedish technical university. The 'passionate student' subject position found in the CSE program contribute to it's hetero-masculine connotations, while the absence of that subject position seemed to contribute to the relative gender inclusiveness of the CE program.

C. Constructionist thematic analysis

Taking our point of departure in a social constructionist perspective on technology education, the study applies thematic analysis [16] to the images chosen and deployed in online representations of study programmes. The perspective is inspired by discourse analysis in that the visual communication in schools' websites is seen as the discursive practice through which they intend to communicate the values, intent and experience of their education. The websites can be viewed as both produced (by the school or principal) and consumed (by visitors to the website), contributing to the social practice of post compulsory education [17].

III. Objective

The rationale for studying the images schools utilise to advertise TE is threefold. Firstly, they communicate technology education and TE to presumptive pupils who are interested in choosing TE, giving them a preview of what they might expect. Secondly, they communicate technology education and TE to all pupils who are about to start the gymnasium and this might affect the conceptions of technology education of all pupils who might at a later state consider a technological trajectory. Thirdly, they communicate technology education at large to whoever makes their digital way past the school website.

In this paper we address the following research questions:

- How do Swedish gymnasium schools present their preparatory programs through images on their websites?
- How is TE presented in contrast to other programs?
- To what extent do the features revealed emerge as prevalent when programs are compared to each other?
- How can these visual themes connected to conceptions of technology education in previous research?

IV. Method

A. Sampling and selection

Twenty-three schools around Sweden were selected using the website Gymnasieinfo.se. One site from each Swedish County was included in the study sample to provide a coverage representative of the country. In addition, the schools were selected in order that the ratio between independent and state operated schools included in the study should be close to the national ratio of 1:2. Schools that offered all of the programs of interest: Technology (TE), Natural science (NA), Social science (SA) and Economics (EK), were prioritized over those that did not. In a couple of Counties, no school offering all preparatory programs was found. In those cases two schools were selected, each offering three of the programs in our research focus. School websites that did not contain images were not considered, for obvious reasons.

Where websites contained more than one image in the program material all images were included as separate items in the analysis. This choice is motivated by the limitation inherent in the school's ability to present a program in a fair way using only one image. One might argue that the appropriate unit of study is the collective of the images available from a

school's presentation of that program. The weakness in using this approach is however that the sum of the images in one program presentation is not considered in the analysis, but each and single as a separate unit. Some schools present the program orientations separately, using different images for different orientations. In those cases all of the images representing the orientations were included. With the above described selection of images a total of 134 images were analysed; TE=37, NA=32, SA=36 and EK=29. The variation in number of images from each program is due to the additional images from the different orientations of each program. All images were saved to a folder for an overview of the material.

B. Analysis

In the first round of analysis an observation protocol was used (see Appendix A) to provide a high level structure to the image data. Questions informing the protocol were: Who/what is seen in the picture? What activity is carried out by whom? Who is watching? What emotions can be seen? At whom/what should the Web Site visitor (spectator) look?

Features that stood out and seemed to differentiate the total body of images emerged from this first round of analysis. These are classified as follows: the setting in which the scene is couched (Environment), in what form the school work was performed/carried out (Pedagogical approach), and to what extent the actors in the image interact with each other, artifacts and the spectator (Human presence).

With these three features in mind the images were analysed and a range of sub-themes emerged. The images were finally categorized into the sub-themes under each major thematic focus area in order to evaluate the prevalence of depictions of that thematic structure within each program.

V. Results

The three primary visual themes depicted in images from school websites emerged, as described in the previous sections, through an initial round of thematic analysis conducted by the first author. The resulting categories were; *Learning space*, *Learning experience values* and *Focal point and agency*.

When these initial results were discussed among the authors it became clear that within each high level thematic cluster of images there was significant additional complexity in terms of focal point of the image, activities depicted, number of people and artifacts present, among other dimensions of potential analysis.

A further round of analysis and inductive coding of the rich detail of the collection of images resulted in the final analytical structure of themes and sub-themes described below.

A. Learning space

All images offer the viewer a setting in which the scene takes place communicating context and expectations. In our material this setting has been coded as a socio-contextual dimension represented in five distinct sub-themes: *Formal spaces*, *Collegial spaces*, *Community spaces*, *Informal/Non-formal learning spaces* and *De-contextualised spaces*.

a) Formal spaces: Classroom situations of a traditional character. This includes pupils sitting at desks during a lecture, doing laboratory work, doing individual work or working in a group. Sometimes a teacher is present interacting with the pupils. In many of the images there is equipment visible.

b) Collegial spaces: Pupils engaging with school work beyond the formal structure of the classroom. These settings include "common rooms" or library environments where the nature of the gathering revolves around sitting groups of pupils. The atmosphere is more collective, and no clear authority figures are present. In the Swedish cultural context this conveys a sense of a meeting of equals, reflecting peer learning processes and values.

c) Community spaces: Images in this category are clearly located outside the classroom and study is clearly not the dominant context. These images depict pupils standing in other school spaces, reflecting the broader school environment. Such a setting might be a school corridor including pupils carrying books or a laptop, walking in a corridor, or hanging around typical school features such as storage lockers.

d) Informal spaces: In these pictures the emphasis is on settings in a place outside the school environment. Examples of this include pupils who are out hiking in nature or pupils visiting the parliament, meeting with politicians or visiting other cultures.

e) De-contextualised spaces: This theme consists of pupils posing in front of a background that can be anything from a white surface to a school corridor. A school corridor can also be a setting in the sub-theme *Community spaces*, however pupils there interact with the environment, in that they walk in the corridor or lean against lockers, and in this theme they don't.

B. Learning experience

Many of the images include depictions of school work or learning activities of some kind. In this theme the focus lies in the depictions of the experience of learning. The various instructional paradigms deployed in this thematic focus are related to: *Information transmission, Experiential learning, Collaborative learning* and *Individual learning*.

a) Information transmission: Images showing lectures focus, often with a focus on the teacher in the front of the classroom, giving a lecture or a demonstration. These images are often taken from the spectators position as a pupil in class. Sometimes the spectator's view is from the front of the classroom showing pupils raising their hands, conveying a sense of teacher expectations of student behaviour, the "eager student". The dominant underlying educational paradigm is information transmission emphasising the role of the teacher as expert and authority. Cf. the work of Prosser and Trigwell on pedagogical models and traditional teaching approaches [18], [19].

b) Experiential learning: Laboratory work is a common setting for both natural sciences and technology. The laboratory work performed in natural sciences images shows pupils in white lab coats, sometimes wearing protective glasses.

Pupils wearing full protection garments are often pouring fluids, looking at graduated cylinders or test tubes or burning substances in a gas burner. Looking in a microscope and investigating a model torso are other activities performed by natural science pupils. Other laboratory work performed in the images are physics labs, here a focus on phenomena such as acceleration and electronics, and technology labs, showing programming and construction work.

Another major focus is the Field trip, in which the focus is on outdoor and study-visit environments. Pupils are depicted in a range of environments relevant to the study program involved. For natural sciences this is often outdoor settings, with a focus on plants or animals. Other contexts include visits to galleries, museums, political monuments, and other cultural and historical locations.

c) Collaborative learning: In many of the images, pupils cooperate in some way. In some images it is hard to determine whether there is interaction between the pupils or if they conduct their work individually just sitting in a group. The impression of people sitting in a group and they are turned toward each other is however that they will at some point interact and collaborate. In images with two people sitting next to each other the collaboration needs to be stated in the image in order to be considered a group work situation. The sizes of the groups range from two pupils up to nine.

d) Individual learning: In these images focus is on an individual conducting a task or schoolwork of some kind. There can be other pupils or a teacher in the background, but the pupil is focused on completing a task without interaction with others. Types of activities can be reading a textbook, reading/writing on a computer or laptop, doing laboratory work, operating a machine or receiving individual instruction or guidance from a teacher.

C. Focal point and agency

This theme captures aspects of focal intensity and human agency in the empirical material. We consider how different levels of human presence can be arranged, and where the focal point of the image might be interpreted to lie from an observer perspective. A high degree of presence is associated with images where pupils are looking straight into the camera (external focal point), to a total absence of human figures (internal focal point, artefact focus). In between these extremes there are several levels of human presence and in this case images are categorized based on the amount of eye contact offered with the people in the image.

a) External: Images in this sub-theme consist of people looking into the camera. There are mainly two types of images here. One type where the pupil is posing like in an interview image. In these images the environment does not play a significant role and the same images constitute the corresponding Learning space sub-theme *De-contextualised*. The other type shows a scene with an activity, like writing on a laptop or setting up an experiment, where a pupil looks into the camera like she/he has just been interrupted by the photographer, thus including the viewer in the image experience.

b) Internal: The focus here is on an artefact but in contrast to the pure artefact focus, pupils can here be seen to operate on the artefacts. However, no eyes are visible and if a head is depicted in the image, the face is turned away from the camera. In this category all activity is internal to the image, and the spectator is distanced from the actions taking place, a passive observer unnoticed by the participants.

c) Artefact: Here no part of a human is visible. Typical for this category is a focus is on some equipment that is commonly used within the program. This might be an element of complex laboratory equipment, a book of legislation or legal precedent, a construction, a 3D printer or a computer. Here the emphasis is entirely on things, and the social context of the artefacts is largely excluded.

D. A comparison of features within and between programs

To explore dominant themes and sub-themes within and between programmes we adopted a quantitative approach based on the themes identified during the qualitative analysis. Our hypothesis was that some themes and sub-themes would be more dominant in some program image clusters. Based on the preceding analysis and system of classification proceed to compile thematic and sub-thematic frequency in relation to what appears to dominate images drawn from different program web sites. This step in the analysis quantifies the thematic and sub-thematic features of the images drawn from a programme context to present commonalities (shared thematic features) for each programs as well as what thematic factors stand out in terms of distinguishing between the different programs. These thematic frequencies are summarised in the following tables which show the number of images found in that sub-theme grouped by programme.

a) Where does learning happen?: Many of the images representing Economics (EK) and Social science (SA) are in an environment outside of the classroom (represented by the sub-themes *Collegial spaces* and *Informal spaces*) compared to images from NA and TE where the setting is inside the classroom *Formal spaces* (Table I). Due to laboratory exercises that demand certain equipment, such as fluids, stationary computers and model torsos, which should stay in the classroom, the classroom setting in Natural sciences (NA) and Technology (TE) is rather self evident. However, the largest subject in terms of class time in both the NA and TE curricula is mathematics, which mostly only requires a book and a calculator. The images showing pupils working on mathematics are nonetheless set inside a classroom emphasising *Formal learning*.

The sub-theme *Collegial learning* is prevalent in images used to depict EK, SA and NA. Interestingly, the only image from NA representing this sub-theme comes from a description of the program profile oriented towards social science. The representations of the sub-theme *Informal learning* environments are a small number of images, however those are concentrated within the material associated with SA (only one image was found associated with NA). Images where the environment does not play a significant role, *De-contextualised*,

are also quite few in number, and appear in the context of materials describing the EK and SA programmes.

Finally, we also observe that the EK and SA programmes are associated with the greatest variety of environments, whereas NA and TE are nearly exclusively shown inside classroom environments.

TABLE I
LEARNING SPACE

Sub-theme	Number of images			
	EK	***NA***	***SA***	***TE***
Formal	8	28	14	26
Collegial	5	-	10	2
Community	6	1	2	-
Informal	-	1	3	-
De-contextualised	4	2	3	1

b) How does learning happen?: When scrutinizing the images in terms of the learning experience it became apparent that a primary feature was how the programs presented pupils working on tasks together in groups. In particular the distribution of group sizes varied (Table III). In TE, many of the images showed pupils working on their own or in groups of two. This is contrasted to SA where the most common group size is a group of three. Further, both EK and NA show images mostly with pupils working in groups of two, however a little more spread in number of participants is seen in EK. When the average number of group members is calculated for each program, TE stands out as having the smallest number, followed by NA, EK and lastly SA.

TABLE II
LEARNING EXPERIENCE

Sub-theme	Number of images			
	EK	***NA***	***SA***	***TE***
Information transmission	2	-	2	1
Experiential learning	-	22	3	26
Collaborative learning	12	14	17	15
Individual learning	2	5	4	12

TABLE III
GROUP SIZES

Size of group	Number of images			
	EK	***NA***	***SA***	***TE***
1	2	5	4	12
2	6	9	4	14
3	2	3	7	-
4	3	2	2	-
5	1	-	1	-
6	-	-	1	-
7	-	-	2	-
8	-	-	-	-
9	-	-	-	1
Average group size	2,6	2,1	3,1	1,5

c) What is learning about?: The focal point of the images reflects the access the spectator obtains to the people in the images. This differs considerably between the programs. In SA and EK pupils in the images look straight at the spectator *External*, while pupils in NA and TE do not (Table IV). Images categorized as *Internal* or *Artefact* are dominated by TE and to some extent NA, leaving SA as the program where human presence is most prevalent.

TABLE IV
FOCAL POINT AND AGENCY

Sub-theme	Number of images			
	EK	***NA***	***SA***	***TE***
External	12	3	13	5
Internal	2	4	-	4
Artefact	2	1	1	4

VI. DISCUSSION

Several high level patterns associated with the portrayal of university preparatory programs in general, and TE in particular, can be clearly identified. *Learning spaces*, which serves to characterize the setting for the images and can be interpreted as reflecting the learning context of the programs they represent. *Learning experience*, which depicts the different approaches to organize school work in the programs. The nature of the image in terms of *Focal point and agency*, which associates the discipline with concrete items, manifestations of technology as items and is contrasted to the higher level of human presence and spectator engagement in images prevalent in the presentation of other programs.

A. Technology people are less social than others

There are two findings that contribute to the image of technology people as less social. The first is the sub-themes of the theme *Learning space*, especially in terms of the sub-themes *Collegial* and *Community*. Here pupils interact with each other outside of the classroom *Formal* context. Since this is only seen in EK and SA, it appears to represent the social part of being a pupil in EK and SA, leaving TE and NA as being the choice of the less social ones or perhaps those who are constrained by or preferring their school tasks.

The lack of social activity can also be interpreted from the theme *Focal point and agency*, where pupils in SA and EK images look at the spectator more than pupils in NA and TE. The conception of technology people as less social is specially prevailing for computer scientists, with descriptions like 'lacking interpersonal skills' [12], [20]. A meta analysis of gender differences in vocational interests found that men preferred working with things *Artefacts* and women with people [21]. Considering the portrayal of TE in our images, we observe substantially less human presence and more focus on things, this might be expected to appeal to more male than female pupils.

B. Technology professionals work alone

When the sub-themes *Collaborative learning* and *Individual learning* of the major theme *Learning experience* are analysed for frequency in images associated with the different programs, a pattern of small group sizes emerged for NA and TE can

be found. This is in stark contrast to the larger group sizes of SA and EK. The average number of participants in a group differed by a factor of 2 between TE and SA, distinctly depicting TE as more associated with individual work than group work.

Again this has gender coding implications. College women who read about a scientist performing independent tasks showed less positive attitudes toward science careers than college women who read about scientists doing collaborative tasks [6].

The contrasts between the programs might draw youth, having a certain view of their identity rather than because of interest, to some programs, differentiating the body of pupils, which in turn recreates the prevailing norms and culture within the program. However, information about prospective study programmes will most likely also be gathered from a variety of other sources beyond the context of school websites, such as, friends, programme reputation, open house events at schools, student counselors amongst others. However, these other sources of information are also coloured by prevailing socio-cultural norms.

While the overall analysis presents a rather conservative image of TE, the presence and variation of visual features designed to communicate TE in our material is diverse and the focus of the images differs greatly between schools. While many schools present a stereotypical image of technology education as masculine and centered on artefacts, others in our sample utilise images where both gender and activity does not reproduce the prevailing stereotype.

VII. Conclusion

We analysed pictorial data collected from a sample of upper secondary (gymnasium) schools around Sweden. Social constructionist thematic analysis was applied as a theoretical lens with which to explore communicative patterns in the images associated with different study programmes. Our analysis identifies several clearly distinct themes and this combined with a supplementary quantitative content analysis allows us to conclude that despite a rhetoric of change, the dominant portrait of technology education remains artifact-centric and socially distant. This finding is deeply problematic in the light of prior research on the impact of an artifact-centric and socially distant structure on inclusivity and diversity of recruitment in the engineering education literature [22], both in terms of gender balance, as well as the broader accessibility of engineering identities for under-represented, and diverse socio-economic groups.

Acknowledgment

The authors wish to extend their sincere thanks to Mr. Andrew Doyle for valuable input regarding formulating the results in a clear manner and in particular the compilation and interpretation of the tables.

References

[1] C. Schreiner and S. Sjøberg, "Science education and youth's identity construction-two incompatible projects?" in *The Re-emergence of Values in Science Education*, 2007.

[2] M. V. Bøe, E. K. Henriksen, T. Lyons, and C. Schreiner, "Participation in science and technology: young people's achievement-related choices in late-modern societies," *Studies in Science Education*, vol. 47, no. 1, pp. 37–72, Mar. 2011. [Online]. Available: http://www.tandfonline.com/doi/abs/10.1080/03057267.2011.549621

[3] A. Bryman and B. Nilsson, *Samhällsvetenskapliga metoder*, upplaga 3 ed. Stockholm: Liber, 2018.

[4] N. Fairclough, *Language and power*, ser. Language in social life series. London ; New York: Longman, 1989.

[5] L. Archer, E. Dawson, J. DeWitt, A. Seakins, and B. Wong, ""Science capital": A conceptual, methodological, and empirical argument for extending bourdieusian notions of capital beyond the arts: SCIENCE CAPITAL," *Journal of Research in Science Teaching*, vol. 52, no. 7, pp. 922–948, Sep. 2015. [Online]. Available: http://doi.wiley.com/10.1002/tea.21227

[6] A. B. Diekman, E. K. Clark, A. M. Johnston, E. R. Brown, and M. Steinberg, "Malleability in communal goals and beliefs influences attraction to stem careers: Evidence for a goal congruity perspective." *Journal of Personality and Social Psychology*, vol. 101, no. 5, pp. 902–918, 2011. [Online]. Available: http://doi.apa.org/getdoi.cfm?doi=10.1037/a0025199

[7] M.-T. Wang and J. Degol, "Motivational pathways to STEM career choices: Using expectancy–value perspective to understand individual and gender differences in STEM fields," *Developmental Review*, vol. 33, no. 4, pp. 304–340, Dec. 2013. [Online]. Available: https://linkinghub.elsevier.com/retrieve/pii/S0273229713000269

[8] S. Cheryan, V. C. Plaut, P. G. Davies, and C. M. Steele, "Ambient belonging: How stereotypical cues impact gender participation in computer science." *Journal of Personality and Social Psychology*, vol. 97, no. 6, pp. 1045–1060, 2009. [Online]. Available: http://doi.apa.org/getdoi.cfm?doi=10.1037/a0016239

[9] M.-T. Wang and J. L. Degol, "Gender Gap in Science, Technology, Engineering, and Mathematics (STEM): Current Knowledge, Implications for Practice, Policy, and Future Directions," *Educational Psychology Review*, vol. 29, no. 1, pp. 119–140, Mar. 2017. [Online]. Available: http://link.springer.com/10.1007/s10648-015-9355-x

[10] "SCB," 2020. [Online]. Available: https://www.scb.se/vara-tjanster/oppna-data/

[11] D. I. Miller, A. H. Eagly, and M. C. Linn, "Women's representation in science predicts national gender-science stereotypes: Evidence from 66 nations." *Journal of Educational Psychology*, vol. 107, no. 3, pp. 631–644, 2015. [Online]. Available: http://doi.apa.org/getdoi.cfm?doi=10.1037/edu0000005

[12] S. Cheryan, V. C. Plaut, C. Handron, and L. Hudson, "The Stereotypical Computer Scientist: Gendered Media Representations as a Barrier to Inclusion for Women," *Sex Roles*, vol. 69, no. 1-2, pp. 58–71, Jul. 2013. [Online]. Available: http://link.springer.com/10.1007/s11199-013-0296-x

[13] S. Cheryan, J. O. Siy, M. Vichayapai, B. J. Drury, and S. Kim, "Do Female and Male Role Models Who Embody STEM Stereotypes Hinder Women's Anticipated Success in STEM?" *Social Psychological and Personality Science*, vol. 2, no. 6, pp. 656–664, Nov. 2011. [Online]. Available: http://journals.sagepub.com/doi/10.1177/1948550611405218

[14] U. Tellhed, M. Bäckström, and F. Björklund, "Will I Fit in and Do Well? The Importance of Social Belongingness and Self-Efficacy for Explaining Gender Differences in Interest in STEM and HEED Majors," *Sex Roles*, vol. 77, no. 1-2, pp. 86–96, Jul. 2017. [Online]. Available: http://link.springer.com/10.1007/s11199-016-0694-y

[15] A. Ottemo, *Kön, kropp, begär och teknik passion och instrumentalitet på två tekniska högskoleprogram*. Göteborg: Acta universitatis Gothoburgensis, 2015, oCLC: 943199537. [Online]. Available: http://hdl.handle.net/2077/39621

[16] V. Braun and V. Clarke, "Using thematic analysis in psychology," *Qualitative Research in Psychology*, vol. 3, no. 2, pp. 77–101, Jan. 2006. [Online]. Available: https://www.tandfonline.com/doi/abs/10.1191/1478088706qp063oa

[17] M. Winther Jørgensen and L. Phillips, *Diskursanalys som teori och metod*. Lund: Studentlitteratur, 2000, oCLC: 467842534.

[18] K. Trigwell and M. Prosser, "Development and use of the approaches to teaching inventory," vol. 16, no. 4, pp. 409–424. [Online]. Available: http://www.springerlink.com/content/v67702j33t854r35/
[19] M. Prosser and K. Trigwell, "Confirmatory factor analysis of the approaches to teaching inventory," vol. 76, pp. 405–419.
[20] J. Margolis and A. Fisher, *Unlocking the clubhouse: women in computing*, 1st ed. Cambridge, Mass: MIT Press, 2003, oCLC: 254900261.
[21] R. Su, J. Rounds, and P. I. Armstrong, "Men and things, women and people: A meta-analysis of sex differences in interests." *Psychological Bulletin*, vol. 135, no. 6, pp. 859–884, Nov. 2009. [Online]. Available: http://doi.apa.org/getdoi.cfm?doi=10.1037/a0017364
[22] S. Virtanen, E. Räikkönen, and P. Ikonen, "Gender-based motivational differences in technology education," vol. 25, no. 2, pp. 197–211. [Online]. Available: https://doi.org/10.1007/s10798-014-9278-8

APPENDIX A

The observation protocol used to support the analysis of the images that constitute the empirical data collection for this study can be found below.

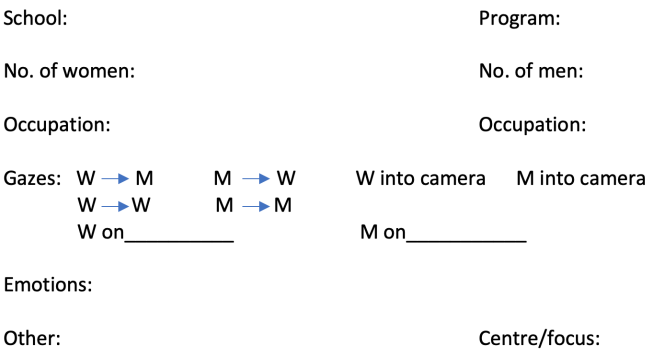

Fig. 1. Observation Protocol used in Analysis of Pictorial Material.