# Networked youth research for empowerment in digital society. The WYRED project

Francisco J. García-Peñalvo
GRIAL Research Group
Research Institute for Educational Sciences
University of Salamanca, Spain
fgarcia@usal.es

Nicholas Alfred Kearney
The BOUNDARIES Observatory Research Department, UK
nickkearney@gmail.com

## **ABSTRACT**

The emergence of the young as a distinct social group, and their slowly increasing empowerment through the availability of digital technology, has brought with it an understanding that they have a key role to play in the digital society, as drivers of new behaviors and understandings. However, their active participation in society is not reflected sufficiently in policy and decision-making, especially in relation to digital issues. Because of this, they are not well represented and unheard, and this makes it hard for research and policy to identify and understand their needs. These issues are further complicated by the fact that the group is a swiftly moving target, it is as heterogeneous as the wider society, and young people can be unwilling to be subjects of research. The WYRED project (netWorked Youth Research for Empowerment in the Digital society) aims to provide a framework for research in which children and young people can express and explore their perspectives and interests in relation to digital society, but also a platform from which they can communicate their perspectives to other stakeholders effectively through innovative engagement processes. It will do this by implementing a generative research cycle involving networking, dialogue, participatory research and interpretation phases centered around and driven by children and young people, out of which a diverse range of outputs, critical perspectives and other insights will emerge to inform policy and decision-making in relation to children and young people's needs in relation to digital society.

# **CCS Concepts**

- Information systems applications →Collaborative and social computing systems and tools →Social networking sites
- Human-centered computing → Human Computer Interaction (HCI)
- Law, social and behavioral sciences →Sociology
- Visualization → Visualization application domains → Information visualization

## **Keywords**

Social structure; Inequalities; Social mobility; Interethnic relations; Communication networks; Media; Information Society; Innovation policy; Technological ecosystems.

#### 1. INTRODUCTION

A particularly important change in the last 100 years in current society has been the emergence of the young as a distinct social group, and with it an understanding that they have a role in social change, as drivers of new behaviors and understandings. In particular, the young constitute one of the most active and enthusiastic sets of consumers of digital technology. For those born since the late 90's the Internet has always been there [24; 25], as television was for the previous generation, and for a large majority digital technology permeates most if not all aspects of their lives. In some senses, it could be said that they live —digitall lives. Given this, it might seem natural perhaps to include their perspectives in decisions about the digital society.

Unfortunately, this is not the case. As Tibor Navrascics, the Commissioner for Education, Culture, Youth and Sport points out in the Foreword to the recent European Commission document "Focus on: Empowering Young People to Participate in Society" [4] more than half of the young feel that "in their country young people have been marginalized and excluded from economic and social life" and many believe their concerns are not taken up by politicians.

In this context the WYRED (netWorked Youth Research for Empowerment in the Digital society) H2020 European Project was born. It aims to give young people a voice, and a space to explore their concerns and interests in relation to digital society and share their perspectives and insights to stakeholders with other strata of society.

Smith [31] identifies a number of factors affecting social change, such as shifts in relationships between social groups, shifts in categories of understanding of prevailing social structures, changes in the availability of sustaining material resources, changes when material objects that instantiate and express social structures (like, for example, church buildings, pubs or post-offices) fall into disrepair or become irrelevant, changes in moral and normative beliefs in the practices, procedures, rules and laws, or changes when newly mobilized systems of communication decrease the intractability of coordinated interactions. Much of this is happening in current society at present, we face challenges relating to resources, climate change and other environmental issues, an ageing population, and a range of inequalities, especially relating to gender. Many, if not all of these changes are affected, whether exacerbated or alleviated, by digital technologies. Furthermore, they are changes that most of all will affect the lives of those who are young at present. To address these challenges a more sustainable social and economic model is needed, since this is the only way to guarantee a viable future, and constructing this requires reflection on a range of issues, in the context of the digital society. These include, among others:

- Our lifestyles and consumption patterns.
- The diversity and inclusiveness of our society.
- Our business and economic behaviors.
- Our urban and domestic organization and behaviors.
- Our communication patterns.
- The boundaries of public and private.
- Societal organization and governance.
- Intra- and intergenerational relations, identity and trust.

Reflection on these issues, and the related development of a more sustainable social and economic model for a digital society cannot be carried out without the participation of the young. Each of the above issues requires exploration from their multiple perspectives (the young are not a homogeneous group). Their attitudes and concerns, their behaviors and ways of being will conform the focus of the future society, and need to be surfaced and understood.

The ultimate aim of the WYRED project is to contribute to the emergence of a good society, by helping young people to explore their concerns and voice their perspectives in relation to the digital society.

This is not however an easy undertaking; the current marginalization and disengagement that young people feel is partly due to the fact that their views have not been taken sufficiently into account.

Many initiatives have engaged in dialogue with the young, and countless reports have been generated, however the degree to which the conclusions of these reports are implemented into policy is limited, and this contributes to the sense of marginalization. The ways in which research is carried out also contribute to the lack of involvement. Frequently, the research process is owned and framed by others, and the phenomena that are observed and the questions asked belong to others. If we expect young people to engage, and participate in the definition of sustainable models for future society, they need to be able not only to express their views, but also to be directly involved in the framing and design of the research process; in order to ensure that the issues explored are relevant to them, and that the questions asked are apposite.

A key aim of WYRED is therefore to engage young people in a process of social dialogue that gives them a voice, and help them use this process to design participatory research projects that allow them to surface and explore their concerns in ways defined by them. These projects may explore the issues chosen for investigation through a variety of approaches, including:

- Research projects where a social issue is addressed and solutions explored and discussed, surfacing attitudes and understandings through reflection in the process.
- Creative projects involving among others video, theatre, web publishing, comics, music, art, events of different kinds, that express attitudes and understanding though these media.
- Journalistic approaches, observing, documenting, recording and commenting on social phenomena, either online or off, producing documentary outputs in different media.
- Action research and ethnographic projects in which the participants explore their own perceptions as they play in their day-to-day lives, for example though journals or video blogging.
- Solidarity projects, where a specific problem is identified, and practical solutions implemented, where the output is a narrative of
  the process and the problems faced in solving them.

The central element in common to all the WYRED approach is that they will be driven by the young themselves. The projects will be self-directed, though supported by the WYRED project consortium; the research and youth partners have extensive experience in facilitating this range of different processes. The work will therefore generate a wide range of artefacts, and insights and recommendations grounded firmly in the concerns of the young themselves.

This kind of research approach can sometimes be objected to on the grounds that it is not objective. Unfortunately, complex systems such as those that affect change in society, particularly technological changes such as the advent of the digital do not permit the adoption of an external viewpoint. The complex feedback mechanisms involved in the interactions between for example technology and people are difficult to comprehend not least because there is no external vantage point where an observer can be positioned. We are all participants in the processes taking place. Furthermore, deep understanding of the changes taking place cannot arise through economic or academic

abstractions alone. As Feenberg argues, "The economic significance of technical change often pales beside its wider human implications in framing a way of life" [5]. There is a need to surface grounded, practical insight gained from direct contact with the ways of life that are affected. We need the voices of those affected to be heard if the new insights that emerge are to be relevant.

This requires a kaleidoscopic approach to research that includes as wide a range of voices and perspectives, and allows them to interact and engage with each other, rather than a wide angle perspective from a single view point. This heterogeneity needs to apply not only to contexts, the backgrounds of the participants, but also to their ways of seeing, listening and speaking and the ways in which research projects are framed.

This aspect relates to another key issue in the WYRED approach. At times in popular media the "young" is treated as a homogeneous group, but it is important to note that the youth population is highly heterogeneous not only horizontally across interest groups, sociocultural background and other factors, but it is also vertical. The wide age range that the term encompasses poses particular challenges, and the assumption of homogeneity leads to generalizations and misconceptions that compound the existing marginalization they suffer in decision-making processes.

The dynamics of privilege and exclusion remain as operative as in other segments of society and are arguably exacerbated by these assumptions of homogeneity. WYRED will address this by giving especial attention to inclusion and diversity, and especially gender issues. The consortium will ensure that all the processes and activities involved make include as wide a range of youth voices and perspectives as possible, with the object of facilitating the emergence of a truly diverse youth research community.

The WYRED project's innovative approach to social research with young people will focus on current attitudes, norms and values among young people in relation to the digital society. In particular attention will be given to the fact that though many young people are enthusiastic consumers of digital technology, they can often be vulnerable users. For this reason, part of the exploration in the project will be dedicated to the issue of online resilience and critical perspectives, moving towards autonomous use of digital technologies as opposed to consumption. The participatory research approach will also help to examine what may determine their engagement with society and change, and in particular to what extent they may drive or participate creatively in change.

## 2. PROJECT INFORMATION

WYRED (netWorked Youth Research for Empowerment in the Digital society) is a European Project (Ref. 727066.) funded by the Horizon 2020 Programme in its "Europe in a changing world – inclusive, innovative and reflective Societies (HORIZON 2020: REV-INEQUAL-10-2016: Multi-stakeholder platform for enhancing youth digital opportunities)" Call.

The project is coordinated by GRIAL research group [11; 14] of the University of Salamanca (Spain), starting at November 2016 and ending at October 2019. The consortium is completed with the following partners:

- Oxfam Italia Onlus (Italy).
- PYE Global (United Kingdom).
- Asis Ogretim Kurumlari A.S. (Turkey).
- Early Years The organisation for young children LBG (United Kingdom).
- Youth for exchange and understanding international AISBL (Belgium).
- Zauchner Studnicka Sabine (MOVES) (Austria).
- Boundaries Observatory CIC (United Kingdom).
- Tel Aviv University (Israel).

The total projects budget is 993,662.50€.

With the aim to provide a framework for research in which children and young people can express and explore their perspectives and interests in relation to digital society, but also a platform from which they can communicate their perspectives to other stakeholders effectively through innovative engagement processes, WYRED is informed by the recognition that young people of all ages have the right to participation and engagement. It has a strong focus on inclusion, diversity and the empowerment of the marginalized. The aim is to replace the disempowering scrutiny of conventional research processes with the empowerment of self-scrutiny and self-organization through the social dialogue and participatory research.

## 3. PROJECT STRUCTURE

The WYRED project is designed to work in cycles. The young are a moving target, as they grow and their attitudes change and develop. In order to maintain a flow of relevant insights it is necessary to maintain the flow of generative research and dialogue. For this reason, the WYRED process is understood as an ongoing cycle of contact and networking, social dialogue, open research activity, interpretation and recommendation, that as soon as it ends begins again. Two cycles are planned within the funding period. A third will begin just as the project is ending.

The issue of empowerment is important in relation to research with young people. research projects are frequently framed and designed in terms that are not those that young people either identify with or find relevant or useful. The result is that although young people may respond to the questions asked of them in these contexts, both before and after the questions are asked their voices are subjected to the theorizing of others about their reality.

This leads to a sense of disengagement and marginalization, and a simple understanding that their concerns are not being heard. In contexts such as these the real understandings and perspectives held by young people can be driven underground.

The WYRED project aims to replace disempowering scrutiny with the empowerment of self-scrutiny and self-organization through the process of social dialogue and research activities that it aims to facilitate.

Other important issue is heterogeneity. Despite the fact that the media and society frequently portray young people as a homogenous mass, the perception of WYRED consortium is that young people do not perceive themselves in this way. They are as heterogeneous and diverse as any other social group. Though when addressing issues relating to discrimination, it may be necessary to speak of young people as a single group it is largely unhelpful since it constitutes an obstacle to understanding the variety of different perceptions and understandings that young people may have. This implies that single theories and explications of the nature of young people, the perceptions of young people, the motivations of young people are likely to miss the target. What is needed is an approach that respects and celebrates the diversity of young people and gives space for all their voices. The WYRED platform (WP3) aims to do this by integrating attention to inclusion and diversity throughout the project thanks to the inclusion of a specific work package (WP2) for this purpose. In addition to this, by attracting a wide diversity of young people into the activity (in WP4 networking), by engaging in social dialogue (in WP5) that respects and reflects the diversity of perspectives, and then by facilitating a wide range of different research activities for different issues and different groups, each organized as the young participants involved see fit. In this way the diversity of youth perspectives can emerge and be explored.

A key challenge however that arises out of this heterogeneity is that it complicates the generation of outcomes for policy. The domain of the study of changes in society, especially in relation to digital aspects, is contested: many discourses including philosophy, sociology, social cybernetics, biology, psychology and economics provide differing, and sometimes overlapping accounts of the changes currently taking place in the ways we live, behave and work. This contested theoretical setting is coupled with the heterogeneity of young people and of human communities, and personal identities whose agency is increasingly oriented around similar technological practices, but whose identities, values, histories, and tendencies as we have commented, remain distinct and irreducible. The situation is more complex than earlier in the 20th century when grand theories (for example those of Keynes [22] or Hayek [19]) could be used to ground reliable interventions by policy makers. Now policy makers have to absorb knowledge from a vast range of theoretical contexts, and gain insight into the diverse communities with which they seek to intervene, many of which may have conflicting demands and ideas. At the same time, practicable policies have to be produced, bearing in mind the need for political pragmatism and the development of policy which resonates with popular (rather than academic) understandings.

The WYRED consortium position is that the transformations we are currently undergoing in European society are of such plasticity that formalized models and academic grand theory will increasingly be compromised in their ability to explain and predict events, not only in everyday life, but also within their own academic terms. In order to address this problem WYRED focuses on implementing a process of continual dialogue and exploration, generating insights (rather than grand theories) that are grounded in the everyday perceptions and understandings of young people and their lived experience in the digital society. The data and other outputs of the process are subject to interpretation by the young people themselves, by the partners in the consortium and importantly by other stakeholders and indeed the wider society, since the data and outputs will be open access. In the processes of evaluation and recommendation that take place in WP7, the insights and outputs of the WYRED process will be discussed and interpreted, and explanations and recommendations generated for use in the valorization work package (WP8). WYRED aims to have an impact on policy-makers by helping them to engage with what is an interpretive and adaptive process, rather than produce a closed product. Only in this way can the heterogeneity be respected. In this sense, the key aim of WYRED is to suggest a rich range of possible paths for transition to future models, as opposed to a fixed roadmap.

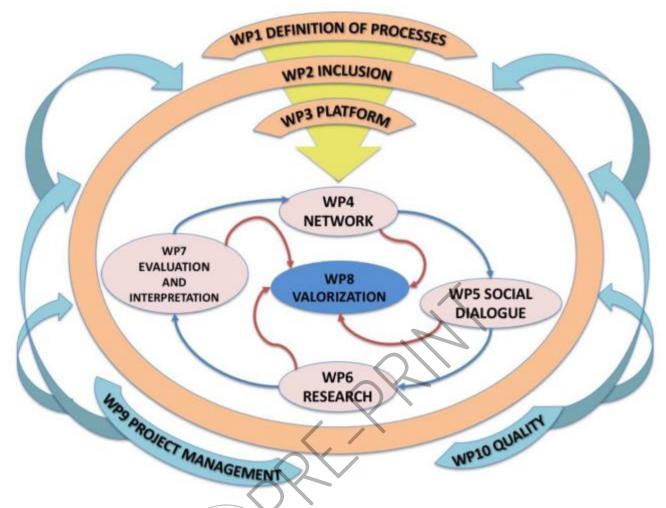


Figure 1. Work Packages diagram of the WYRED project

Another important aspect of the WYRED approach is the notion of generative research. This idea derives especially from the contexts of design and user research which are appropriate for the kind of research that is needed to surface the attitudes, experiences, understandings etc. of the participants. Generative research is creative [30]. In generative research the creativity of the participants is given space and structured around shared experience, such as the research activities proposed in WP6. The focus in the project is on what can emerge from the research process and particularly on what the young people who participate may create or generate through their exploration. The consortium is multidisciplinary, with a range of different forms of expertise including software engineering, computer science, gender studies, future studies, educational research, cybernetics, evaluation, business, market research, sustainability and environmental issues, creativity, youth activity, and peace-building. It is envisaged that the research activities will focus on arriving a wide range of different social and cultural issues related to different aspects of the digital society, which as is perhaps self-evident in increasingly intertwined with the analogue indeed it might be argued that in many walks of life to distinguish between them is no longer useful. These issues will be defined and selected through the social dialogue process in WP5 and to provide an agenda a priori would be to betray the focus on the need for young people to set the agenda. However, given its extensive experience in the context of work with young people the consortium anticipates that issues such as online safety and vulnerability, trust, identity, the boundaries of public and private and other aspects of appropriate online behavior, relationships and communication are especially likely to be explored. Other wider issues that are affected by the digital in diverse ways are also likely to appear, such as sustainable lifestyles, consumption patterns, ethical business and economic behaviors, climate change and resource scarcity. Others such as civic organization and behaviors, domestic organization and behaviors, aging populations and health care will also be floated as possible areas to explore.

However, it is also important to note that the generative process involved in the WYRED cycle also includes the dialogue and interaction processes involved, particularly in WP5 but also in parts of WP3. A diverse range of asynchronous and synchronous dialogue approaches will be used in the project, including for example Structured Dialogue, World Café, Open Space Technology and others, and these will be designed to generate insights around thematic areas and important issues and questions to be explored. These will emerge as much from the interaction between different perspectives and viewpoints as from the expression of singular positions. In this sense, the dialogue process generates insight and understanding, and gives a chance for diverse voices to be heard.

The WYRED project is focused on sustainability and community-building. Because of this, the initial finance for the project may be seen as seeding continual processes of exploration, experimentation and engagement as has been seen in other areas of Citizen Science. The ideas explored in WYRED are ideas which are important to everyone, since everyone is touched by digital society and the social change it involves. To understand and address the deep problems presented to us by far-reaching change in our society, large-scale, self-sustaining participation in open research by young people is necessary and we believe that this is an appropriate path to adopt in achieving this: the WYRED platform provides a means whereby young people can explore and surface their understandings, perspectives, perceptions and concerns, and the insights emerging from the process can be made available to society and more specifically to policy. Every engagement with the WYRED cycle, whether it is a group of young people presenting results of an open research activity involving a GPS based video study on city transport networks, or someone participating in a dialogue around gender issues in social media, or someone listening to a rap about club culture, or exploring visual data about the interactions in a Twitter exchange on climate change will permit deeper and wider understanding of the perceptions of young people and the roles they can play in digital society now and in the future. WYRED presents a way of surfacing these, and capturing what Popper alluded to in 1945 when he said "Even a man who opens a new shop, or who reserves a ticket for the theatre, is carrying out a kind of social experiment on a small scale; and all our knowledge of social experience is gained by making experiments of this kind" [23].

The nature of this project, which is not focused on technology, means that to speak of Technology Readiness levels is not especially relevant. However, the project is developing as new approach to research with young people which will be validated and demonstrated in relevant environments with young people, furthermore the aim is for the approach to be actually self- sufficient and autonomous by the end of the funding period, so that it is possible to speak of a TRL 9 equivalent.

Figure 1 presents the Work Packages diagram of the project.

#### 4. PROJECT TECHNOLOGICAL BASE

WYRED will need a well-stablished technological ecosystem [3; 7-9; 12] that supports the interaction platform. This ecosystem must guarantee three main features in the project lifecycle:

- 1. **Interaction facilitator**. Most of the discussions will be done inside the platform. Given the importance of mobile online spaces [1; 26-29], especially among children and young people, it is considered vital that the platform exist as a web-based platform and a mobile app with extensive integration with the social media in which the target groups are active. It will contain profiling functionalities, interaction spaces that facilitate and promote exchange of messages, videos and other artefacts in different formats, a repository for the artefacts generated in the research process, and a range of analytics instruments for the processing of the dialogue that takes place between WYRED participants.
- 2. Data analysis platform. The social dialogue and participatory research activities in the project will generate heterogeneous data including transcripts, analysis, hypotheses, artefacts, workflows, narratives, quantitative and qualitative data related to perceptions and understandings around social change. The storage of this data will be based upon recent developments in Open Source grid-based Citizen Science platforms [2; 6] like MyExperiment (<a href="http://myexperiment.org">http://myexperiment.org</a>) and open data formats including the Research Object standard (<a href="http://www.researchobject.org">http://www.researchobject.org</a>) and Linked Data (<a href="http://linkeddata.org">http://linkeddata.org</a>). WYRED will exploit these and other standards and tools to provide flexibility in the ways the data can be managed, organized and made available in different formats and contexts. WYRED will actively engage a wide range of stakeholders by making the project platform a space where all can access the data and artefacts generated, explore and interpret them. The process of interpretation which will be managed by the consortium but open to all is expected to generate elements for potential new models and strategies for transitioning towards these models. These will permit automatic processing and analysis of the raw data from conversations and its visualization so that the user can interact with the visualizations in order to extract new knowledge or select data to be qualitatively analyzed [10; 13; 17; 18] (as in the Keim cycle [20; 21] or VeLA model [15]). These visualizations will include word-cloud- based visualizations and social graph based visualizations [16].
- 3. Security and privacy supporter. The WYRED platform represents a safe space in which children and experts will be able to express their views and reflections on the influence of technology in their lives. As technology affects transversally all social areas and involves people of different nationalities and beliefs, the platform must make a double effort to preserve the space in which they will express personal opinions and monitor that will not be any type of abusive situation / cyber bullying among participants.

# 5. CONCLUSIONS

The INEQUAL 10 call states that the work should "bring together stakeholders from research and policy makers, together with children and young people around Europe" and focus on "the use and interactions with the digital world of children and young people". This is an extensive remit which potentially touches almost all aspects of the life of a young person, as an individual, and in his/her interactions within communities and the wider society. In a research context such as this, we are all stakeholders, and it is hard to dissociate the production of outputs from their impacts and define simple cause-and-effect relationships. Society and individuals are both subject and object of the research action. For this reason, in the WYRED project, impact is understood as part and parcel of the research activity, so that throughout the work involves the engagement of a variety of stakeholders beyond the consortium itself, so that, in addition to the specific impact-focused activity taking place in the valorization work package, there is an impact element integrated into all of the principal work packages.

The WYRED platform is framed as an activity open to any member of society, and it reaches well beyond the timeframe of the funding period.

The project expects impacts that include child and youth-directed research. In this project the approach is based on the paradigm of citizen science, understood as the active engagement of citizens in the scientific process. In addition to this, the project is informed by a child

rights approach acknowledging that young people of all ages have the right to participation and engagement and that it is our social responsibility to support the methodology for engagement. In WYRED this participatory paradigm is extended to the young. The children and young people participating design their own research activities with the support of the research teams.

WYRED aims to address this by supporting the voice of children and young people, and we see an urgent need to ensure that the outputs generated have impact not only on policy and future thinking, but also on individuals and communities within society. For this reason, the impact-focused activity within the project is divided into two streams, one of which we term the "influence" stream and the second the "social" stream. While these overlap they can be spoken of separately:

- The "influence" stream is made up of individuals who due to their specific professional role may have a direct influence on
  policy. These include policymakers themselves, decision-makers, and experts and future thinkers in different fields whose advice
  feeds into policy.
- The "social" stream, of which the members of the influence stream and the consortium themselves form part, refers to the wider society which in a more diffuse way influences policy and is itself the object of policy. For the WYRED project to be fully successful, impacts in each of these streams need to be taken into account.

The project will generate a range of concrete impacts. Among other outputs WYRED will provide:

New insights into the perspectives and understandings of children and young people, compared and contrasted with those of other generations, in relation to the digital society and the changes it brings in different social areas.

- Recommendations to policy derived from the outputs of the social dialogue and the research activities in a wide range of contexts relating to children and young people and the digital society.
- Artefacts, and stories emerging from the research cycle that reflect and express children and young people's vision of the digital
  society and their role in it, future potentials and motivations for participating in and engaging with society.
- Raw data for further more detailed analysis and experimentation.
- A knowledge base collecting and curating all of the above.
- A continuously evolving space in which children and young people are able to generate and explore their perceptions in relation
  to the digital society, with the support of professional researchers. The WYRED platform constitutes a new, more grounded, and
  respectful approach to social research into youth issues, in which the young engage not only with each other but also with
  stakeholders from a wide range of relevant constituencies, such as policy, industry, civil society and research.
- The knowledge generated will also lead to social impacts such as the generation of new opportunities for innovative companies, public services and other social groups which, on the basis of the insights derived from the work, can create products and services which are more closely aligned with the lived experience and concerns of children and young people.

#### 6. ACKNOWLEDGMENTS

With the support of the EU Horizon 2020 Programme in its "Europe in a changing world – inclusive, innovative and reflective Societies (HORIZON 2020: REV-INEQUAL-10-2016: Multi-stakeholder platform for enhancing youth digital opportunities)" Call. Project WYRED (netWorked Youth Research for Empowerment in the Digital society) (Grant agreement No 727066). The sole responsibility for the content of this webpage lies with the authors. It does not necessarily reflect the opinion of the European Union. The European Commission is not responsible for any use that may be made of the information contained therein.

#### 7. REFERENCES

- [1] Alonso De Castro, M.G., 2014. Educational projects based on mobile learning. Education in the Knowledge Society 15, 1, 10-19.
- [2] Blanke, T. and Hedges, M., 2013. Scholarly primitives: Building institutional infrastructure for humanities e-Science. Future Generation Computer Systems 29, 2 (2//), 654-661. DOI= http://dx.doi.org/http://dx.doi.org/10.1016/j.future.2011.06.006.
- [3] Dini, P., Darking, M., Rathbone, N., Vidal, M., Hernández, P., Ferronato, P., Briscoe, G., and Hendryx, S., 2005. *The digital ecosystems research vision: 2010 and beyond.* European Commission.
- [4] European Union, 2015. Focus on: Empowering young people to participate in society. European good practice projects Publications Office of the European Union, Luxembourg.
- [5] Feenberg, A., 2010. Between Reason and Experience: Essays in Technology and Modernity. MIT Press, Boston.
- [6] Florio, L., Reilly, S., Demchenko, Y., Varga, T., and Harangi, G., 2012. Advancing technologies and federating communities: a study on authentication and authorisation platforms for scientific resources in Europe. European Commission.
- [7] García-Holgado, A. and García-Peñalvo, F.J., 2013. The evolution of the technological ecosystems: An architectural proposal to enhancing learning processes. In *Proceedings of the First International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM'13) (Salamanca, Spain, November 14-15, 2013)*, F.J. García-Peñalvo Ed. ACM, New York, NY, USA, 565-571. DOI= http://dx.doi.org/http://dx.doi.org/10.1145/2536536.2536623.
- [8] García-Holgado, A. and García-Peñalvo, F.J., 2014. Architectural pattern for the definition of eLearning ecosystems based on Open Source developments. In *Proceedings of 2014 International Symposium on Computers in Education (SIIE), Logrono, La Rioja, Spain, 12-14 Nov. 2014*, J.L. Sierra-Rodríguez, J.M. Dodero-Beardo and D. Burgos Eds. Institute of Electrical and Electronics Engineers, USA, 93-98. DOI= http://dx.doi.org/10.1109/SIIE.2014.7017711.
- [9] García-Holgado, A. and García-Peñalvo, F.J., 2016. Architectural pattern to improve the definition and implementation of eLearning ecosystems. *Science of Computer Programming 129*, 20-34. DOI= http://dx.doi.org/http://dx.doi.org/10.1016/j.scico.2016.03.010.
- [10] García-Peñalvo, F.J., 2015. Issue on Visual Analytics. Journal of Information Technology Research 8, 2, iv-vi.
- [11] García-Peñalvo, F.J., 2016. Presentation of the GRIAL research group and its main research lines and projects on March 2016. GRIAL Research Group, http://hdl.handle.net/10366/127737.

- [12] García-Peñalvo, F.J., 2016. Technological Ecosystems. *IEEE Revista Iberoamericana de Tecnologias del Aprendizaje 11*, 1, 31-32. DOI= http://dx.doi.org/10.1109/RITA.2016.2518458.
- [13] García-Peñalvo, F.J., Colomo-Palacios, R., and Hsu, J.Y.J., 2013. Discovering Knowledge through Highly Interactive Information Based Systems Foreword. *Journal of Information Science and Engineering* 29, 1.
- [14] García-Peñalvo, F.J., Rodríguez-Conde, M.J., Seoane-Pardo, A.M., Conde-González, M.Á., Zangrando, V., and García-Holgado, A., 2012. GRIAL (GRupo de investigación en InterAcción y eLearning), USAL. IE Comunicaciones. Revista Iberoamericana de Informática Educativa, 15, 85-94.
- [15] Gómez-Aguilar, D.A., García-Peñalvo, F.J., and Therón, R., 2014. Analítica Visual en eLearning. *El Profesional de la Información* 23, 3, 236-245. DOI= http://dx.doi.org/http://dx.doi.org/10.3145/epi.2014.may.03.
- [16] Gómez-Aguilar, D.A., Hernández-García, Á., García-Peñalvo, F.J., and Therón, R., 2015. Tap into visual analysis of customization of grouping of activities in eLearning. *Computers in Human Behavior 47*, 60-67. DOI= http://dx.doi.org/http://dx.doi.org/10.1016/j.chb.2014.11.001
- [17] González-Torres, A., García-Peñalvo, F.J., and Therón, R., 2013. How Evolutionary Visual Software Analytics Supports Knowledge Discovery. *Journal of Information Science and Engineering* 29, 1, 17-34.
- [18] González-Torres, A., García-Peñalvo, F.J., and Therón, R., 2013. Human-computer interaction in evolutionary visual software analytics. *Computers in Human Behavior 29*, 2 (Mar), 486-495. DOI= http://dx.doi.org/10.1016/j.chb.2012.01.013.
- [19] Hayek, F., 1944. The Road to Serfdom. Routledge Press, UK.
- [20] Keim, D., Andrienko, G., Fekete, J., Görg, C., Kohlhammer, J., and Melançon, G., 2008. Visual analytics: Definition, process, and challenges. In *Information Visualization*, A. Kerren, J. Stasko, J. Fekete and C. North Eds. Springer, Berlin, Heidelberg, 154-175. DOI= http://dx.doi.org/http://dx.doi.org/10.1007/978-3-540-70956-5\_7.
- [21] Keim, D.A., Mansmann, F., Schneidewind, J., and Ziegler, H., 2006. Challenges in Visual Data Analysis. In *Proceedings of the Tenth International Conference on Information Visualization*, 2006. London, England. 5-7 July 2006 IEEE, USA, 9-16. DOI= http://dx.doi.org/10.1109/IV.2006.31.
- [22] Keynes, J.M., 1936. The General Theory Of Employment, Interest, And Money. Palgrave Macmillan, London.
- [23] Popper, K., 1945. The Open Society and its Enemies. Routledge, London.
- [24] Prensky, M., 2001. Digital Natives, Digital Immigrants Part 1. On the Horizon 9, 5, 1-6. DOI= http://dx.doi.org/http://dx.doi.org/10.1108/10748120110424816.
- [25] Prensky, M., 2001. Digital Natives, Digital Immigrants Part 2: Do They Really Think Differently? On the Horizon 9, 6, 1-6. DOI= http://dx.doi.org/http://dx.doi.org/10.1108/10748120110424843.
- [26] Sánchez Prieto, J.C., Olmos Migueláñez, S., and García-Peñalvo, F.J., 2014. Understanding mobile learning: devices, pedagogical implications and research lines. *Education in the Knowledge Society* 15, 1, 20-42.
- [27] Sánchez Prieto, J.C., Olmos Migueláñez, S., and García-Peñalvo, F.J., 2016. ¿Utilizarán los futuros docentes las tecnologías móviles? Validación de una propuesta de modelo TAM extendido. *RED-Revista de Educación a Distancia 52*, Artículo 5. DOI= http://dx.doi.org/http://dx.doi.org/10.6018/red/52/5.
- [28] Sánchez Prieto, J.C., Olmos-Migueláñez, S., and García-Peñalvo, F.J., 2016. A TAM based tool for the assessment of the acceptance of mobile technologies among teachers. GRIAL Research Group / University of Salamanca.
- [29] Sánchez-Prieto, J.C., Olmos-Migueláñez, S., and García-Peñalvo, F.J., 2017. MLearning and pre-service teachers: An assessment of the behavioral intention using an expanded TAM model. *Computers in Human Behavior In Press*. DOI= http://dx.doi.org/http://dx.doi.org/40.1016/j.chb.2016.09.061
- [30] Sanders, E.B.-N., 2001. Virtuosos of the experience domain. In Proceedings of the 2001 IDSA Education Conference.
- [31] Smith, C., 2010. What is a Person? University of Chicago Press, Chicago