E-learning material on gender equality in information system professions

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ABSTRACT

Gender equality is a worldwide actual issue touching upon every one of us. Without gender equality, we cannot reach a sustainable world. Information technology seems to be a domain and professional area where men have traditionally dominated, without any good reason. There is a worldwide call for more women to become IS professionals. In this article, we review what kind of open-access material to educate about gender equality in Information System domain and professions can be found. Together 6 (n=6) material sets were found, mainly targeted for adolescents. Public bodies such as UN or UNESCO provide open source materials, though activity of some private parties can also be found.

CCS Concepts

Applied computing→Education→ E-learning

Keywords

IS professions, Information Systems, eLearning, learning material, Gender Equality

1. INTRODUCTION

Gender equality is one of the United Nations 17 sustainable development goals (SDGs) to transform our world [1]. Many areas do not yet show reasonable and satisfying development, and Information Systems development and use is one of them [2-4]. Especially, several studies have shown that women are not enough recruited to Information and Communication Technologies (ICT) professions and education [5-8].

Lack of development is not due to missing material. Alone Google Scholar found some 1 880 000 results with the search term "Gender Equality" 1.11.2019. The same day Google found 15 800 000 results with the search term "Gender Equality Seminar". Material on gender equality in ICT professions is of course less in amount, but not at any means scarce.

This richness of material invited to study, what kind of teaching material there is for available actors wishing to educate third parties about gender equality in ICT. This research topic is important, as absorption of gender equality ideas and worldview is a social activity, naturally and more intensively happening in a social interaction such as face-to-face studies and as individual labour.

As far as we know there are no earlier studies that would have undertaken this research task. There are plenty of studies discussing gender equality teaching and education [9-11], but we have found no research analyzing publicly available gender equality in ICT professions teaching/education material.

This research endeavor meant that we had to define what teaching material is. We define teaching material here as something to be used by an actor to teach further, third parties. Self-learning material, which constitutes the most of the material in the Internet about gender equality, is not teaching material in the sense we are looking. Without excluding self-learning material, we would have drowned to material to be analyzed.

At best teaching material would of course be called "teaching material" or "education material" or similar. Typical teaching materials are PowerPoint slides, and nowadays videos, available for example on the YouTube. Books and other long text materials, even though maybe called as teaching material, are not the kind of teaching material we were searching, as they cannot be completely consumed within a face-to-face teaching episode.

For us the starting point was that the material should be freely available for everybody, also open source [12]. The natural place to search for open-source material is Internet.

A strong indicator that we have to do with teaching material would of course be availability of items such as "timeplan for lectures", "curriculum plan", "teacher support material", "sample questions", "sample examinations" or similar. Mention of some target group for the education or teaching would also be rather convincing to show that the material at hand is teaching material.

Our starting point for the material is that it can be used in face-to-face (classroom) teaching situations. Of course, we also analyzed material to support learning in digital settings. We set no boundaries on the target groups: any target group for small children all the way to people in executive positions and top of politics would be included.

2. REVIEW OF TEACHING MATERIAL

2.1 Methods and research material

The web represents an opportunity to provide accessible material on gender equality in ICT. In this paper, we aimed to research on-line learning materials that a user might access when searching for information on gender equality in the context of ICT.

It is critical to have a definition of what we consider as a *learning environment* in this study. Here a learning environment refers to a lot more than the physical locations [13]. With other words a learning environment is a digital, spatial or spiritual space where the learning happens. Here we consider the internet as a digital learning environment or an e-learning environment. Teacher has an essential role for designing, creating and maintaining the learning environments for the learners.

2.2 Study questions

This paper answers to the study question: What kind of learning material for instructors or teachers exists at the internet? It has to be noted, that in this paper we do not analyze the contents of the study material, as the amount of data would be too big. We rather describe to whom the material is provided, how it can be accessed, who has published the material and who is it targeted to. This information is relevant when designing learning environments in the context of gender equality in ICT.

To find out what are the resources for teaching gender equality in ICT we identified potential sites or relevant links for the study by using Google search engine by using the search words: *teaching gender equality in ICT, gender equality curriculum in ICT, gender equality and ICT toolkit, gender equality in ICT lesson plan, gender equality ICT curriculum.* We excluded the sites that were about gender equality in ICT, but were not direct teaching material such as reports, newsletters or webpages presenting activities of an organization or activity. After the prior process, we assessed the sites by the content of the pages and decided to use the snowball method to find more research material suitable for this study. We analyzed all the webpages that we agreed to include in to the research by rating the scope, publisher, the geographical area, update information, open access and motivation behind.

2.3 Results

We found six (n=6) web pages in English that contained learning material for gender equality in the context of ICT. The studied materials with their URL are summarized in Table 1.

Table 1 The studied materials and their URLs

Material name	URL
Towards Gender Equality in Education Policies and ICTs	https://www.intel.com/content/dam/www/public/us/en/documents/corporate-information/gender-equality-education-ict-unesco-girl-rising.pdf
ICT in Education Policy Platform	https://www.ictedupolicy.org/content/about-us
Guidelines to Increase and Retain Women in ICT	https://eskills.org.mt/en/womeninict/Documents/Guidelines_Women_In_ICT.pdf

The Gender Equality Collective	https://thegec.org/edtechcollective
Tech pathways	https://techpathways.london
@TeacherToolkit	https://www.teachertoolkit.co.uk/2017/03/27/girls-into-tech/

2.3.1 Towards Gender Equality in Education Policies and ICTs

The use of this 26-page material is for the internal and external experts, gender consultants and event management teams. The owner and publisher of the material is the Intel Corporation in collaboration with UNESCO and GIRLRISING. The content is for policymakers and stakeholders who are involved with gender equality issues. Material is at quite a general level, but offers discussion topics and gives detailed information, how to establish a workshop activity The material is targeted for low-income countries, development countries (e.g. Africa) or developing countries (e.g.South East Asia), but can be implemented worldwide. The material guides how to organize 1 or 2-day workshops. It describes how to establish a policy plan systematically by creating a shared vision, developing a Master Plan, Implementing Initiatives as well as the Evaluation. The publisher launched the material 2014. It seems no to be updated since the publication time and it has the open access status. The material is established by Intel. Based on the picture material (one picture with five school-aged young African girls running in their school uniforms) it looks like the motivation behind this material is to get more girls in developing or development countries to get involved with ICT through education. On a larger scale, this material is about educational transformation with developing curriculum, pedagogy, assessment, teacher professional development and further on the educational system.

"ICTs are considered one part of the broader context of educational transformation. Policies and programs linking ICTs to curriculum, pedagogy, assessment, teacher professional development, and school organization and management can transform an entire educational system and guide everyday practices of teachers and school leaders."

The material provides detailed instructions on how to establish a workshop as an instructor or teacher. As the material is not a traditional teaching material but for policymaking, there are no possibilities to test the outcomes of the learning.

2.3.2 ICT in Education Policy Platform

The material is a portal, an online platform that provides The ICT in Education Policy Platform offers countries a shared space dedicated to transforming education through education policy - a possibility for countries to create and discuss their respective plans and implementation. Ministry officials, academics, practitioners and other stakeholders engaged in the field of ICT in Education — from primary to higher education — can access resources, news, and join policy discussions. One topic of this platform is gender equality. The platform enhances to organize working groups on the topic of gender equality in ICT. Weidong Cloud Education Group is a global Internet education platform operator from People's Republic of China and it holds a strategic partnership with UNESCO and focuses on building worldwide Internet-based educational ecosystems for learners, educators and government. UNESCO promotes the use of ICT to achieve inclusive and equitable quality education. Through assisting countries in

developing and implementing education policies, UNESCO places particular emphasis on the empowerment of teachers, the promotion of Open Educational Resources, and the use of mobile technology for lifelong learning opportunities.

The publisher updates the material as there is a newsletter added to the open access web pages. This portal does not provide any practical hints or advices for the instructors or teachers, tests nor any other evaluation material.

The portal provides access to UNESCO-ICT-in-Education Toolkit. UNESCO Bangkok administrates this portal. Based on the logos in the bottom of the web pages the collaborative partners are Japanese-Funds-In-Trust; InfoDev; AED and Knowledge Enterprice. The United Nations Educational, Scientific and Cultural Organization and Asia and Pacific Regional Bureau for Education conceived and originated the idea of a toolkit to support decision making regarding the integration and the use of information and communication technology in education and learning systems. The principal Architect and Author of the portal is Wadi D. Haddad, Ph.D.

The available toolkit is updated version 2.0. Knowledge Enterprise, LLC published this version of the Toolkit for infoDev (World Bank) and the original web pages were created 2007.

The teacher or instructor is able to access to the material by submitting a registration. There are registration challenges due to Modzilla update launched 2016 as the connections seems not to be working. Based on the picture material (children in school groups, academic, agricultural, European, African people) and the text, the idea behind this portal is to develop 21st Century Skills worldwide, the focus is in developed and developing countries.

2.3.3 Guidelines to Increase and Retain Women in ICT

These 33 page wide guidelines are published in pdf format. The publisher is eSkills Malta Foundation. The eSkills Malta Foundation is a National Coalition made up of various representatives from Government, industry and education, who can contribute to the increase in digital skills and the development of the IT profession. The Maltese Government established the eSkills Malta Foundation to reflect this paradigm of inclusive synergy. The Founding members of the Foundation are the Ministry for Education and Employment, the Malta Information Technology Agency, the Malta Communications Authority, the Malta Enterprise, The Malta Gaming Authority and The Malta Chamber of Commerce Enterprise and Industry.

The webpages are for those stakeholders who may have concerns about the low percentage of women in the ICT sector. The material is designed for small, medium and large enterprises together with NGOs, gender equity advocacy coalitions, the media, educators, career advisors, the government and decision makers. The introductory part of these guidelines provides a short summary of facts and statistics that describe some issues that women face in the ICT sector, and then suggests possible reasons why women are not interested in this area. The second part of the document provides guidelines that the learner may adopt for increasing and retaining women in the ICT sector.

International best practices indicate that multi-sectoral partnerships are one of the key approaches in achieving synergy in the sustainable development of the right digital skills. One of the main national and European concerns is the participation of certain groups in the society, both for the participation in the ICT industry and for having access to equal opportunities in taking advantage of the digital opportunities. One of these target groups is the female

gender where especially in the ICT industry the numbers are very low. The proposed objectives of the group are: to increase the participation in the Digital industry or digital related industry by girls and women; to enhance access to equal opportunities in taking advantage of the digital opportunities; to increase the Quality of Resources for the ICT Industry; to discuss Gender issues at place of work in the digital environment and propose possible solutions and to contribute to Policy to stakeholders.

These Guidelines are presenting initiatives, policies and best practices that are compiled in Europe, Malta and Australia in the Western culture. However, this document could serve to inspire organizations worldwide to engage a continuous dialogue on the subject.

The material does not have any lesson descriptions or precise instructions for the teacher or instructor, rather it explains that stakeholders should educate teachers to make them understand how important it is to enhance girls and women to get involved in ICT. The most recent references are from 2017, but the update information is not available. This material is open access.

The eMalta Foundation has designed the material. The European Commission repeatedly claims that the EU is facing a potential crisis in human capital, which can endanger its ability to be competitive in world markets. Although the unemployment rate in the EU amounts to 8,5 % in 2017, there are branches of the labour market that are faced with a drastic scarcity of skilled employees, and many job vacancies are not filled for months or years. The ICT sector is one of such sectors.

It is predicted that Europe "may experience a shortfall of up to 756,000 ICT professionals by 2020." One of the main reasons why the sector suffers from such a lack of labor is that women are not fully engaged in the sector. Only 28% of workers in the ICT industry are women. In this learning material, there are no practical instructions for teachers, but some general topics for instructors to carry out discussions and take actions towards learning and working environments that are more equal and in the context of ICT.

2.3.4 The Gender Equality Collective

The Gender Equality Collective (GEC) is a portal type web page that presents gender equality issues. The users can be for instance policy makers, teachers or youth workers. Two women established this portal. They wanted to implement the gender equality principles. The focus of the portal is in making change with conscious measures and action taking. There are various sub-pages, for instance signing a charter (some kind of agreement or promise) to enhance gender equality. The charter is a commitment by signatories to work together to achieve gender equality. The founders built the Charter on the belief that equality of the sexes is critical to the future of the UK. The founders are committed to building a country whose leadership, influence and agenda is directed to people who fully reflect the society they serve. The pages present women in technology who have created their career in the technical sciences or those women who are promoting gender equality in their work-life activities.

The content aims to bridge the gap in the imbalance of genders in homes, schools and business. The portal enables education, debate, listening, discussions and comments, voting and sharing. The material is practical, but does not hold precise curriculum contents, rather ideas that teachers or instructors could implement. This material is interactive and asks those, who sign in to participate debates, signing charts or reading the blogs.

This material seems international, but it has strong connections to the UK. The activities for teaching are however on quite general level. The material is on developing phase and the founders are collecting donations for to complete the web pages. The founder established the pages 2018 and added some updates 2019, so the pages are up-to-date. The use of the material requires registration, but otherwise it is open access. There are no specific requirements to use the web pages. The material explains in a detailed way, how to discuss the gender imbalance, but as the web pages are still on developing phase, the material is not very rich. There are some self-assessment activities available. The sub-web page #Smashing Stereotypes has minor activities and competitions for Children and for the youth to participate.

2.3.5 Tech pathways

The London Connected Learning (LCLC) is leading the program in partnership with Queen Mary University of London. The office of Mayor of London has designed this Tech pathways material as part of the Digital Talent programme, aiming to bridge the digital skills gap between education and the 21st century job market. The program helps educators support young people in developing the digital skills they need to succeed in the modern workforce. The program links educators with industry partners from across London's digital and cultural sectors. The material is free to use, but only those who are involved in teaching technical skills for the youth aged 11 - 24 years are eligible to sign. On the other hand, the portal says "whatever your subject or area of expertise, this programme is for you".

The website presents the face-to-face courses, online lessons, blogs and videos. The gender equality is one topic of Unconscious bias toolkit. It aims to bridge the digital skills gap between education and the 21st century jobs market. The aim of the program is to help educators support young people in developing the digital skills they need to succeed in the modern workforce.

The courses are ready made and locked in such a manner that teachers can´t make any additional parts to them. The publisher designed the material to serve better the youth educators in London. There are different kinds of courses. The short courses are between 45 minutes to two hours; these courses provide information about digital skills needed by industry. The Depth courses would last two terms containing face-to-face sessions, online learning and industry mentoring. The gender equality is one of the short courses containing issues like unconscious bias. The material and the portal is newly established and the latest updates are from autumn 2019.

The aim of TechPathways London is to bridge the gap between the digital skills acquired in education and those required by London's digital and creative industries. The founders are working to help educators to develop their digital skills and to increase knowledge of and access to London's diverse and growing digital sectors. The motivation behind the activities seems to be serving better the needs of growing industries in London area as well as providing easily accessible material for educators to teach young people for these needs. The program is collaborating with some stakeholders such as program A New Direction. That is a London-based non-profit programme to generate opportunities for children and young people to unlock their creativity.

The short courses contain quiz questions. To fill in the evaluation questionnaire is compulsory, otherwise the continuing the use of material is not possible. There is a possibility to join for interactive social media activities such as discussion forums to share the knowledge and learn from other educators. Some of the courses are computer science focused, but the service provider is co-operating with cultural organizations and creative industries to look at how technology is transforming those workplaces and how best to prepare young people for them.

2.3.6 @TeacherToolkit

Teacher toolkit is a platform providing with lesson plans, blogs, social media, trainings and presentations on various subjects for all levels of education from kindergarten to university. The company was founded by a private person, who has been working as a teacher and is currently working with his phD in Britain. The gender equality part of the learning material consists of tips to teach technology for girls and to enroll in the TechFuture Girls, an after-school club that the stakeholders designed to encourage girls to stay engaged in IT. The provider points out that this club helps girls develop their tech skills through a series of fun challenges, themed around their interests – like music, sport and dance. The TechFuture Girls provides unlimited access at home for all staff and students in the school. The material is very practical, such as starter guide, posters for advertising and an access to dedicated club facilitator area. The material has also support materials for preparing the lessons. TechFuture Girls learning topics includes over 60 hours of online and more than 150 hours of offline extension activities.

The target group is teachers on all levels kindergarten, primary, secondary, gymnasium, even university. The gender equality material is for primary school students as it is meant to be used in the after school activities. The material consists of teaching materials, lesson plans and exercises. Also background information for professional development is provided as well as books, written by the founder. The portal type web page describes teaching and schools in various countries, for instance in Belarus. The material is international. The activity started 2008 and has been up-to-date since then. This material is open access and partly for free use. Some parts of the material has to be purchased. The company gets advertising outcome from private companies. Teacher Toolkit articles and resources have reached over 10 million readers in over 200 countries.

@TeacherToolkit content is shaping classroom practice, supporting teachers, parents and students the world over, for instance 50 million people have seen their tweets during the last year. This company was originally founded in 2008 and it started from a Twitter account. Later on the founder Ross Morrison McGill moved towards a team approach in 2017 as more resources were needed. This portal gives teachers "a professional platform from which to be heard; to promote the teaching community by sharing ideas, research; to challenge policy, guidance and publications; to provide teachers across the world with solutions to support their professional lives and working environments." The company promotes edtech start-ups, offering them the support and the chance to publish their work with us, publishing resources they believe in, content that is up to date and inclusive.

The material about gender equality tells a video story of a teacher and how she was "breaking into the tech world" and became a Senior Business Technologist. The web page offers tips, how to engage girls with technology and it advices teachers to be forward-thinking, so that we can make the curriculum fit to what the children need and tailor IT classes to their real life experiences of technology. It advices teachers, how to motivate young girls with ICT, for instance "Don't give a child data to input in Excel, that's not interesting to most children. Get them to create films, walk through booking tickets for transport to explore timetables, create their own vlogs imitating their heroes." The company is active in the social media and for instance there is a podcast How Can We Encourage Girls Into STEM Careers. Carrying out TechFuture Girls doesn't need any specialist IT expertise or software and it's

curriculum-compliant. It supports girls' learning in IT and across the curriculum, and benefits their confidence and self-esteem.

3. CONCLUSIONS

In our review we found six (n=6) by using Google search machine, all of which were included in this study. To frame the research area we included only those materials that had information on gender equality in ICT and that were pointed directly to the teacher or an instructor. As this paper has a multi-disciplinary approach, we consider here the learning materials as digital learning environments for teachers.

Based on the findings of this research we conclude firstly that the stakeholders seem to have a shared concern that we should teach gender equality issues in the context of ICT. The stakeholders, such as UNESCO as well as business and education, share the concerns. Secondly, based on the available teaching material this concern is worldwide - more girls and women should be involved with ICT in development, developing and high income countries. The lack of women in ICT seems affect the business and the situation is getting worse as the digitalization affects more our societies. The learning environment that was included in this study covered all study levels from kindergarten to university as well as working life. The designers of the materials were private bodies, companies, associations and NGO´s, city councils and administration.

The digital material analyzed in this study contained videos, lesson plans, discussion ideas and interactive parts, such as social media, for instance Twitter or Instagram. The teachers could use the material upon registration or it was open access and mostly the material was free of charge.

The critical question is whether teachers really find this material in the internet and how well this material serves their needs. Our findings raise questions about the contents and usefulness of the gender equality teaching materials. It seems that no one holds a general or holistic picture of the situation and the result remains fragmented. There is a need to improve the accuracy and coverage of information.

4. DISCUSSION

Gender Equality is one of the 17 UN Sustainable Development Goals. Digitalization is one of the key megatrends in the world. These meet strongly when we discuss population groups in danger of exclusion in the Digital World, women in general being a part of this risk zone. At the core of this discussion is the share of women in ICT professions and in education leading to ICT professions.

We started with the idea that learning values (such as gender equality) is a social process that is empowered in a social setting. Active education and teaching, when possible happening face-to-face, is at the core of such learning. We should support this kind of learning opportunities.

With these starting points we started to search for open-source, free, education and teaching material available on the Internet, in English language, for parties that would like to organize education and teaching in issues related to ICT professions and education towards them. Any material planned to be studied alone was not included.

With Google search engine, we found six sets of education materials on ICT professions and Education Gender Equality. We analyzed these materials from various angles, including dimensions of the scope, publisher, the geographical area, update information, open access and motivation behind.

The first conclusion is that such teaching material provision seems not to be a big business. Might be because we were searching for open source material, but big traditional publishing and education commercial actors, as well as universities, seemed to be out of the field. Rather, the teaching materials seemed to be initiatives of public organizations such as UN or UNESCO, or initiatives by local national governments. These initiatives might have a commercial partner such as Intel in the first analyzed material set.

A second important conclusion is that the materials are mainly targeted towards school-aged children and adolescents. This might be natural, as they are the ones to be helped in their individual careers. On the other hand, material explicitly targeted on the other side, such as managers and employers of ICT companies, was completely missing, which leaves room for future improvements.

Sadly, we found no material that would inform us about the use activity of these materials. The material designers did not provide any user statistics or user experiences/feedback. Such material would first of course then be crucial when the amount of material would allow for selection. As researchers, we would welcome the use of statistics as a measure of the education activity in the field.

As said, we think our study is a pioneering work in such a research question and data collection endeavor. This of course leads to the situation that many shortcomings and limitations are connected to our study. We just used one search engine, Google, and searched for material on the English language. Future studies must be extended to other material search methods and to other languages. For the search terms to be used we had no previous examples, and we had to lean on snowball sampling [14] in addition to using pre-defined keywords. These on the other hand, should also be valuable add-ons to our search activities.

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