Universiteit Leiden

ICT in Business

‘The Relationship of Learning Agility and 21st Century Skills in the IT Industry’

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MASTER'S THESIS

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Abstract

In a fast changing, more connected and globalized world, companies are required to be more competitive and more effective in a less costly way. Similarly, skill diversity and evolution are also expected to keep up with the needs of the ever changing and technological advanced world. The goal of this research is to highlight the importance of Learning Agility when it comes to acquiring skills that represent the needs of the 21st century business.

Companies and organizations must become more agile and prepared to adjust their business processes and practices. The development of new tools and new technologies are emerging, forcing companies and organizations to keep up by training their employees continuously. (Brassey, Christensen and Dam, 2018). Well-sharpened skill sets give them the opportunity to master on what they do as a result to improve their work performance. Thus, companies will increase the productivity and narrow the gaps of the employees by recognizing the core skills and competencies that are needed in order to satisfy their work duties.

Until now skills and Learning Agility have been in the spotlight of researchers with the connection between them however remaining obscure. The goal of this MSc Thesis is to stress the importance of connecting these two elements in order to reach the desired 21st century business model. Learning Agility is not only connected but also really important when it comes to skills.

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1. Introduction

1.1 Research Context

Organizations and companies need to have a workforce that can adapt quickly to the transforming environment and to the new order of things to gain their survival.[1] The more productive someone is the more productive he or she will be in daily basis, by handling new challenges. Change is becoming a continuous process, requiring unprecedented levels of organizational agility. It's very important for the individuals to improve their Learning Agility, their ability to rapidly develop new behaviors, be flexible and adaptable, to have the ability to incorporate new skills and at the same time to unlearn those skills that are ineffective (Derue, Ashford and Myers, 2012).

Our contemporary society is the result of the continuity of time and technology. The 21st century market requirements are not similar to the ones a decade ago (Soulé and Tatyana, 2015). In an eternally competitive, agile, and fast-changing world, it is important for organizations to deliver great value. Moreover, organizations need to improve competitiveness, increase productivity and efficiency, accelerate growth, support innovation and reduce costs (Atkinson, 2013). The world is changing at a fast pace. We can no longer live in isolation in our local communities and career specializations or rely on continuing to work with familiar technology (Askenazy and Galbis Moreno, 2007). What we need now was not so essential a decade ago and might not be of use in a decade after. Many of the processes we relied on just a few years ago have now become obsolete (Nedelkoska, 2013).

1.2 Research Objective

Hence, due to the highlighted importance of the growing interest in Learning Agility and 21st Century Skills, this study aims to contribute on how important Learning Agility is to the

[1] Harvard Business Review: Adaptability: The New Competitive Advantage. Retrieved from: https://hbr.org/2011/07/adaptability-the-new-competitive-advantage

individuals and provide ways and measures on how these, 21st Century Skills and Learning Agility, can be integrated into the process.

Therefore, the main question of this research study is:

What is the Relationship of Learning Agility and 21st Century Skills in the IT Industry?

1.3 Supportive guiding questions

The guiding research questions of this study are:

- How one can measure the Learning Agility of the individuals?
- What are the skills that one needs to establish for the changing future?
- What are the skills connected to Learning Agility?
- What are the most and least important skills?

1.4 Thesis Overview

In order to answer the questions above, the study will follow a qualitative approach. A literature review will be conducted so that firstly, Learning Agility and 21st Century Skills can be defined. Secondly, in order to establish which metrics, need to be considered as measurements for the Learning Agility in the 21st century.

The study overview will follow a series of steps that will:

- Introduce the reader to the concept of this study, including the research objective, the research idea, the research question, and scope.
- Present and elaborate on the literature review. Following this, the reader will be familiar with concepts such as Learning Agility, 21st-Century Skills, and the link between those two.
- Present the research methodology.
- Present the results derived from the interviews and questionnaires.

- Answer the research question by discussing and analyzing the findings gathered from the previous steps.
- Conclude and recommend future research.

2. Literature Study

2.1 21st Century Skills and their history

In this section, the reader will find an explanatory analysis of the 21st-Century skills. More specifically, one can find the history of the 21st-Century skills, as well as the most important of them, which one needs to acquire. Moreover, the reader will find the most current framework that has been used in the past decade in order to specify those skills.

The world we live in today has changed dramatically in the last several decades, and the market requirements have been reformed over the past decades (Soulé and Tatyana, 2015). In an eternally competitive, agile, and fast-changing world, it is important for organizations to deliver great value. Moreover, organizations need to improve competitiveness, increase productivity and efficiency, accelerate growth, support innovation, and reduce costs (Nikoi and Boateng, 2013).

Studies by national and international research organizations such as The International Society for Technology in Education and OECD (Organization for Economic Co-operation and development) have shown that complex thinking and analytical skills are an integral part of learning at every stage of development (Silva, 2009). Each person has individual talents and strengths that have to be adjusted and tuned in the organization (Kotter, J, 1990). However, conditions have changed during the past 100 years. Globalized political, social and economic systems coupled up with competitive market rules have led to massive growth in the knowledge generation, management industry, and information communication technologies. (Chalkiadaki, 2018)

Even if the technological revolution is more visible now than ever, during the last decades changes have already transformed the structure and the characteristics of our societies. A brief review of these changes is adequate to clarify and justify the attempts made in recent decades. Thompson and Harvey (2007) divided the 20th century into five basic eras:

- Era I: 1900-1945
- Era II: 1945-1970
- Era III 1971-1991

- Era IV: 1991-2001
- Era V: 2001+

Era I: Mechanization and food production

Technology focused on the mechanization and the production of goods. Business and economic sectors became contributors to critical societal issues, for instance, health/safety in the workplace, employee rights, and child labor. After the two World Wars, businesses and organizations grew in wealth and size, while management and ownership separated. As a result, with the evolution of industrial technology, companies were focused on improving the productivity of human assets, highlighting the importance of understanding the social interaction of workers. Later, these facts led to the concept that the work environment needed to give the individual a sense of belonging in order to be able to function at maximum and, thus, popularized the term group dynamics.

Era II: Development and delivery services

In the three following decades, there was a shift towards reliance on emphasis on the development and delivery of services. Team and group dynamics became the main focus of management focus. The advent of the civil rights movement emphasized on human assets and capital and later was oriented towards group or team dimensions, rather than individuals. With the advent of the computer, it was clear that employees should develop different skills, which would have a significant contribution to their teams and organizations.

Era III: Technological growth

Technology spread globally and the demand for services grew exponentially. Changes in working dynamics were also of critical importance. Teamwork and subsequent social facilitation were recognized as important features, while negative behaviors were also identified. Communication and collaboration were increasing creativity and motivating individuals in order to give greater effort. All these changes lead individuals to need higher and more varied initial skills.

Era IV: A need to identify skills

Pfeffer (1994) argued that gaining the skill to effectively manage people was one of the most competitive tools. Different definitions were mentioned to define new skills for the workplace. They were called “core skills” in England, “essential” skills in New Zeeland and “key

competencies" in Australia (Stasz, 1997). Employers became more aware of the needed skills. First frameworks were starting to show up, such as SCANS, in order to identify these skills and competencies. Stasz (1997) states that most of the skills were based more on conventional wisdom than on empirical evidence and that only little research has been done one technical work. She sums up the four-skill area, which is the most notable:

- Problem-solving
- Teamwork
- Communications
- Work-related dispositions

Era V: Fast-paced technological pace

The 21st-century dawn brought major changes in terms of the global economy and competition. Fast-paced technological change has had a significant impact on the structure of the workforce, altering, and in some cases, replacing demand for human labor (Lamb, Maire, and Doeke, 2017). Some skills evolved from the 20th century and have been studied for some time, such as problem-solving, while others such as creativity or digital literacy, are new and unfamiliar. (Voogt, Dede and Erstad, 2009). A lot has been said about 21st-century skills, roughly defined as the competencies required to fill the jobs of the future, according to Carnevale, 2013. He continues stating that "Having the appropriate skills for the job is critical […] so organizations can remain competitive, attract the right type of industry and engage the right type of talent in a knowledge-based and innovative economy. […] The fast-growing occupations require more workers with postsecondary education". Therefore, S. Lamb, et al., 2017 present a brief outline of current researches on the most cited skills, which include:

1. Critical thinking
2. Creativity
3. Metacognition
4. Problem-solving
5. Collaboration
6. Motivation
7. Self-efficacy
8. Conscientiousness

9. Grit or perseverance

Moreover, Trilling and Fadel in 2009 identified the following seven (7) skills:

1. Critical thinking and problem solving
2. Communications, information, and media literacy
3. Collaboration, teamwork, and leadership
4. Creativity and innovation
5. Career and learning self-reliance
6. Cross-cultural understanding
7. Computing and ICT literacy

In addition, a research made by van Laar *et al.* (2017), concludes that digital skills are equally important. Their research shows seven (7) core skills, which to a great extent determined organizations competitiveness and the capacity to drive innovation. The rapid change and the influence of the technology will lead the employees to develop 21st-century digital skills to cope and thrive in this changing society. Those skills are the following:

1. Technical
2. Information management
3. Communication
4. Collaboration
5. Creativity
6. Critical thinking
7. Problem Solving

However, different studies have different approaches to 21st-century skills, as it was mentioned before. Thus, the overlaps among the results identify a commonly shared core aiming to find those skills that are needed to participate in a workforce and to put employees in charge of their own learning. The overlying concept sets as its purpose the productive employment of these skills as well as the maximization of the employee's efforts and the full benefits of the ICT.

2.1.1 How can we define skills?

Ultimately, all the organizations' core competencies help to define and support the position and the reputation of the employees in the industry. According to Davis, Misra and Van Auken(2002) measuring competencies is essential for evaluation of any gaps that may exist between the present workforce and the present and future needs. Competency evaluations have, as a result, critical data and information for the managers, to the board and to the organization itself in order to set up significant training and development programs to develop talent pools for the future of their companies and organizations.

However, it must be understood that there is a distinction between soft and hard skills. According to Williams (2001), the majority of people rapidly perceive the contrast between hard-skills or technical training, for instance working with software and equipment, and soft-skills training, which is more focused on interpersonal or intrapersonal relationships. This leads to only beneficial understanding of how skills can be extremely helpful. Moreover**,** Laker and Powell (2009) and his colleagues, in their paper in 2016, summarized all the differences between soft and hard skills in one table (Table 1 - Differences between hard and soft skills (Laker, et al. 2006):

Table 1 - Differences between hard and soft skills (Laker, et al. 2006)

Characteristic	*Hard-Skill Training*	*Soft-Skill Training*
Prior learning and experience	Less prior experience	Greater prior experience
	Less negative transfer	Greater negative transfer
Trainee resistance to learning	Less trainee resistance	Greater trainee resistance
Organizational resistance to training	Less organizational resistance	Greater organizational resistance
Managerial support and resistance	Greater support and less resistance	Less support and greater resistance
Identification of training needs and objectives	More precise identification of training needs and objectives	Less precise identification of training needs and objectives
Immediacy and salience of feedback and consequences	More immediate and more salient on the job	Less immediate and less salient on the job
Similarity between training, work, and work environment	Greater similarity, less variety, narrower range of alternative situations	Less similarity, more variety, wider range of alternative situations
Level of proficiency (mastery) achieved in training	Greater degree of proficiency (mastery) achieved	Lesser degree of proficiency (mastery) achieved
Degree of self-efficacy achieved	Greater degree of self-efficacy achieved	Lesser degree of self-efficacy achieved
Scope of training responsibilities and methods of instruction	Hard-skill trainers and methods of instruction are frequently hard-skill specific	Soft-skill trainers and methods of instruction are frequently soft-skill specific

Skills Panorama[2], a webpage powered by the European Commission and Cedefop, the European Centre of the Development of Vocational Training, state in their article that information about skills is collected through various surveys of individuals and employers. The most common measures or approaches that these surveys use have their advantages and disadvantages and read as follows:

1. Occupation
2. Qualification
3. Duration of Education
4. Skill tests
5. Self-assessment
6. Job requirements

[2] https://skillspanorama.cedefop.europa.eu

The author of the same article defines as *occupation* the level of qualification and the type of tasks that are needed to be carried out; eventually this is why occupation is a good proxy to measure the skill levels. By using a standard classification system, such as the International Standard Classification of Education (ISCED), it is possible to evaluate the degree to which individuals are *qualified* at various dimensions. Correspondingly, *the duration of education* gives a proportion of skill analogous to that of qualification. The assumption is that there is a positive connection between people's time spent in education and their skill levels. The disadvantage, when using qualification and duration of educational measures of skills, is that they cannot completely depict the several skill levels and abilities that can be seen inside a given qualification level.

Accordingly, skill levels can be controlled by *testing the skills* directly. These tests include evaluation through which the respondents are approached to finish assignments that are standardized and allow comparing skill levels across a particular population. Individuals may also *self-report* the skills and the abilities they have or the skills that they use in their everyday jobs. Self-assessment approaches will in general spread a wide scope of skills, but with many self-reported surveys. However, as with many self-reported surveys, there are concerns about the accuracy with which individuals self-survey their abilities and skills. Rather than asking individuals to self-assess their skill levels, the job requirement approach gets some information about the aptitudes they use in their jobs.

In addition, the European Commission's Cedefop[3] defines as a skill "the ability to perform tasks and solve problems, while competence is the ability to apply learning outcomes adequately in a defined context; it also encompasses functional aspects as well as interpersonal attributes. Ananiadou and Claro (2009), define 21st-century skills and competencies as "those skills and competencies young people will be required to have in order to be effective workers and citizens in the knowledge society of the 21st century, while Gren, Knauss and Stettina, 2018 define them as "the ability to do something well; expertise"**.**

[3] http:// www.cedefop.europa.eu/nl/publications-and-resources/publications/4064

2.1.2 Which are good ways to measure skills?

As it was mentioned in the previous section, the "Skills Panorama" made by the European Union, identifies that surveys of individuals and employers are the main ways to collect information about skills and competencies. However, Silva E. (2009) suggests that the assessment of core content and advanced skills should be a program which includes "multiple choice questions, short-response questions, structured and open-ended problem-solving questions, data analysis questions, case studies and essay questions." M.Handel (2017), in his study about "Measuring Job Content", mentions that he uses mostly survey self-reports and multiple-choice questionnaires or responses options with range, such as "strong agree" to "strongly disagree".

Nevertheless, a research made by J. Allen and Van Der Velden in 2005, supports the importance of self-assessment. In their research it is stated that many studies have shown that self-assessment is more accurate, pointing out that they provide more accurate information than information from observers. In addition, a report from Eurostat in 2016 states that a more recent approach-method to assess skills is self-reporting and self-assessment. Sedikides, Skowronski and Zanna (1995), define self-assessment as "the motivation of people to obtain a consensually accurate evaluation of their self". Thus, there are some implications regarding this way of measuring skills. This might be due to the fact that people are capable of distinguishing bad and good performance, but are reluctant or unable to apply similar standards to their own performance (Allen and Van Der Velden, 2005).

2.1.3 The New Literacies and the 7Cs of the 21st Century Skills

During the 70's, Freire (1974) added to the term of literacy, which according to Oxford Dictionary[4] is "the ability to read and write", a parameter which suggests that literacy includes the understanding on how the world works and operates. In accordance to that, Knobel and Lankshear (2007) in their book "A New Literacies Sampler" suggest that an individual is literate if he or she has the ability to "make sense of reading, compose and make as basic components of social practices". One of the reasons for the continuous changes on the way we live, learn and work is, undoubtedly, the Internet's dominance in our lives. (Leu, Jr. *et al.*, 2005; Scott, 2015). In addition,

[4] https:// www.oxfordlearnersdictionaries.com/definition/english/literacy

UNESCO's (2004) definition reflects the meaning of literacy as "the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying context. Literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society".

According to Kalantzis and Cope (2008), all these new literacies mentioned previously, related to technology, also include social and cultural understanding, as well as digital, visual and networking skills, which are fundamental in order to address the difficulties of the new millennium. Correspondingly, in the book "Literacy for the new Millennium" (Guzzetti, 2007), in chapter 15, (Labbo, 2006) aims that "New Literacies are multiple in nature and refer to on screen skills and strategies that include abilities to utilize multimedia resources for various academic, personal and communicative purpose". In addition, Kalantzis and Cope (2008)**,** introduce the term "Multiliteracies". By this term they wanted to exemplify the significance of cultural and linguistic diversity, as well as the impact of communication technologies on learning. Of these literacies, digital literacy is associated with the use of computers, social media and the internet itself, including: a critical analysis of the media, media literacy and research skills (information literacy), visual literacy including on-screen presentation of multimodal texts, and community literacy constituting the skills that are needed to "help students turn their self-expression into a form of public participation" (Rheingold, 2008).

Our everyday life has turned out to be digital, as technology is dominant more than ever. 21st-centruty learners need to move rapidly in order to learn how to be able to understand, evaluate, and produce multimodal texts in order to communicate effectively in various contexts (Ananiadou and Claro, 2009). According to Bell, 2010, in order to achieve an environment, which responds to the fast pace of the 21st century, learners have to continuously figure out how to adjust to the new learning conditions utilizing digital and non-digital sources to comprehend and interpret the world and, thus, acquire a plethora of literacy skills that will empower them to adapt to the demands of the 21st century.

The 7Cs of the 21st-Century

In 1956, Bloom *et al.* suggested that skills are categorized into three broad domains:

1. The Cognitive: which involves the mental skills related to knowledge acquisition.
2. The Affective: which refers to feelings, attitudes and emotions.
3. The Psychomotor: which is related to physical and behavioral skills.

All these categories, according to the latter, complement each other. In spite of the fact that the level of the complexity may differ, on social or even cultural contexts, Trilling and Fadel (2009), summarized these competencies into seven categories which read as Table 2- The Seven Cs (Trilling Bernie, 2007) depicts:

Seven Cs	Component Skills
Critical Thinking and doing	Problem-solving, research, analysis, project management, etc.
Creativity	New Knowledge Creation, "Best Fit" design solutions, etc.
Cross-cultural understanding	Across Diverse ethnic, Knowledge and Organizational Cultures
Communication	Crafting Messages and using Media Effectively
Computing	Effective Use of Electronic Information and Knowledge Tools
Career and Learning Self-reliance	Managing Change, Lifelong Learning, Career Redefinition
Collaboration	Cooperation, Compromise, Consensus, Community-building, etc.

Table 2- The Seven Cs (Trilling Bernie, 2007)

2.1.3.1 Critical Thinking and Doing

Through learning procedures, learners can easily plan ways to understand the world, a procedure that incorporates cognitive-involving mental skills and abilities, like critical thinking (Bloom *et al.*, 1956). A theory proposed some years later by Kapitzke, (2003), supports that learners come to understand the presence of alternatives and different solutions and to create analytical abilities so that they can compare, contrast, assess and combine ideas, procedures and standards. These skills lead them to develop new learnings depending on previous schemata by means of new associations

and learning experiences. However, a most recent approach supports that critical thinking as a skill refers to the ability to evaluate the estimation of an information and to make a decision about what to accept or to believe (Lamb, Maire and Doeke, 2017).

2.1.3.2 Creativity and Innovation

Learners should be able to create in both digital and non-digital contexts (Grand-Clement *et al.*, 2017). According to Bloom's taxonomy, creativity empowers the learners not to exclusively vent out their self-expression, but to also discover suitable answers for real life problems. It also stresses the learners' affective domain, as it respects their feelings, self-development, and attitudes. Furthermore, creativity is often connected with critical thinking or other cognitive skills such as problem solving or problem identification (Lamb, Maire and Doeke, 2017).

However, Pellegrino and Hilton (2012)**,** referred to creativity skills as the learners' activator in order to fully develop the potential of improving their innovative accomplishments. They have also added that, by being responsive to new perspectives, learners can create, execute, and communicate unique and innovative ideas in quest for a positive commitment to their community.

2.1.3.3 Cross-cultural Understanding

Internationally, cross-cultural competencies have turned out to be critical for executive success (McCall, 1993). As 21st-century citizens connect to the various environments within which they operate, learners should be able to respect differences, accept diversity and endure cultural differences (Pacific Policy Research Center, 2010). Apart from that, Kalantzis and Cope (2008), support that learners need to be open-minded and open to adopt skills and attitudes in order to promote multicultural and cross-cultural understanding. This will empower them to work in a different social environment, because of the mobility of our modern world. Accordingly, Combi (2016) argues that the fast pace of development, such as Web 2.0 technologies, have transformed the social space, which helps to break down stereotypical ideas in respect to societies and cultures different that one's own.

2.1.3.4 Communication and media fluency

The ability to communicate with others is one of the most important human social functions (Greenaway *et al.*, 2015). According to Brink and Costigan (2015), in the context of the workplace there are many differences in a sense of behaviors, such as explaining, informing, describing,

influencing, managing, resolving, advising or negotiating. Accordingly, they mention that communication is an oral method in order to set apart different types of communication as non-linguistic written or oral. They also state that almost every action in the work environment involve specific social and interpersonal interactions.

Furthermore, communication skills are not only related to oral or writing communication. They also involve multiple digital elements of today's sharing and interacting. Those elements are increasingly appealing to the young, like social media and web applications (Scott, 2015)**.** A media literate individual is capable of creating and delivering effectively media products. In addition, a learner proficient in media literacy will almost certainly understand the ethical issues and the use of different media structures.

2.1.3.5 Computing and ICT fluency

ICT literacy refers to all the technical skills that are related to the use of technology and its tools (Anderson, 2008). The fast-paced changes in ICT demands the understanding of the information science so that learners will use effectively and ethically the diverse spectrum of its application (Scott, 2015). Web 2.0 technology empowers individuals to produce and share content in real-time: user-produced content creations and remixing have already become creative and given the freedom of new practices that are really challenging, comparing to the traditional relationships and communications (Pacific Policy Research Center, 2010).

"Computer skills are the grammar of the 21st century" – Ed Vaisey: British former Culture Minister

According to Lamb and Callison (2005), the use of the Internet and the employment of tools such as web-based resources, e-mail, chat or videos, is leading the individuals to the E-learning. Accordingly, Pacific Policy Research Center (2010), supports that ICT opens up new opportunities for collaborative knowledge, shared assets, problem solving and the distinction between knowledge and communication. Voogt and Roblin (2012), argue that "the main difference between ICT literacy and technological literacy lies in their emphasis with regard to the competences needed to function in a knowledge society. Technological literacy emphasizes the inter-play

between technology and society, as well as the importance of understanding the technological principles needed to solve complex problems and face the challenges of a knowledge society. Conversely, ICT literacy focuses mainly on how to make an effective and efficient use of digital technologies".

2.1.3.6 Career and Learning self-reliance

These skills relate to the ability of making individual decisions without any assistance or guidance. Such self-reliance is gradually built through self-awareness, self-assessment and metacognition, and constitutes the ability to learn how to learn; all these skills represent strategies, which promote autonomy. Self-reliance skills enable learners, the future professionals, to climb the career ladder as they constantly strive to adapt to a rapidly changing environment and seize opportunities. During this lifelong process, they become able to identify areas of personal improvement, assume responsibility for their actions, reflect critically on their decisions, seek and express criticism. Hence, they take responsibility for their own careers (Byster, 1998; Papaefthymiou Lytra, 2014).

2.1.3.7 Collaboration and teamwork

Learners should become adept at collaborating in digital environments, which favor Computer Mediated Communication (CMC), that is, socializing by means of diverse networking technology. However, at school, students mostly work individually, using pen and paper. In other words, school promotes an unrealistic context, which deprives learners of the communicative digital skills they will be called to exercise in their future life, which affects negatively their intrinsic motivation and impedes their social skills. Instead, via the digital competences they could build up their communicative competence through authentic teamwork and joined effort, whose outcome can benefit the entire community (Rheingold Howard, 2008).

2.1.4 Frameworks for 21st-century skills

During the past decades, with all those rapid technological advances and an increasingly global economy, students, employers and more generally individuals will need to know how the world will look like when they will enter the workforce. Thus, new models of assessments that measure both content and skills are emerging and hold the potential to move us toward an assessment system that is more aligned with what future employers, and not only, will need to know (Silva, 2009).

Many countries and organizations were involved in sponsoring and taking part in the research where frameworks were developed in order to get a better insight into the most significant skills and competencies. All the frameworks seem to be largely consistent in terms of what 21st-century skills and competencies are, however, each framework has different focus and areas of emphasis within the overarching competencies and skills (Voogt and Roblin, 2012). Thus, based on a review of the literature, the most well-known frameworks for the 21st-century competencies and skills are presented below.

2.1.4.1 P21

In 2001, The Partnership for 21st-century skills - and now Partnership for 21st Century Learning – (P21, 2015) was founded in the US with sponsorship by the government and several organizations from the private sector. Later on, in 2005, it became an independent non-profit organization that included members of education leaders, national business communities and policymakers.[5] Their main goal is to position 21st-century skills at the center of K12 education in the US. (Voogt and Roblin, 2012). P21's learning and motivation skills are creativity, critical thinking, problem-solving, communication, and collaboration. Moreover, they focus on technical skills as well as media, and target skills such as information, media, communication and technology literacy. They also believe that skills such as flexibility, adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, leadership and responsibility, belong to significant skills that one needs in life and career. (Chalkiadaki, 2018)

2.1.4.2 EnGauge

In 2003 the Metiri Group and the North Central Regional Educational Laboratory, based on two years of research, posted a report entitled "enGauge 21st Century Skills: Literacy in the Digital Age" (NCREL, 2016). The purpose of enGauge was to foster 21st-century competencies in students, teacher, and administrators (Voogt and Roblin, 2012). The report aimed at highlighting the relationship of those skills to the academic standards, to recognize the need for multiple assessments in order to measure and evaluate the skills in a context of academies standards and

[5] http:// www.battelleforkids.org/about-us

the current technological and global society (Coughlin *et al.*, 2003, Metiri Group- NCREL). The report identified four "skill clusters", which read as follows(Chalkiadaki, 2018):

- Digital age literacy: targeting the basic, scientific, economic, technological, visual, information, multicultural literacy, and global awareness.
- Inventive thinking: referring to adaptability, managing complexity, self-direction, curiosity, creativity, risk-taking, high-order thinking, and sound reasoning.
- Effective communication: identifying teaming and collaboration, interpersonal skills, personal, social, and civic responsibility and last but not least the interactive communication.
- High productivity: referring to prioritizing, planning and managing for results, effective use of real-world tools, and the ability to produce relevant high-quality products.

2.1.4.3 European Parliament and Council

In December 2006, the Official Journal of the European Union published a *Recommendation of the European Parliament and of the Council of the European Union on key competencies for lifelong learning.* In this article, it is stated that a combination of skills, attitudes, and knowledge, is necessary so that one could be a productive employee, with successful integration and also personal fulfillment. They spot eight key competencies that are critical for a person. These skills take into consideration:

1. communication in the mother tongue
2. communication in foreign languages
3. mathematical and basic competencies in science and technology
4. digital competence
5. learning to learn social and civic skills
6. sense of initiative and entrepreneurship
7. cultural awareness
8. expression

(European Commission, 2006)

As one can notice, the eight competencies take into consideration the adaptability and flexibility of people to the continuous changing world.

2.1.4.4 OECD - DeSeCo

Two years later, in 2005, an initiative undertaken by the OECD (Organization for Economic Co-Operation and Development) aimed at providing policymakers, researchers and educator with orientations for the design of educational policies and practices that address the requirements of learners in the knowledge society. Their project entitled "Central to the new Millennium Learners", is the Definition and Selection of Competencies (DeSeCo) program, which was launched in order to develop a conceptual framework to identify and define the key competencies and to serve as a theoretical foundation for PISA (OECD, 2002; OECD, 2005; Voogt and Roblin, 2012). Program for International Student Assessment (PISA) launched in 1997 by the OECD countries in order to monitor the extent to which students have the necessary knowledge and skills at the end of their compulsory schooling (OECD, 2005). This project continues to this day.

In 2005 they identified three categories which highlight strategic, interpersonal and related competencies and skills (OECD, 2002; Chalkiadaki, 2018):

- Using Tools Interactively: including skills such as language symbols, texts, knowledge, information, technology.
- Interacting in Heterogeneous groups: related to how an individual co-operates, works within teams, manages and resolves conflicts.
- Acting autonomously: related to how an individual acts within a big picture, forms and conducts life plans and personal projects, and how he/she defends and asserts rights, interests, limits, and needs.

2.1.4.5 UNESCO – Learning Metrics Task Force (LMTF)

In 2008, UNESCO designed a framework for teachers. This framework aims at recognizing all those skills that are required for the integration of ICT in teaching and learning. Through this manner, they wanted to improve the practices that teachers and educators use with a focus on ICT competencies and on developing perspectives in teaching methods, pedagogy and school organization. (Voogt and Roblin, 2012).

Later on, in 2013, UNESCO’s Institute for Statistics and the Center for Universal Education at Brookings, worked on The Learning Metrics Task Force (LMTF) in order to improve the learning outcomes for children and youth around the globe (UNESCO, 2013). By the end of 2015, they achieved to launch the second phase LMTF 2.0.

Based on their research, they defined 7 various competencies with the subdomains of each one of them (UNESCO, 2013). For more details, please check Figure 1 - Subdomains from UNESCO's LMTF.

1. Physical well being
2. Social and emotional skills
3. Culture and arts
4. Literacy and communication
5. Learning approaches and cognition
6. Numeracy and mathematics
7. Science and technology

Domain	Description	Subdomain Examples*
Physical well-being	How children and youth use their bodies, develop motor control, and understand and exhibit appropriate nutrition, exercise, hygiene and safety practices.	• Physical health and hygiene • Food and nutrition • Physical activity
Social and emotional	How children and youth foster and maintain relationships with adults and peers. Also, how they perceive themselves in relation to others.	• Social and community values • Civic values • Mental health and well-being
Culture and the arts	Creative expression, including activities from the areas of music, theater, dance or creative movement, and the visual, media and literary arts. Also, cultural experiences in families, school, community and country.	• Creative arts • Cultural knowledge • Self- and community identity • Awareness of and respect for diversity
Literacy and communication	Communication in the primary language(s) of the society in which children and youth live, including speaking, listening, reading, writing, and understanding the spoken and written word in various media.	• Speaking and listening • Vocabulary • Writing • Reading
Learning approaches and cognition	Learning approaches describe a learner's engagement, motivation and participation in learning. Cognition is the mental process of acquiring learning through these various approaches.	• Persistence and attention • Cooperation • Problem solving • Self-direction • Critical thinking
Numeracy and mathematics	The science of numbers and quantitative language used universally to represent phenomena observed in the environment.	• Number concepts and operations • Geometry and patterns • Mathematics application • Data and statistics
Science and technology	Science is specific knowledge or a body or system of knowledge covering physical laws and general truths. Technology refers to the creation and usage of tools to solve problems.	• Scientific inquiry • Life science • Physical science • Earth science • Awareness and use of digital technology

Figure 1 - Subdomains from UNESCO's LMTF

2.1.4.5 Conclusion on frameworks

As can be seen from the previous review of the most cited frameworks there is variety in context and terminology regarding the categorization of skills. It is also worth mentioning that some of the frameworks have been developed under international organizations, such as UNESCO, OCED, and European Union. This shows that there is a strong enthusiasm and interest in 21st-century skills and competencies from the society and the public. Figure 2- Comparison Table for 21st Century Skills' Frameworks represents a summary of the skills that have been found throughout the frameworks for 21st Century Skills.

Name of Framework	Year	Target group	Length / Amount of Questions	Owner/Creators	Purpose	Skills																				
						creativity	*critical thinking*	*problem solving*	*communication*	*social & civic responsibility*	*decision making*	*collaboration*	*media & technology skills*	*technology/digital litercy*	*global awarness*	*adaptability & flexibility*	*self direction*	*leadership/ responsibility*	*productivity/accountability*	*managing complexity*	*manage and solve conflicts*	*risk taking*	*effective use of real world tools*	*interacting in heterogenous groups*	*acting autonomously*	*physical well-being*
P21 for 21st Centuty Learning	2001	students, innovative education	no information	Battelle for Kids - non profit organization	Create enduring impact for	x	x	x	x			x	x	x		x	x	x	x							
EnGauge 21st century skills	2003	educators	literature reviews, input from educators, data from educator surveys, and reactions from constituent groups	Metiri Group and the North Central Regional Educational Laboratory	practices necessary to give students the education they require in a knowledge-based, global society	x			x	x		x	x	x	x	x	x		x	x		x	x			
OCED (DeSeCo)	2005	educators	no information	Organization for Economic Co-operation and Development	policy-makers, reserchers, educators with orientations for the design of educational	x	x		x			x	x	x							x			x	x	
European Parliament & Coucil	2012	students, educators	gathering data through assesment	University of Melburne Sponsored by CISCO, INTEL and	Empowering Students to Succeed	x	x	x	x		x	x	x		x							x				
UNESCO	2013	teachers, studens	modules, courses	UNESCO and Microsoft	identify common set of qualifications needed for the integration of ICT in teaching and learning	x	x	x	x	x		x	x	x	x	x			x					x		x

Figure 2- Comparison Table for 21st Century Skills' Frameworks

Summarizing all the frameworks that are listed in this research, a compiled list of the skills was needed and it is presented alphabetically below, as Chalkiadaki mentions in her article:

1. creativity,
2. divergent thinking,
3. critical thinking,
4. team working (especially in heterogeneous groups),
5. work autonomy,
6. developed cognitive and interpersonal skills,
7. social and civic competences,
8. responsible national and global citizenship,
9. the consciousness of interdependence,
10. acceptance and understanding of diversity,
11. recognition and development of personal attributes,
12. interactive use of tools,
13. communication in mother tongue and foreign languages,
14. mathematical and science competence,
15. digital competence,
16. sense of initiative and entrepreneurship,
17. accountability,
18. leadership,
19. cultural awareness and expression,
20. physical well-being

However, in order to recognize the skills and the competencies that the next generation needs, a broader list of competencies and skills is required, so that it is easier for skills and competencies to embed, as Table 3- The four categories of the discussed 21st-century skills, by *Chalkiadaki, 2018* shows (Chalkiadaki, 2018).

1. Social skills
2. Personal skills
3. Knowledge and information management skills

Personal Skills	**Social Skills**
Self- development, and autonomy (self-management, self-organization, self-regulation, self-direction, self-reflection, independent thought, autonomous acting, ability to form and conduct life plans and projects and to defend assert rights, emotional intelligence). Creativity (curiosity, imagination, playfulness, creative production, co-creativity, innovation). Problem-solving, critical thinking (in authentic learning environments, analytical thinking, analysis and evaluation of evidence, ability to provide solutions in given challenges, higher-order thinking, sound reasoning, informed decision-making, innovation). Presence in the globalized environment (adaptability, agility, managing complexity, risk-taking).	Communication- collaboration (skilled oral and written communication in the mother tongue and foreign languages, team-working especially in heterogeneous environments, open-mindedness, conflict management). Cultural awareness, global awareness (ability to appreciate the value of the varied cultures and to intentionally construct cross-cultural relationships and networks). Leadership (self-motivation, initiative taking, entrepreneurship, leading by influence).
Information and knowledge	**Digital Literacy**
Learning (self-reflection, self-assessment, self-improvement, meta-cognition, e-learning, self-directed learning, independent learning, knowledge construction, social and collaborative learning, intellectual risks). Information management (information literacy, data access and analysis, managing multiple streams of simultaneous information, applying knowledge to new situations, creating new knowledge, content knowledge).	Confidence in the use of media and ICT, proficiency in the use of digital tools, interactive digital skills, critical use of digital tools (analysis, critique, evaluation, creation), ability to attend to ethical responsibilities required in complex environments, participatory culture in technology.

4. Digital Literacy

Table 3- The four categories of the discussed 21st-century skills, by Chalkiadaki, 2018

Nevertheless, many will wonder how trustful those frameworks are and if it is worth the time, effort and, of course, monetary investment. As one can understand from the literature, the fact that many companies and organizations are spending money in research for making frameworks, proves that they are essential. Therefore, defining 21st Century Skills is a fundamental first step to identify expected and current needs. The next chapter will explain which are the most important skills that someone needs for the 21st century.

2.2 Learning Agility

"The ability to move readily and quickly, the ability to think and understand readily and quickly; dexterity; alertness" [6]

2.2.1 Definitions

To have a better understanding of what Learning Agility is, definitions and perspectives were gathered and presented in a chronological order, in the following section:

"Capability of an organization to operate profitability in a competitive environment comprised of continually changing customer habits" (Goldman, Nagel and Preiss, 1995)

"A successful exploration of competitive bases (speed, innovation, flexibility, etc.) through the integration of reconfigurable resources and knowledge management, to provide customer-driven products and/or services in a fast-changing market" (Yusuf, Sarhadi and Gunasekaran, 1999)

"The ability of an organization to thrive in a constantly changing and unpredictable business environment" (Rigby *et al.*, 2000)

[6] The Oxford English Dictionary.

"An organization's ability to sense environmental changes and respond effectively and efficiently to that change" (Ashrafi *et al.*, 2006)

"The capacity to identify, capture, and exploit opportunities more quickly than rivals do" (Sull, 2009)

"Speed, flexibility, underlaid by cognitive and behavioral processes, something conceptual different"(Derue, Ashford and Myers, 2012)

As one can notice there is no clear agreement that links Learning Agility with a common core definition. Thus, the scope behind it is more or less equivalent.

2.2.1.1 An early approach to Learning Agility

Nowadays, the world we live in and in which organizations and companies operate is becoming more and more complex and dynamic. Every function and every role within the organizations and companies is changing rapidly and continuously. "Organizations need leaders with learning agility in order to move ahead successfully in volatile times" (Amato and Molokhia, 2016). "As businesses come to depend more on agile talent, their only way forward to successfully cope with the future is by "liberating" their employees from a conservative working environment. Selecting the right people then takes on monumental importance. This means focusing on people who are resilient and adaptable, and who can quickly learn in completely new circumstances"[7]. Knegtmans R. (2018) states in his article in Cornerstone International Group[8]. As a result, we need leaders and employers who are not only accomplished, but who are also agile learners.

[7] https://tofasakademi.com/learning-agility-can-be-more-important-than-experience/

[8] https:// www.cornerstone-group.com/2018/08/23/learning-agility/

The very first approach was made by Spreitzer, McCall, & Mahoney in 1997. In their research, they developed an assessment in order to measure one's ability to learn, based on six (6) competencies.

1. Uses feedback
2. Seeks opportunities to learn
3. Is open to criticism
4. Is flexible
5. Seeks feedback
6. Is culturally adventurous

Their findings resulted in the difficulty to observe the learning behaviors for learning competencies. Nevertheless, it is significant to note that the concept of Learning Agility at the time of their research was not yet presented.

Three years later, in the early 2000s, Lombardo and Eichinger wanted to identify a different measurement strategy and tried to explain some initial steps that one should look at the characteristics of the learning agile. They defined the construct as "the willingness and ability to learn new competencies in order to perform under first-time, tough, or different conditions". As a result of factor analysis, they identified four factors that describe the aspects of Learning Agility.

1. *People Agility:* people, who know themselves well, learn from experience, treat others constructively, and are cool and resilient under the pressure of change.
2. *Results Agility:* describes people who get results under tough conditions, inspire others to perform beyond normal, and exhibit the sort of presence that builds confidence in others.
3. *Mental Agility*: describes people who think through problems from a fresh point of view and are comfortable with complexity, ambiguity, and explaining their thinking to others.
4. *Change Agility*: describes people who are curious, have a passion for ideas, like to experiment with test cases and engage in skill-building activities.

In 2004, in a further study, Eichinger and Lombardo tried to identify, albeit unsuccessfully, a relationship between Learning Agility and promotion. Thus, they concluded that the only correlation was that Learning Agility was a very important predictor of performance.

2.2.1.2 Recent approaches to Learning Agility

However, the interest in Learning Agility has been growing during the past years. DeRue and his colleagues (2012), recognized this and, even with the absence of theoretical background, reviewed research in order to see how researchers and scientists define and measure Learning Agility. They suggested that Learning Agility has been wrongly characterized as much for its potential antecedents as its results, potentially obfuscating what it means to be learning agile.

Researcher Scott DeRue at the University of Michigan built up a model (Figure 3 - A model of Learning Agility) that recognizes the speed and flexibility as the two most significant variables determining Learning Agility (Derue, Ashford and Myers, 2012). DeRue likewise argued that one should probably need to change frameworks, meaning flexibility, in order to see how extraordinary things are connected or associated. At the end of the day, flexibility is about being able to change frameworks as required elements to clarify what is happening. [9] Learning Agility is having the ability to process a large amount of data as quickly as possible (speed) and make sense of what is generally significant.

[9] https://trainingindustry.com/blog/strategy-alignment-and-planning/what-is-learning-agility-anyway/

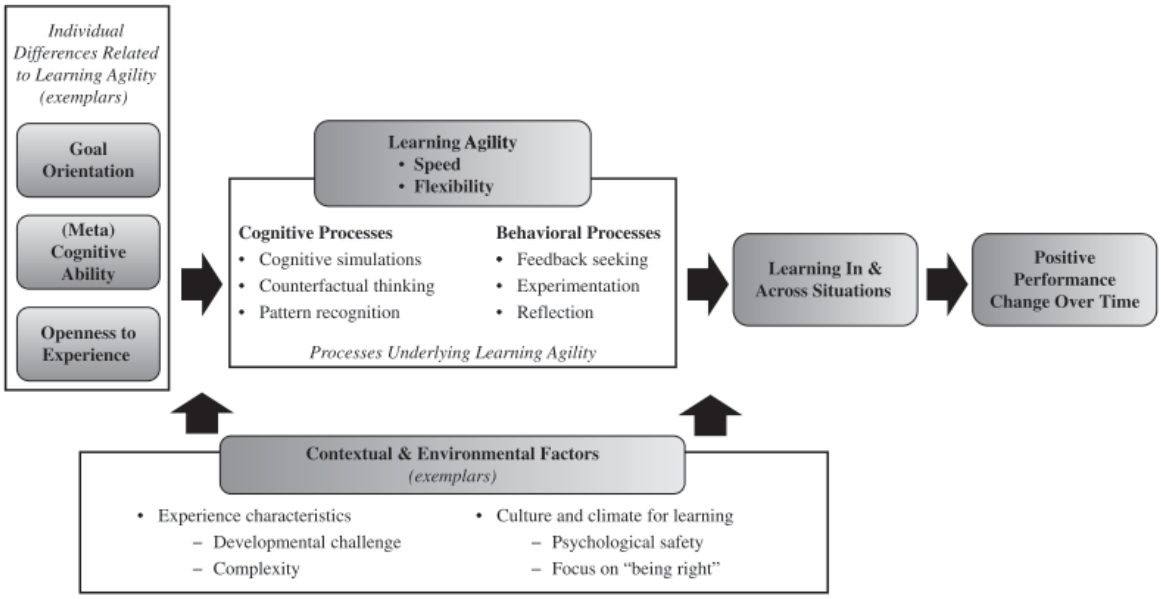


Figure 3 - A model of Learning Agility ((Derue, Ashford and Myers, 2012)

Harvard Business Publishing (Amato and Molokhia, 2016) have identified eight key leadership capabilities with Learning Agility being one of the most important. Moreover, they believe that it has three significant components:

1. **Potential to learn: "**Learning requires an open and receptive mindset. Through years of experience, we often gain expertise and competence, but we may become myopic in our inability to see different, potentially better ways to improve processes or even reach new goals."
2. **Motivation to learn:** "Changing ingrained behaviors and long-held habits is hard work. To the extent that organizations can make learning more enjoyable, they can stimulate the Learning Agility of their employees."
3. **Adaptability to learn**: "Rather than simply following a business-as-usual routine, employees with adaptability to learn consistently reflect on the effectiveness of their skills. This helps determine whether they need to develop certain competencies and find new ways to improve efficiency and get better results."

According to Hofkes (2017), “Learning Agility is the ability to develop new effective behavior quickly and flexible based on new experiences. Employees with high Learning Agility benefit more from their experiences, look for new challenges and are open to feedback. Employees with low Learning Agility learn little or nothing from new experiences and stick to old habits. Learning Agility provides organizations with particular insight into the potential of employees. A high degree of Learning Agility proves to be a good predictor of the persons with high potentials in the organization, who will be the leaders of the future.”

But what is Learning Agility anyway? Why organizations should align their business around it? Is it easy to teach or train to be a more agile learner?

2.2.2 Learning Agility Measures

The truth is that not everyone is born to be an agile learner. It is different for each person how to be agile and not everyone can become agile learners. Under this light, while skills can be taught, one needs to know first which of those competencies are absent in any case. [10] According to many research, numerous frameworks have been developed in order to focus on a number of specific personality traits, motivations and behavioral aspects. The significance of conceptual clarity and its role in fostering a higher knowledge of the interaction that we observe in practice is the point that people seem to differ and such a clarity is vital and necessary. (DeRue, Ashford and Myers, 2012)

Most of these frameworks have been developed and are now only available as consultancy products, with an average cost of 200$ per assessment. It seems that the concept of Learning Agility is promising. However, the way it has been handled so far, is driven by profit motives. Thus, this means that any further development of accurate measuring tools or frameworks is inhibited.

2.2.2.1 CHOICES Architect

Choices Architect Suite, sold by Korn Ferry, is a tool based on research measuring Learning Agility using a set of 81 behavior items. The questionnaire is divided into 4 factors and 27

[10] https:// www.efrontlearning.com/blog/2019/03/learning-agility-what-is-how-nurture-it.html

dimensions (Ferry, 2008). Basically, this mechanism uses sort cards, paper surveys and e-surveys. It applies methods for validating high-potential talent for use in succession planning. As a result, it identifies individuals within the organization more readily, while it implements development and succession planning and growth efficiently (Ferry, 2016). This test is the most frequently used metric and produces as an outcome that the results are not based on one's perception of their teaching agility.(Sims, 2017)

2.2.2.2 viaEDGE

Again, this measure is sold by Korn Ferry International. It is an online, self-report evaluation that measures self-awareness in addition to mental agility, people agility, results agility and change agility (Ferry, 2011). In addition, a research of 1000 individuals from 12 different organizations found that viaEDGE offers both convergent and divergent reliability and sufficient internal consistency without adverse effects (Sims, 2017).

2.2.2.3 Burke Learning Agility Inventory

The Burke LAI Suite is a validated tool made by EASI Consult, based in the U.S. It helps individuals and teams to understand the comprehensive report generated from the inventory, offering insights into Learning Agility both across 9 facets and as a whole. Feedback is included within the report and can support the individuals in building on strengths, addressing critical weaknesses and practicing skills and competencies, in order to improve their own Learning Agility. [11]

2.2.2.4 TALENTx7 Assessment

An assessment made by Dr. Kenneth P. de Meuse. As they mention on their webpage it is an online self-assessment, which the participant is able to do using his or her mobile device. It provides scores on 7 different facets of Learning Agility: cognitive perspective, interpersonal acumen, change alacrity, self-insight, feedback responsiveness, environmental mindfulness, and drive to excel. It provides diagnostic guidance on which leadership areas need enhancement.[12]

[11] https://easiconsult.com

[12] http:// www.thetalentx7.com

2.3 Research Gap

By the term “research gap”, we refer to a problem or research question that either has not been answered appropriately, or not at all, in a given field of study; in this case, “Learning Agility and 21st Century Skills”. The conducted research included many articles that are all mentioned at the end of this paper. Correspondingly, as the results were sorted by relevance, the abstract and conclusion of each paper or source were quickly analysed to select those, which were more relevant to the topic.

Undoubtedly, the 21st century market requirements are not similar to the ones a decade ago (Soulé & Tatyana, 2015). It is clear that the exploitation and productive employment of skills has enormous potential for individuals and, of course, for companies. It should be noted, however, that, the literature review yielded the following result: the existing frameworks are focusing on fostering 21st Century Skills in students, teachers and administrators, which signifies that they are primarily designed for educational organizations.

Of course, there is no doubt that by developing skills and constructing knowledge from a young age, one could master to succeed both within a specific working environment and in life in general (P21, 2015). This process, thus, provides people with a strong foundation on which to build and grow from an early stage. But what about people at a later stage of their lives and careers? Unfortunately, the gap in the literature review indicates that there is no existing framework specifically designed for working individuals. The educational benefits, however, should not be limited according to age. On the contrary, working individuals, in general, should keep on doing a continuous training and education focusing on skills that are related to their career.

In order to achieve a continuous education which will help them to evolve and thrive in their careers, firstly they need to address which are those skills that they are lacking. Furthermore, the individual should assess his/her Learning Agility.

3. Research Methodology and Design

3.1 Introduction

As it is indicated in the title, this chapter provides an outline of the methods used of this dissertation. Throughout the project, qualitative and quantitative research methods have been used in order to explain the main research question and the sub-questions. In the preparation stage, the literature review is conducted. In the research stage, we used questionnaires to answer the main research question that was defined in the Introduction chapter. In order to collect the data, we used Qualtrics, which is a software that allows creating online surveys. This is followed by an explanation of the data collection, where we used three different statistical tools, SPSS, R, Excel to help analyze the data of the survey.

3.2 Literature Review Strategy

The objective of the search process is to identify the most relevant studies. In order to conduct the literature study, tools such as the Google Scholar search engine, digital libraries, the Academia.edu website, Springer, IEEE, white papers, scientific publications and journals were used. The language of the research was decided to be English in view of the fact that most of the publications use this specific language. Finally, this study aims to find the relation between Learning Agility and 21st Century Skills.

In order to select relevant studies, we followed the following steps:

1. The definition of the research objective.
2. The definition of the search strings and keywords; the identification of inclusion and exclusion rules.
3. The conduction of initial research.
4. The review of the title, abstract and conclusions.
5. The selection of potentially relevant studies and the removal of duplicates.
6. The review of selected studies.
7. The review of the entire content of the selected studies.

8. The identification of the final set of relevant studies.

3.3 Research Strategy

Figure 4- Research Flow shows the research flow throughout the research process. It was designed using *draw.io* diagrams.

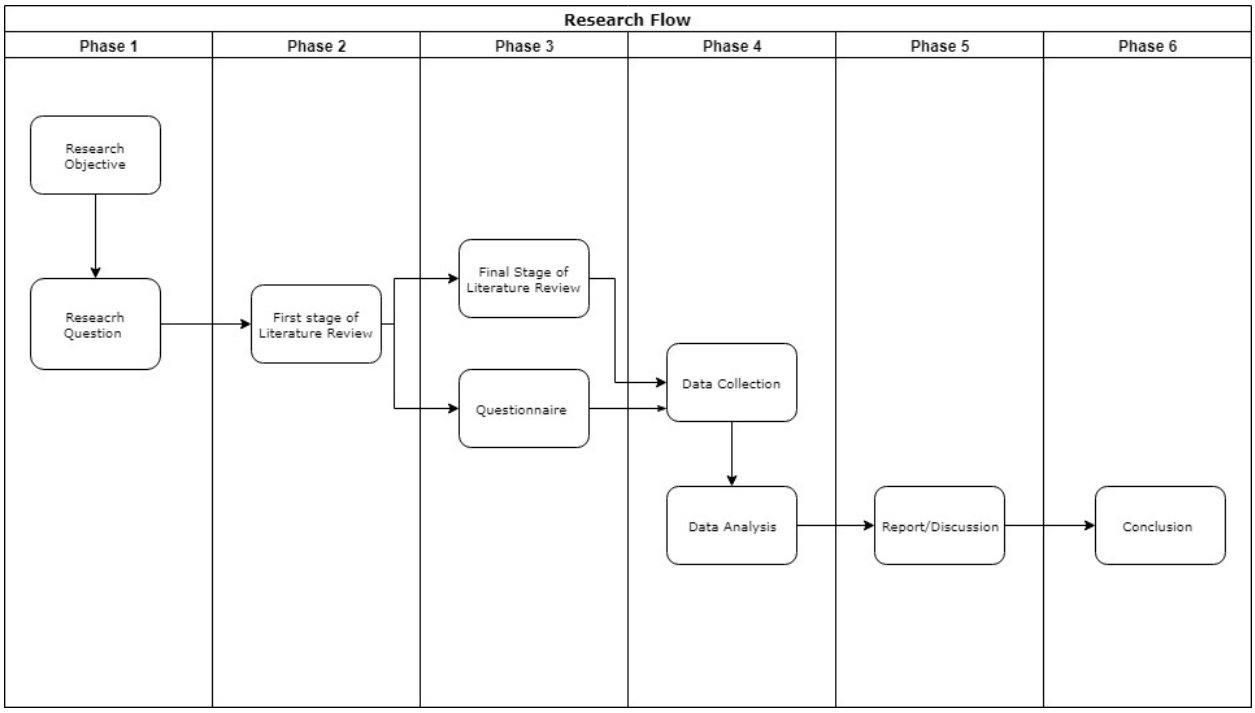


Figure 4- Research Flow

During Phase 1, the very first step in order to identify the research objectives, the main research question and its guiding research questions were made. Basically, this phase represents the research identification. After setting the general direction of the field of study interest, the next step was to identify the key words for Phase 2.

Phase 2 represents the preparation of the research. The latter includes a primary literature review, which can provide a basic understanding and knowledge about the chosen topic. A preliminary library search, which includes online databases and catalogues, the Academia.edu website, Mendeley Library, the Google Scholar search engine, are some among the tools that have been used in order to collect information.

Phase 3 is the core content of this paper and represents the primary research stage. The gaps in the literature were identified and the final stage of the literature review was carried out. At this point it is necessary to mention that the *snowballing technique* was used to find relevant material within the reference lists of the found papers. The abstracts were analyzed to select the most relevant ones. In addition, this phase includes the design of the questionnaire survey. The questionnaire was formulated to support the main problem / research question and finally as a result to receive an answer as soon as the survey is completed.

When phase 3 is completed, phase 4 is to collect the secondary data and analyze them. Of course, there is a need to testify and validate the accuracy of the answers. On the next step, we use SPSS, R and Excel for visualizing, understanding, and representing better the results.

Phase 5 and 6 are the last two phases where the reader will find the discussion on the findings, the answer of the main research question, and elaboration on the topic up to the conclusion, which is a sum up of the findings and outcomes of the data collection.

3.4 Research Approach

In order to determine the research strategy/approach along with the data collection method, which are appropriate to be followed, this study will be structured around the "Research Onion Model" as described by Saunders, Lewis and Thornhill (2009), in the following Figure 5 - Research Onion.

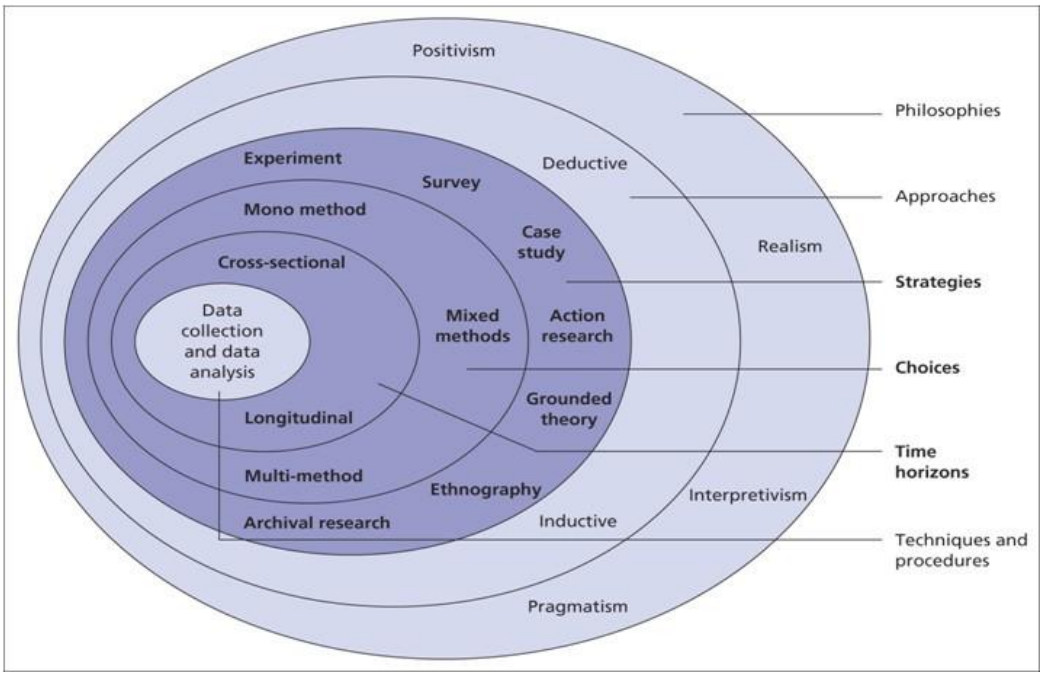


Figure 5 - Research Onion

The research philosophy that will be employed as the background for this research is represented by Pragmatism, as the objective of the research thesis is to identify the practical consequences of the phenomenon. Moreover, since the phenomenon of 21st Century Skills and Learning Agility constitute a phenomenon that can be examined through a variety of perspective and interpretations. The pragmatist point of view enables this study to acknowledge multiple realities and, thus. work with different philosophical positions, if needed.

Consequently, the selected approach will be Inductive aiming at building a theory, the conceptually framework of 21st Century Skills and Learning Agility. This will be realized by collecting data to explore the phenomenon in question and identify potential themes and patterns. To support methodologically this approach, as Figure 6 - Methodological choicedepicts, the focus will be the collection of quantitative data and each respective statistical analysis; therefore, there will be implemented a mono-method quantitative study (Saunders, Lewis and Thornhill, 2009).

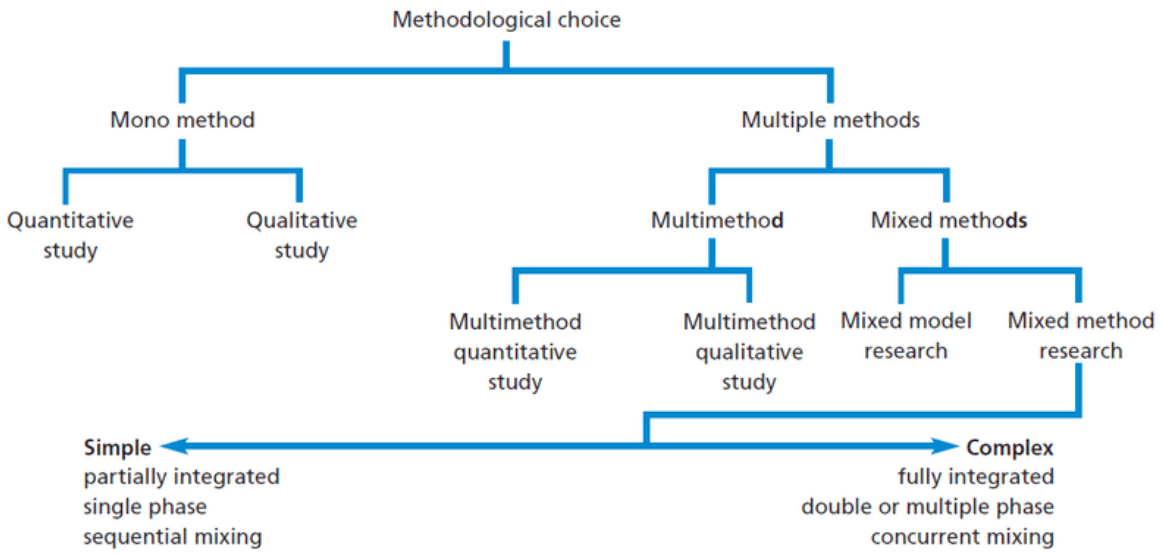


Figure 6 - Methodological choice

Accordingly, the survey strategy will be used as a valuable strategy in business and management research that generates answers in "how" questions. Apart from that, it has the potential to shed significant light into the relationships between different variables to generate findings, representative of a specific group and to grant control to the researcher over the research process. Furthermore, the chosen form of survey would be that of a questionnaire "as it allows the collection of standardized data from a sizable population in a highly economical way, allowing easy comparison" (Saunders, Lewis and Thornhill, 2009).

Regarding the time horizon, the study will be cross-sectional as it represents the study of a particular phenomenon at a particular time. Specifically, for the 21st Century Skills and Learning Agility, one part of the target group, young professionals, have been asked to answer the survey during November to December 2019, whereas the target group of the later-stage career professionals took part in a questionnaire during an event that took place in January 2020 at UBR's office in Utrecht.

4. Data Collection and Data Sources

The collection of the data originated from two main sources:

1. Review and analysis of the available literature based on 21st Century Skills and Learning Agility.
2. Qualitative research based on the questionnaire that was given in young professionals and UBR employees.

4.1 Qualitative data collection

The survey was conducted in order to deeply explore and to collect information for our study, which ensures a more accurate result to answer our main research question:

'What is the relationship of Learning Agility and 21st Century Skills in the IT Industry?'

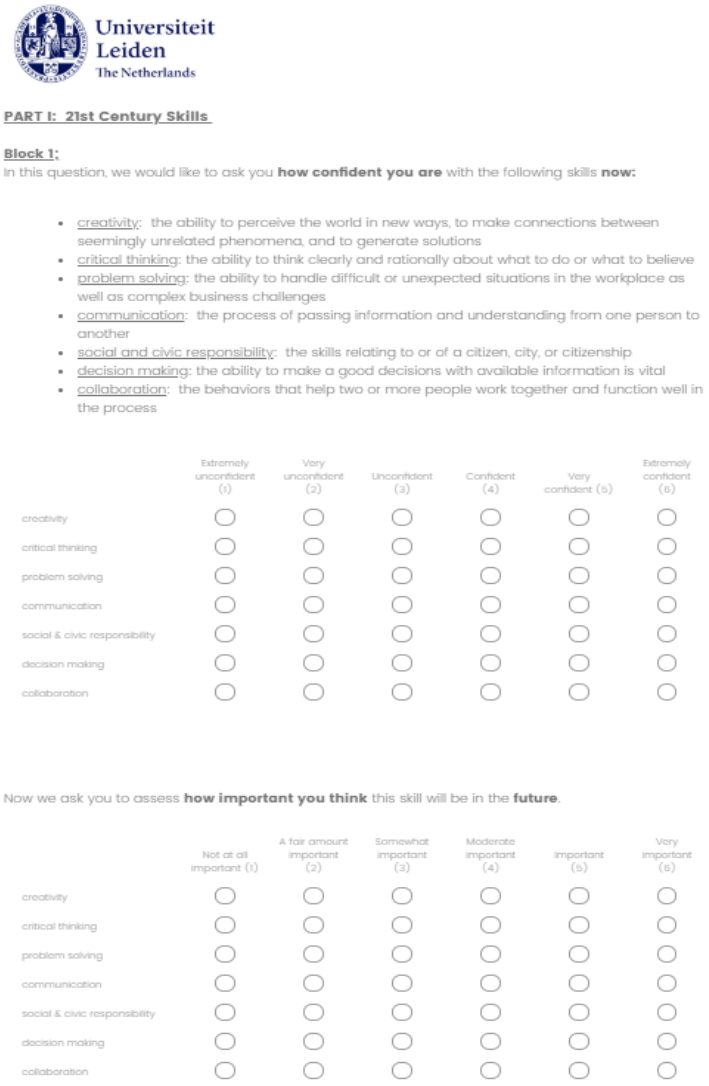
The respondents of the questionnaires are young professionals, who are going to referred from now on as Group 1, and a part of the sample is represented by employees from the same organization, who from now on they will be referred as Group 2. More specifically, Group 2 participants are from a governmental organization named UBR, which is a government-wide service provider working for the public domain, as part of the Ministry of the Interior. Their goal is to make the government better, stronger, and smarter. They focus on providing consultancy, transition, innovation and interim projects within the four areas of expertise: [13]

- Computerization
- Personnel
- Organization
- Purchasing

[13] Information retrieved from: https:// www.ubrijk.nl/

4.2 Survey: As a collection method

Surveys are used in quantitative research to collect quantitative data and consequently to be examined by the researcher. To design the survey, we have used the online survey tool Qualtrics[14], which Leiden University is offering to its students. Qualtrics is a quantitative statistical analysis tool to create online surveys or questionnaires for research. Figure 7 - Part of the Survey shows a part of the survey, however, you can find the rest of the questionnaire on the Appendix.



Universiteit Leiden
The Netherlands

PART I: 21st Century Skills

Block 1:
In this question, we would like to ask you **how confident you are** with the following skills **now:**

- creativity: the ability to perceive the world in new ways, to make connections between seemingly unrelated phenomena, and to generate solutions
- critical thinking: the ability to think clearly and rationally about what to do or what to believe
- problem solving: the ability to handle difficult or unexpected situations in the workplace as well as complex business challenges
- communication: the process of passing information and understanding from one person to another
- social and civic responsibility: the skills relating to or of a citizen, city, or citizenship
- decision making: the ability to make a good decisions with available information is vital
- collaboration: the behaviors that help two or more people work together and function well in the process

	Extremely unconfident (1)	Very unconfident (2)	Unconfident (3)	Confident (4)	Very confident (5)	Extremely confident (6)
creativity	○	○	○	○	○	○
critical thinking	○	○	○	○	○	○
problem solving	○	○	○	○	○	○
communication	○	○	○	○	○	○
social & civic responsibility	○	○	○	○	○	○
decision making	○	○	○	○	○	○
collaboration	○	○	○	○	○	○

Now we ask you to assess **how important you think** this skill will be in the **future**.

	Not at all important (1)	A fair amount important (2)	Somewhat important (3)	Moderate important (4)	Important (5)	Very important (6)
creativity	○	○	○	○	○	○
critical thinking	○	○	○	○	○	○
problem solving	○	○	○	○	○	○
communication	○	○	○	○	○	○
social & civic responsibility	○	○	○	○	○	○
decision making	○	○	○	○	○	○
collaboration	○	○	○	○	○	○

Figure 7 - Part of the Survey

[14] Qualtrics: Leiden University retrieved from https:// www.medewerkers.universiteitleiden.nl/ict/ict-en-onderzoek/surveytools/qualtrics

To have a valid number of respondents and ensure that the survey is enough to be reliable and "statistically significant", the target of survey respondents was set to 100 participants at least. The survey was carried out from early December 2019 until early February 2020. To get this number at first point, the author of this dissertation distributed direct messages to her LinkedIn connections and LinkedIn groups, related to 21st Century Skills and Learning Agility. The impact of respondents was big enough already. However, the survey was distributed to the author's master's group chat, which students had created to share valuable information during their studies. It must be noted that valid participants are only those who are in an early stage of their career. Moving forward, at that timeframe, the author was fulfilling her internship duties as a Marketing and Business Analyst. Thus, she distributed the survey to her colleagues, who were either interns or young professionals on at later stage of their career.

The other target group, as it was mentioned before, was employees from UBRijk, Group 2. In order to get responses from them, we translated the survey in Dutch, with the help of Jesse van der Mijl, Project Manager in Centre for Innovation of Leiden University. The duration of the translation was approximately a month. Thenceforth, we shared an email to the organization, which you can find in the Appendix. Unfortunately, we only received 7 responses. Thus, to reach more participants for this group, the author participated in an event, was organised by RIC[15] in mid-January. The topic was about *Design Thinking*, which is "thinking and doing method with which you can creatively shape innovation issues", as the invitation mentioned. The event took place at LEF Future Center, Utrecht in 16th of January and approximately 35 people attended the event. The author presented her research and handed out copies of the survey to the participants of the event, as it was the most direct way to get direct responses. Nevertheless, there was also the option to scan the QR code and to respond to the survey via their smartphones or laptops.

4.2.1 Data Sources

The questionnaire is divided in two parts. The first part aims to collect data in order to understand the Learning Agility of the respondents. Moreover, the questions for this part were chosen carefully, and all of them were embedded in PhD dissertations. We would also like to include

[15] Rijks Innovatie Community: https:// www.rijksinnovatiecommunity.nl/

questions from the frameworks we have mentioned in previous sections, but unfortunately none of them were available freely. As a result we have included questions from the Learning Agility Assessment Inventory (*LAAI*), which was referenced in a dissertation by Smith, 2015 as an instrument developed by Mitchinson in 2014, and from Dimensions of the Learning Organization Questionnaire (*DLOQ),* which was developed in 2003 by Marsick and Watkins (2009) to encourage sharing and improving into the organization. The second part of the questionnaire is a self-assessment report, which gives the respondents the opportunity to identify their strengths or weaknesses based on the most important skills of the 21st century, that we identified during the literature review.

4.3 Statistical tools

As it has been mentioned before, data analysis is the process of working on data, explaining it and presenting it in a way one will easily understand. As a result, statistical tools have been used to analyze and visualize the results of the survey.

SPSS

SPSS is short of Statistical Package for the Social Sciences and it is one of the most well-known and powerful tools to easily manipulate and visualize data without having coding skills.

Microsoft Excel

Microsoft Excel spreadsheets offer a wide range of statistical functions, and it is very easy to visualize simple set of data.

R-Programming

R is a programming language, which is also free. It has been used for more complex analysis of the data, where SPSS or Microsoft Excel were too slow or could not bring a result.

4.4 Ethical Considerations

The current survey took into consideration certain ethical issues. As it was mentioned earlier, all the participants of the survey declared their acceptance regarding the participation in the survey to ensure that their participation is voluntary, in both online questionnaires and during the Group 2

event in Utrecht. At the same time, we ensured that their participation in the research was voluntary and that they were free to withdraw at any point.

In any case, the answers were treated as confidential and were used only for academic purposes and only for purposes of the research. However, the participants of the survey got informed that, in case they would like to have an insight of the results, they could easily add their email address to a separate link, so as to not track their answers.

5. Data Analysis

This chapter presents the results and the findings of the data analysis, with the use of specific tools and software, as it has been mentioned before.

5.1 Data Cleaning

After the distribution of the questionnaire was completed, and the number of participants was satisfactory, it was necessary to clean the sample from those participants who were not fulfilling the criteria, which are being explain as follows. As a result, the responses were separated into two target groups:

1. Group 1 Respondents
2. Group 2 Respondents

The first target group, Group 1, collected 104 recorded responses. The second phase of those responses was to clean the data. The respective required actions are to distinguish and remove the responses from individuals who did not fully answer the survey, meaning 100% progress, or to remove the responses of small duration, namely less than 11 minutes, which was the Qualtrics estimation time. The emerging results were the following (Table 4- Group 1: Non-Replied vs Attainment):

- 24 answers were less than 100% completed; thus, they were removed from the survey.

# replies	Attainment (100% is fully replied)
13	26%
4	35%
5	43%
1	65%
1	85%

Table 4- Group 1: Non-Replied vs Attainment

- From the remaining answers we have checked the time of the respondents. All the recorded answers with duration less than 11 minutes were deleted.
- This left us with a total of 71 answered responses.

The second target group collected 42 recorded responses. The same procedure was followed in order to clean the data. However, our target for total responses for this group was around 100 respondents. The emerging results were the following (Table 5 – Group 2: Non-Replied vs Attainment):

- 6 answers were less than 100% completed. Thus, they were removed from the survey.

# replies	Attainment (100% is fully replied)
4	26%
1	22%
1	35%

Table 5 – Group 2: Non-Replied vs Attainment

- From the remaining answers we have checked the time of the respondents. In most of the answers one can notice that the duration is just few minutes. The reason for that is that most of the responses were transferred by the author, because respondents answered the survey during the event on copies. Thus, all the recorded responses from this specific date were not removed due to time duration.
- That left us with a total of 34 answered responses.

The goal for the survey was to have two different target groups to observe, one group from the same organisation and one group from multiple organisations. Unfortunately, that proved to be not feasible in order to have an accurate comparison of those two target groups (UBR/RIC was too small), thus we have merged the responses into one target group, from now on referred to it as Total Group. As a result of data cleaning, we have 105 valid answered responses, which was within the limit of the primary goal.

5.2 Results and Findings

The primary purpose of the questionnaire was to collect information about 21st Century Skills and Learning Agility from respondents, by sharing it online or via an event, which took place in Utrecht. More specifically, to understand how individuals perceive the 21 skills which have been identified during the literature review and how agile they are in learning. Following the collection and analysis of data, the present chapter will focus on a series of significant observations.

5.2.1 Demographics of participants

The results of this quantitative study are based on 105 respondents, from different countries and background. All participants voluntarily participated in the study. This analysis is based on 3 different groups, as we have mentioned in previous chapters, Group 1, Group 2 and Total Group, which is the combination of Group 1 and Group 2. Figure 8-Total Group: What is your gender? shows the gender distribution of the participants.

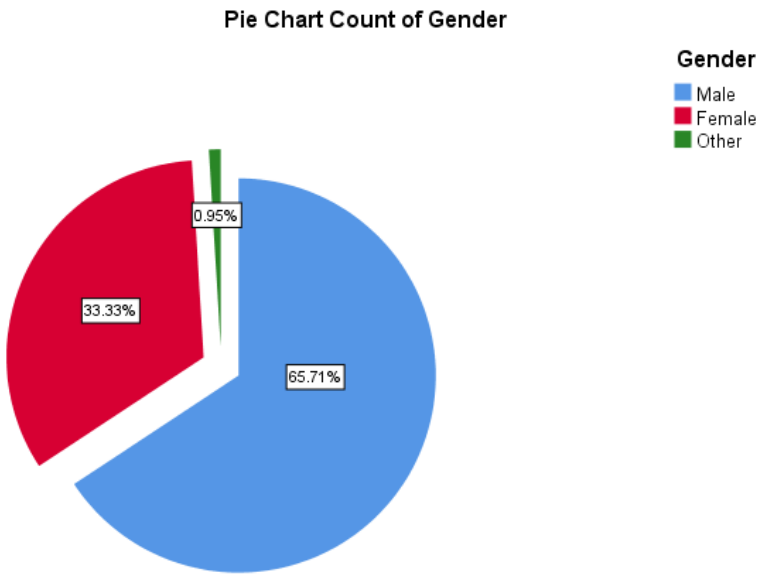


Figure 8-Total Group: What is your gender?

From the Total Group, we had 69 males, 35 females and 1 respondent as not specified or other. Out of those, 20 were between 18 and 24 years-old, 51 between 25 and 34, 15 between 34 and 55, 8 between 45 and 54 and, finally, the rest between 55 and 64, as shows the graph below (Figure 9).

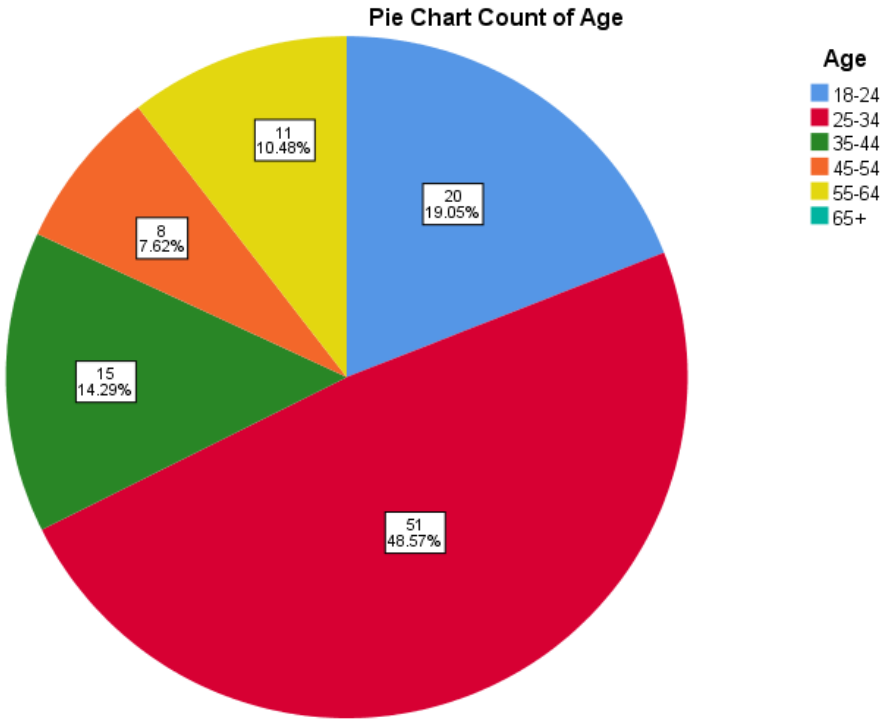


Figure 9- Total Group: What is your age?

Figure 10 shows that 63% or 66 of the respondents have a master's degree and 23% have a bachelor's degree. Interestingly, 5% of 105 participants are holders of PhD.

Fifty percent of the total respondents in the Total Group, are working in IT, 17.3% in Other, 14.4% in Marketing and Sales, 5.8% in Operation/Production, 4.8% in Human Resources and Technical & Research and Development and a minor 3% in Financial, Accounting or Logistics.

On the question "What is your role", 23% of the respondents are Consultants.

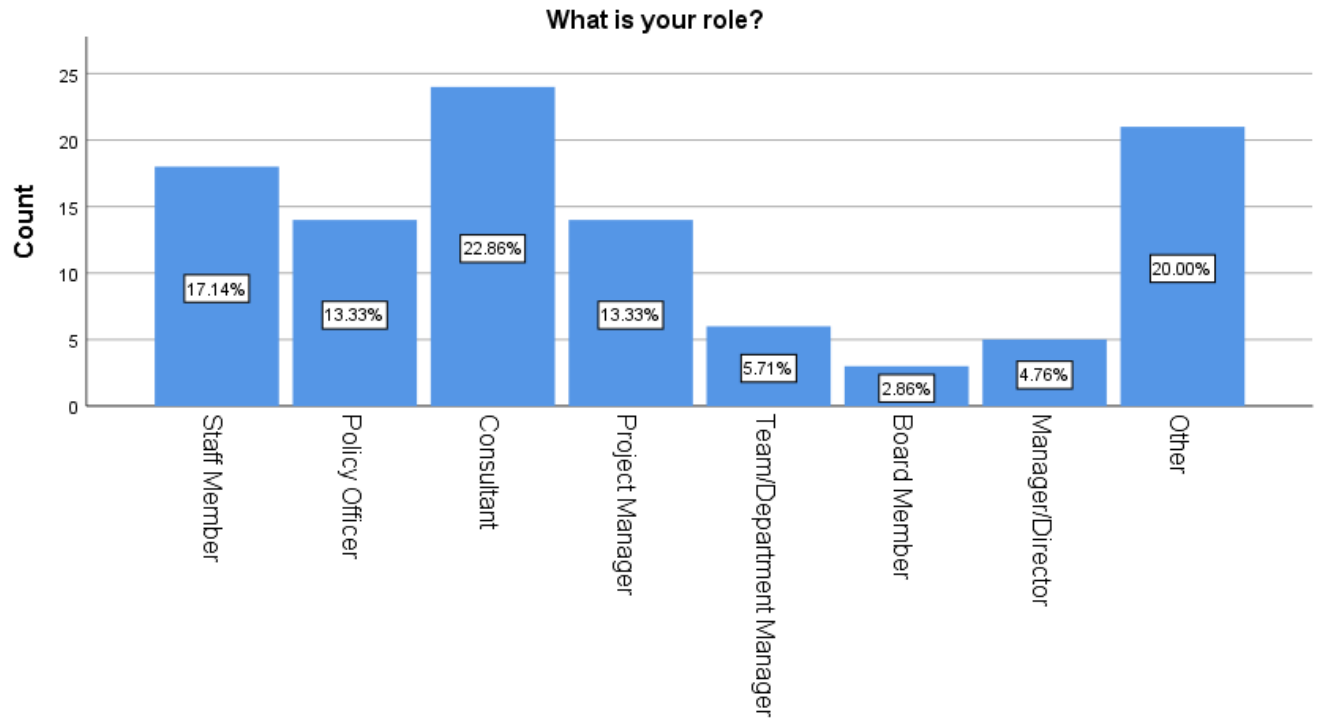


Figure 10- Total Group: What is your role?

5.2.2 PART I: 21st Century Skills Analysis

Most and least valuable skills

Most valuable skills

Regarding the Total sample, it can be deduced that the highest frequency for the most valuable skills leading to success at the workplace has been exhibited in the following six: *communication, critical thinking, collaboration, creativity, problem solving and managing complexity*, as Figure 12 shows.

Firstly, it can be noticed that skills related to technology or tech-skills are not represented in the top 6 most valuable skills. This shows an interesting trend, given that Data and Technology are becoming more and more integral to professional daily life in fields such as Finance, Healthcare or even HR, since HR specialists are, in most cases, using tech tools for the hiring process. Of equal significance is the fact that on the top 6 respondents have placed skills, which are considered

as soft skills and thus are frequently affected by the individual's personality.

Therefore, an emphasis on the personal factor can be noticed and the respondents seem to prioritize skills that AI and robots cannot automate or learn. Similarly, most of the top 6 skills are strongly connected to professional co-operation, which highlights how an individual perceives working within a group in order to successfully solve a problem or task.

Least valuable skills

On the other hand, the least valuable skills form the Total Group are represented by the following five: *acting autonomously, social, and civic responsibility, global awareness, self-direction, and effective use of real-world tools*, as Figure 11 shows.

It seems that respondents see the world with no common aspect of the society, as they have *social & civic responsibility and global awareness* at the top of the least valuable skills. Moreover, the fact that *use of real-world-tools* is within the least valuable skills, is very interesting, since people are not considering as useful the ability to use hardware, software, networking, and peripheral devices or part of them, which is in line with the answers we receive regarding the most valuable skills – the absence of IT skills is once more evident.

On the same direction, the low rank of *acting autonomously* emphasizes the preference of the respondents to be part of a team. However, the lack of *self-direction* indicates potential inability in taking the initiative as well as setting goals related to individual learning.

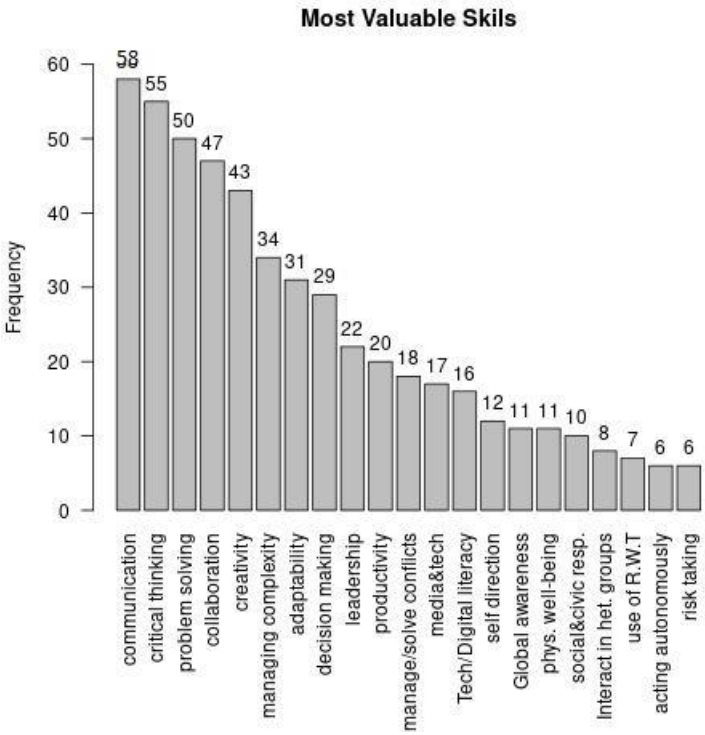


Figure 11 - Total Sample: Least valuable skills descending order

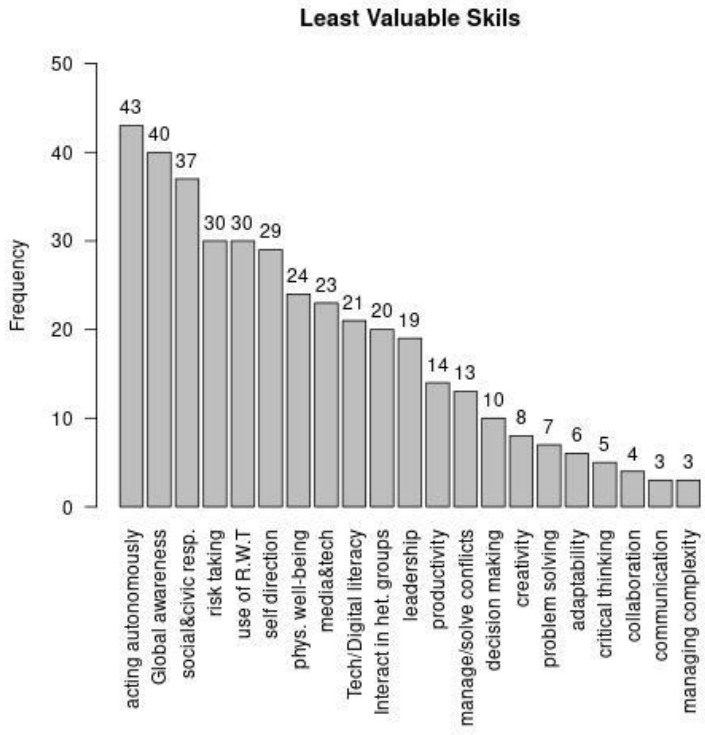


Figure 12-Total Sample: Most valuable skills descending order

Males and Females for most and least valuable skills

Having completed the analysis of the observations above, it is regarded important to also examine how the two gender groups are being differentiated or not from one another. The concluding remarks can be summarized as follows.

We see that for Females most valuable skills are the following, while the full list can be seen in Table 6- Females Total: Most valuable skills:

1. *Communication*
2. *Problem Solving*
3. *Critical Thinking*
4. *Collaboration*
5. *Adaptability & Flexibility*
6. *Managing Complexity*
7. *Creativity*

8. *Manage and solve conflicts*
9. *Decision Making*
10. *Productivity Accountability*

Answer	%	Count
communication	11.70%	20
problem solving	11.11%	19
critical thinking	9.94%	17
collaboration	9.36%	16
adaptability & flexibility	8.19%	14
managing complexity	7.60%	13
creativity	6.43%	11
manage and solve conflicts	5.85%	10
decision making	5.26%	9
productivity / accountability	4.68%	8
leadership	4.09%	7
media & technology skills	2.92%	5
social & civic responsibility	2.34%	4
Technology / digital literacy	1.75%	3
effective use of real-world tools	1.75%	3
interacting in heterogeneous groups	1.75%	3
self-direction	1.17%	2
global awareness	1.17%	2
risk taking	1.17%	2
acting autonomously	1.17%	2
physical well-being	0.58%	1

Table 6- Females Total: Most valuable skills

On the other hand, we see that females as least valuable skills have chosen the following, while the full list can be seen in Table 7:

1. *Acting autonomously*
2. *Global awareness*
3. *Self-direction*
4. *Effective use of real-world tools*
5. *Physical well being*
6. *Risk taking*

7. *Social & civic responsibility*
8. *Interacting in heterogeneous groups*
9. *Media and technology skills*
10. *Leadership*

Answer	%	Count
acting autonomously	12.80%	16
global awareness	11.20%	14
self-direction	9.60%	12
physical well-being	8.80%	11
effective use of real-world tools	8.80%	11
risk taking	6.40%	8
social & civic responsibility	5.60%	7
interacting in heterogeneous groups	5.60%	7
media & technology skills	4.80%	6
leadership	4.00%	5
manage and solve conflicts	4.00%	5
Technology / digital literacy	4.00%	5
problem solving	2.40%	3
productivity / accountability	2.40%	3
decision making	2.40%	3
creativity	2.40%	3
critical thinking	1.60%	2
collaboration	1.60%	2
communication	0.80%	1
adaptability & flexibility	0.80%	1
managing complexity	0.00%	0

Table 7 – Females Total: Least valuable skills

On the contrary, males perceive as most valuable skills:

1. *Critical thinking*
2. *Communication*
3. *Creativity*
4. *Problem solving*
5. *Collaboration*
6. *Managing complexity*
7. *Decision making*
8. *Adaptability & flexibility*

9. *Leadership*
10. *Technology/ digital literacy*

As least valuable skills for males are the following, while the full list can be seen in Table 8:

1. *Social & civic responsibility*
2. *Acting autonomously*
3. *Global awareness*
4. *Risk taking*
5. *Effective use of real-world tools*
6. *Media & technology skills*
7. *Self-direction*
8. *Technology/ digital literacy*
9. *Leadership*
10. *Interacting in heterogeneous groups*

Answer	%	Count
social & civic responsibility	11.41%	30
acting autonomously	10.27%	27
global awareness	9.51%	25
risk taking	8.37%	22
effective use of real-world tools	7.22%	19
media & technology skills	6.46%	17
self-direction	6.46%	17
Technology / digital literacy	6.08%	16
leadership	5.32%	14
interacting in heterogeneous groups	4.94%	13
physical well-being	4.94%	13
productivity / accountability	4.18%	11
manage and solve conflicts	3.04%	8
decision making	2.66%	7
creativity	1.90%	5
adaptability & flexibility	1.90%	5
problem solving	1.52%	4
managing complexity	1.14%	3
critical thinking	1.14%	3
collaboration	0.76%	2
communication	0.76%	2
Total	100%	263

Table 8 - Males: Least valuable skills

It is noteworthy that the male group has selected *leadership* and *technology/digital literacy* as both the most and the least valuable skills. This outcome of the data might be biased. All the respondents completed the survey either online, or during the Group 2 event. Online surveys are easy to create and distribute, but sometimes it is easy to skip an explanation that is critical for understanding the definitions and the idea behind each question.

Males and females have both chosen as most valuable skills *critical thinking, communication, creativity, collaboration,* and *decision making*. This choice is in line with the overall discussion of the Total Group and shows again the importance of teamwork and collaboration, more specifically the fact on how an individual perceives working within a group to successfully solve a problem or task.

Males and females have chosen in common as the least valuable skills *social&civic responsibility, acting autonomously, global awareness, risk taking, leadership* and *interacting in heterogeneous groups*. Firstly, it can be observed that they see the world as individuals, with no common aspect of society. Secondly, it is interesting for both genders that *interacting in heterogeneous groups* is within the least valuable skills, instead of the most valuable, given that society has become more international exhibiting the needs of diversity and inclusiveness.

The same applies for the distribution of the survey during the Group 2 event. Participants of the event were professionals who created some free time for the event itself and might have spent little time on reading and understanding the definitions and the goal of the survey. However, because most of their responses were made on printed version of the questionnaire, we do not have a way to remove those responses based on the time spent to reply the questionnaire, something that we did for the online surveys (we deleted all the respondents who spent less than 11 minutes).

Gap Analysis: Skills

Moving forward with the analysis, it is critical to present the findings regarding the perception of the participants on how valuable they see 21st Century Skills now compared to the future. As it is mentioned in the first part of the survey, the goal was to examine and monitor the 21 skills defined throughout the questionnaire, and to compare their importance between the past five years and in

the future. Again, we have the three groups, we have mentioned before, Group 1, Group 2 and Total Group. The scale that has been used is from one (1) to six (6) (see Table 9) on how they are perceiving the skills now, indicating:

Table 9 - Confidence Range

Weight	Description
1	Extremely unconfident
2	Very unconfident
3	Unconfident
4	Confident
5	Very confident
6	Extremely confident

In addition, the scale, which has been used on how important these skills will be in the future, is again from one (1) to six (6), in order to have a valid comparison between the questions. The scale in

Table 10 is indicating:

Weight	Description
1	Not at all important
2	A fair amount important
3	Somewhat important
4	Moderate important
5	Important

6	Very important

Table 10 - Importance Range

The ranking of the skills was based on their mean average, where the highest mean will have the highest rank. For the analysis, Average Weighted Mean (AWM) was employed to determine the importance of the skills. It is noteworthy that in most of the cases, for all three groups, respondents are willing to, or want to be better in most of the skills that have been provided to them. The list of the skills can be found in the appendix or in the beginning of this chapter. However, one of the skills, *acting autonomously*, is the only skill, which is considered as not important for the future, for all 3 groups we have. The reasons might be plenty. For instance, the respondents might not see the need or significance of this skill, which means that they are not convinced that acting autonomously is a desired competency.

Equation 1 – $Skills\ Gap\ Calculation$ shows the measure of the difference, which is defined as the mean average difference between the two perceptions of the confidence and future importance of the competencies:

Q1. In this question, we would like to ask you how confident you are with the following skills now

Q2. Now we ask you to assess how important you think this skill will be in the future

---

$$Skills\ Gap = \sum_{i-1}^{n} [\frac{resp_{importance} - resp_{confidence}}{n}]$$

Equation 1 – Skills Gap Calculation

Where:

i	refers to the ith respondents
n	refers to the Total number of respondents
Resp_confidence	refers to the respondents' perception on the confidence of skills
Resp_importance	refers to the respondents' perception on the importance of skills

The bigger the mean gap value, the bigger the variance between what is perceived as important skill now and in the future. In addition, negative results indicate that the respondents give less importance to the aforementioned skills, while positive results indicate that participants perceive higher importance on this skill in the future.

Overview of the three sub-groups

The following paragraphs are representing the observations and the results of the three groups that have been set.

For Group 2 group we notice the larger gap in terms of how they see skills now and how they see skills in the future, in *real world tools* and *interacting in heterogeneous groups*. In addition, *physical wellbeing* and *manage&solve conflict*s are represented by a 0.85 gap. The rest of the skills can be seen in Figure 13 - Gap Analysis: Group 2 We see how different this group perceives the way they see the skills for the future. Furthermore, *leadership, decision making, productivity&accountability*, and *social&civic responsibility* are among the skills with the least gap, as one can see in the following graph. Last but not least, *acting autonomously* for Group 2, is the only skill which has negative gap, meaning that the respondents chose a smaller value on how they see this skill in the future compared to how they perceive this skill in the present.

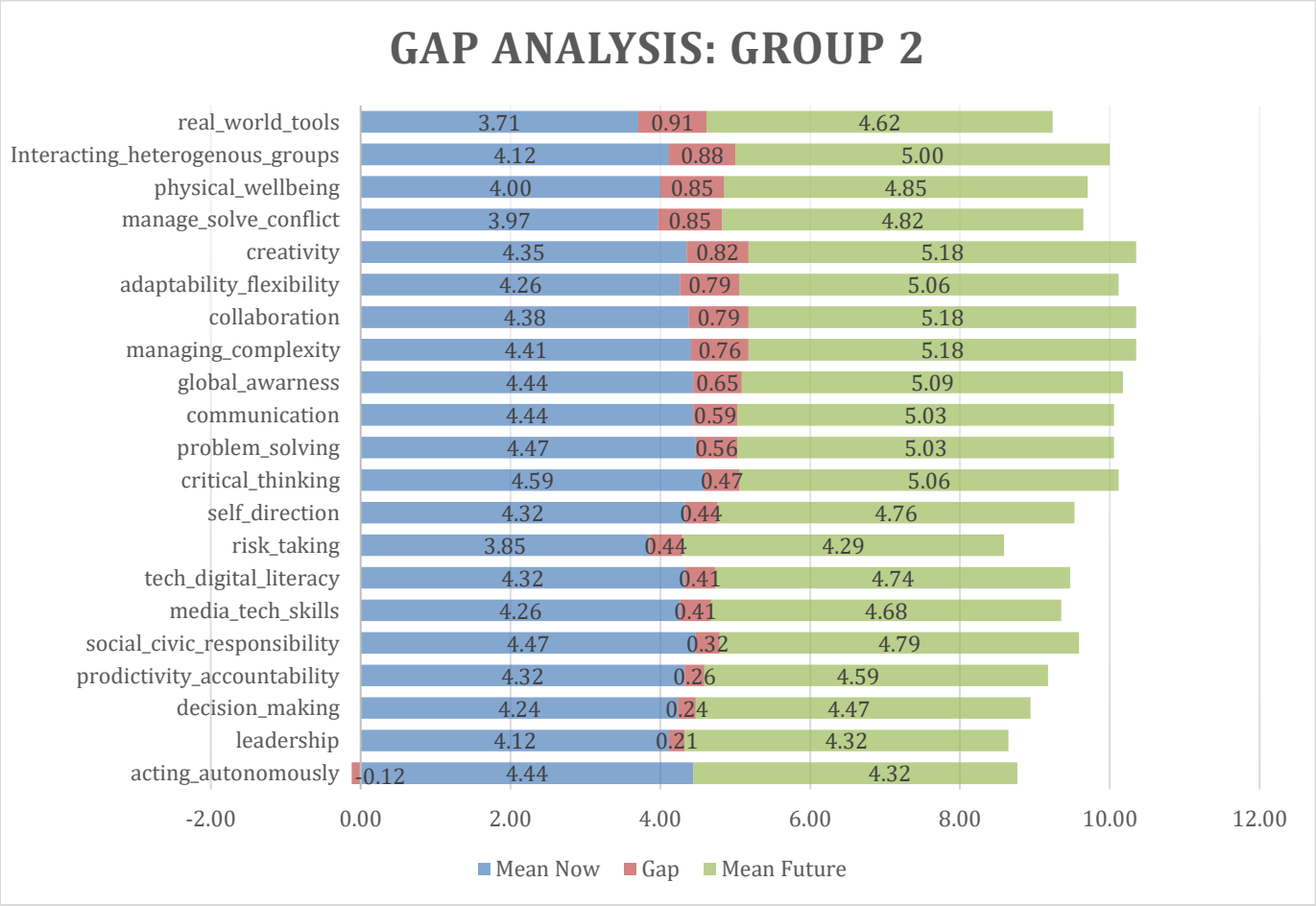


Figure 13 - Gap Analysis: Group 2

Figure 14- Gap Analysis: Group shows the behaviour of Group 1_respondents, in total 71. It is noticeable that participants show that they perceive *managing complexity, manage solve conflict* and *decision making* as those competencies which are more valuable for the future, as they have the largest gap, followed *by communication, creativity* and *leadership*. Skills, which have a small gap, are *social&civic responsibility, media tech skills* and *interacting in heterogeneous groups*, followed by *self-direction, productivity&accountability,* and *tech&digital literacy* with maximum gap at 0.66. However, *acting autonomously* has 0 gap, indicating once more the insignificance of the skill in the future for the 71 respondents of this sample group.

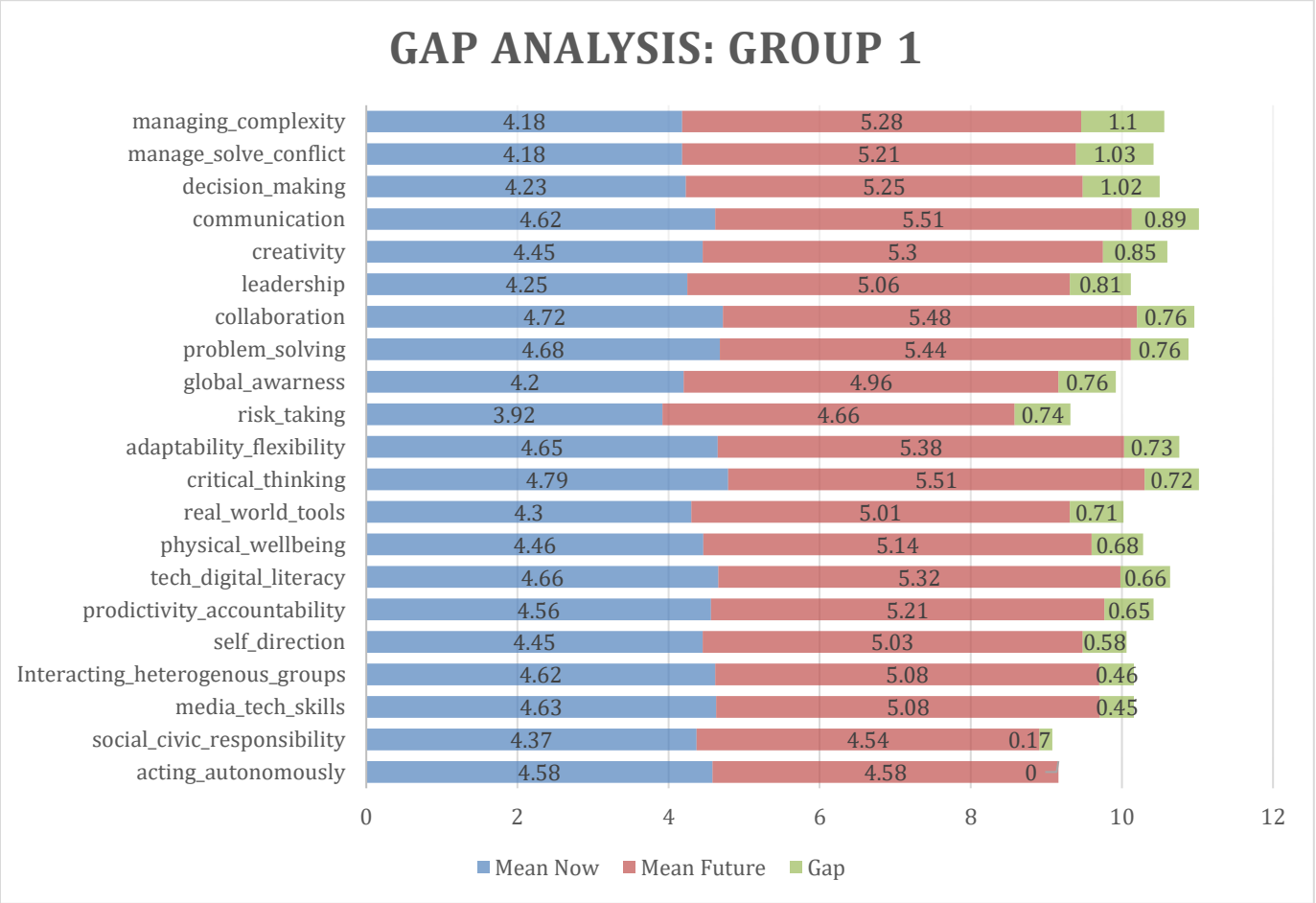


Figure 14- Gap Analysis: Group 1

Furthermore, differences in the Total Group are not so big, since this group is the merge of the two previous groups, Group 1 and Group 2. *Managing complexity*, *manage&solve conflict* and *creativity* are those skills, which are getting most of the interest and being perceived as skills more valuable for the future. On the other hand, without huge gap, *social&civic responsibility*, *media&tech skills*, *productivity&accountability*, and *self-direction* are having the least gap among the other skills. More details can be found in the following Figure 15- Gap Analysis: Total Sample.

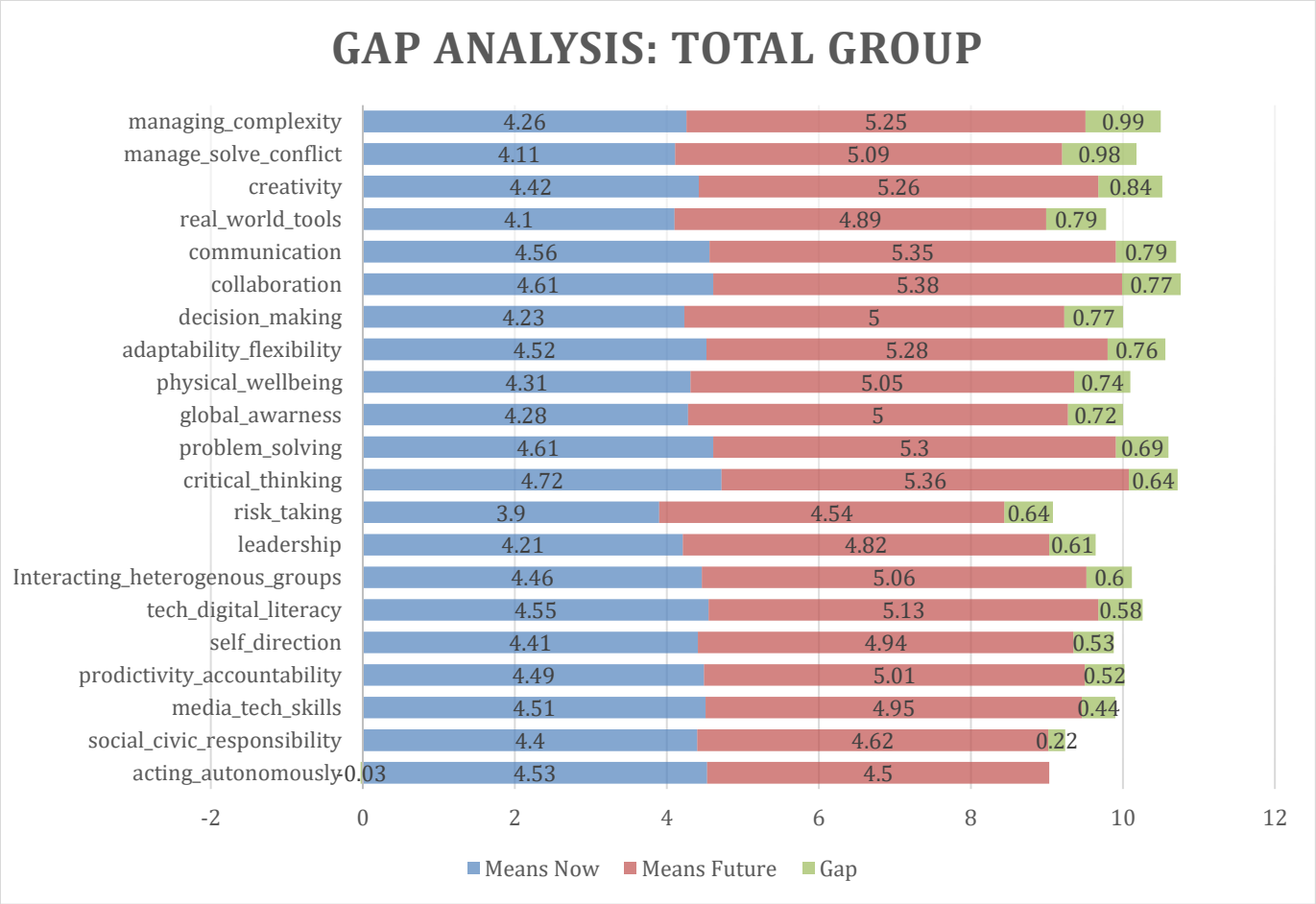


Figure 15- Gap Analysis: Total Sample

Interestingly, the gap of the *creativity* is on average 0.85 for the 3 sub-groups, followed by *collaboration* at 0.77, and *adaptability&flexibility* at 0.76. Therefore, we might suggest that these skills are seen as equally significant for the future.

Gap Analysis: Genders

To continue with the analysis, based on the above results, it is regarded important to also examine how the two gender groups are being differentiated, or not, from one another. Visual results, represented by graphs showing the gap, can be found in the Appendix.

Nine out of 34 were females in the Group 2. The largest gap between the two questions, which have been mentioned in the beginning of this chapter, has been noticed for *real world tools* and *creativity*. This means that females rated those skills as valuable in their future. On the other hand, a negative value gap has been noticed for *leadership*, at -0.11, followed *by acting autonomously*,

productivity&accountability and *self-direction*. For the 26 females of Group 1, there is a trend on *global awareness* and *decision making*, which are having the largest gap, meaning that Group 1 Female group is perceiving these 2 skills as important for their future, followed by *tech/digital literacy, managing complexity, real world tools* and *problem solving*. However, we see again the *acting autonomously* skill last on the list, followed by *social&civic responsibility, collaboration,* and *self-direction*. On the contrary, the 35 females of the Total Group chose as least valuable future skill, *acting autonomously*, followed by *social&civic responsibility* and *self-direction*. *Real world tools* and *global awareness* have the highest gap at 1.17, with *tech/digital literacy* at 1.14, followed by *decision making* and *managing complexity*.

Overall, we can observe that *acting autonomously* is again at the last place of most valuable future skills for the females. The term that was given for this skill was "the behavior of acting separately of other people within a team". On the contrary, *self-direction* is one of skills that gets attention for the female groups. Nevertheless, it must be noted that the sample of Group 2 participants was not too large to be sure that the observations we make are accurate.

Similarly, for the male group in each sub-group *acting autonomously* is once more the least valuable skill for the future, resulting in negative or 0 gap. *Real world tools, interacting in heterogeneous groups, physical wellbeing,* and *manage&solve conflict* for males in Group2_are among the most important skills for their future. However, *leadership, decision making,* and *productivity&accountability* have the lowest gap in future importance. *Managing complexity, manage&solve conflicts* and *decision making* have more than 1.0 gap, indicating these skills as important for males in Group 1 group. *Social & civic responsibility* has 0.17 gap, *media & tech skills* have 0.45 and interacting in heterogeneous groups is at 0.46 gap. However, in male Total Group, *social & civic responsibility, media & tech skills, and productivity & accountability* are trending with less than 0.5 gap, while *managing complexity, manage&solve conflicts* and *creativity* have more than 0.8 gap. For *creativity*, the average gap for these 3 groups is 0.83, followed by collaboration at 0.77 and 0.76 for *adaptability & flexibility*.

Reflections of skills now and in the future

For this part of the analysis, we used a scatter plot to compare how important the skills are now and how important these skills will be in the future. The scale used in the questionnaire ranged

from 1 to 6, indicating as 1 “extremely unconfident” for skills in the present and 1 as “not at all important” for importance in the future. Correspondingly, as 6 is “extremely confident” on how they perceive skills.

To check the questions above, we used the scatter plot to reject or accept if there is a relationship between the variables; the closer the data points lie together to make a line, the higher the correlation. Following is the list with the positively correlated skills that shows the confidence with the x skill (by x we mean each skill we test each time) and its importance between now and in the future.

1. *Creativity*
2. *Critical thinking*
3. *Problem Solving*
4. *Communication*
5. *Social & civic responsibility*
6. *Decision making*
7. *Collaboration*
8. *Managing complexity*
9. *Manage and solve conflicts*
10. *Risk taking*
11. *Effective use of real-world tools*
12. *Interacting in heterogeneous groups*
13. *Physical wellbeing*
14. *Media and technology skills*
15. *Technology and digital literacy*
16. *Global awareness*
17. *Self-direction*

18. *Leadership*

19. *Productivity and accountability*

We have selected 21 skills for our survey, out of a careful research during the phase of the literature review. Nineteen (19) out of 21 scatter plots had a positive correlation. For instance, in *creativity* we see both variables move in the same direction (Figure 16- Scatter Plot: Creativity). In other words, as one variable increases, the other variable also increases. Hence, we see the correlation. Similarly, we notice the same for the rest of the skills.

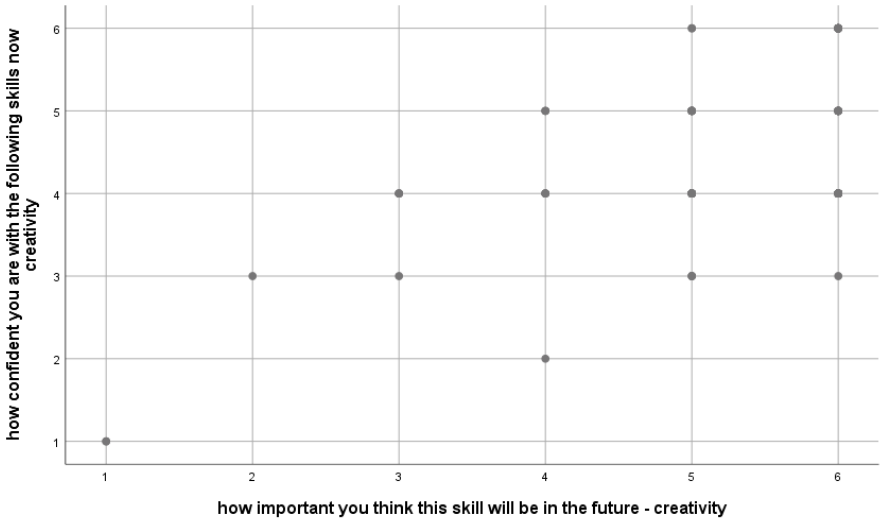


Figure 16- Scatter Plot: Creativity

By looking at the scatter plot (Figure 16) we can see how important *creativity* is and how confident people are with this skill both now and in the future. It can be concluded that people, who are confident with creativity skill and think that it will be useful in future, are positively correlated. This is positively correlated according to the above scatterplot. The same results have been noticed in all the skills listed above.

On the other hand, a non-structured appearance of the scatter plot leads to the conclusion that there is no relationship. We have noticed only two examples of this, for *acting autonomously* and *adaptability & flexibility* (Figure 17 & Figure 18).

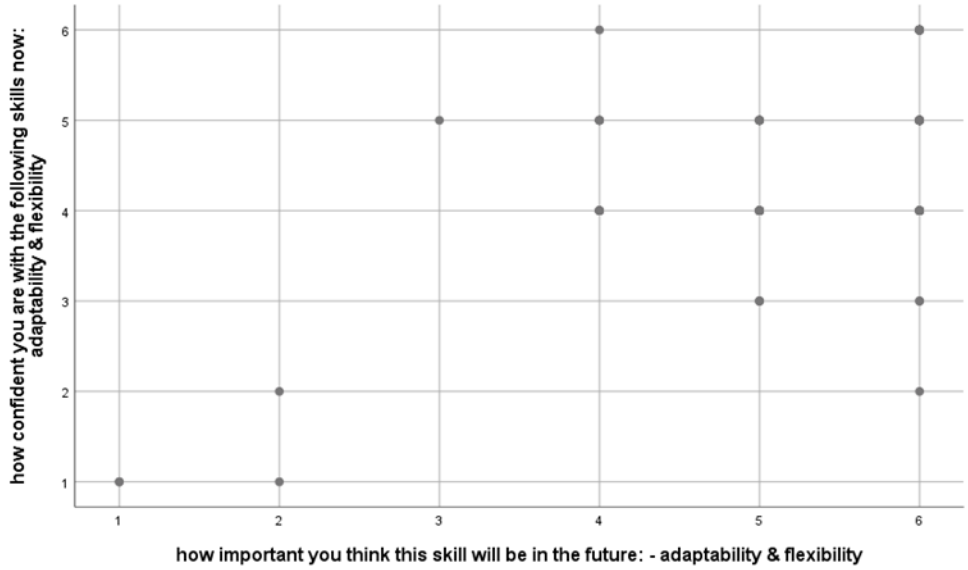


Figure 17 - Scatter Plot: Adaptability & Flexibility

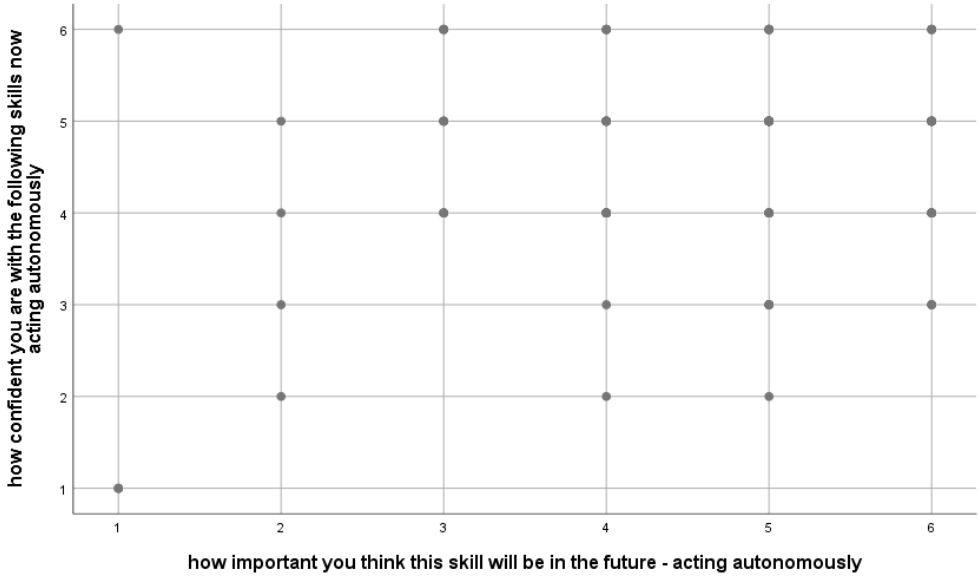


Figure 18 - Scatter Plot: Acting Autonomously

Acting autonomously: Explanation

On the previous chapters, it has been observed that *acting autonomously* was the least important skills for the 3 groups we are focusing on, Group 1, Group 2 and Total Group. Furthermore, *acting*

autonomously showed a non-correlated relationship between how participants see this skill now and in the future. These observations required further examination. As a result, we have checked the role of the people who participated in our survey, in order to come up with a reasonable explanation.

The report in SPSS, Table 11, comparing the role, as independent variable, with the *acting autonomously* skill now and in the future, showed the following results:

- 20% had "Other" role. They believe that acting autonomously is **less** important for the future.
- 17% were Staff Members. They believe that acting autonomously is **less** important for the future.
- 13% were Policy officers. They believe that acting autonomously is **less** important for the future.
- 13% were Project Managers. They believe that acting autonomously is **less** important for the future.
- 5.7% were Team/Department Managers. They believe that acting autonomously is **more** important for the future.
- 3% were Board Members. They believe that acting autonomously is **more** important for the future.
- 4.8% were Manager/Directors. They believe that acting autonomously is **more** important for the future.
- 23% were Consultants. They believe that acting autonomously is has the **same** importance for the future.

We see that employees with higher level roles in their companies believe that *acting autonomously* is very important for the future. Those people are normally overseeing the employees, people are reporting directly to them and they normally work on high-level tasks. On the other hand, employees who have a lower rank in the hierarchy of their companies, such as Staff Members, often need the approval of their Manager or Director in order to proceed in decisions.

The above facts bring us to a significant conclusion on why acting autonomously is having negative or zero gap to our result. More than 60% of the respondents are having roles that do not include high-level tasks.

What is your role?		Acting autonomously: Present	Acting autonomously: Future
Staff Member	Mean	4.61	4.33
	N	18	18
	% of Total N	17.1%	17.1%
Policy Officer	Mean	5.00	4.86
	N	14	14
	% of Total N	13.3%	13.3%
Consultant	Mean	4.50	4.50
	N	24	24
	% of Total N	22.9%	22.9%
Project Manager	Mean	3.93	3.86
	N	14	14
	% of Total N	13.3%	13.3%
Team/Department Manager	Mean	3.83	4.83
	N	6	6
	% of Total N	5.7%	5.7%
Board Member	Mean	4.33	5.33
	N	3	3
	% of Total N	2.9%	2.9%
Manager/Director	Mean	4.20	5.00
	N	5	5
	% of Total N	4.8%	4.8%
Other	Mean	4.71	4.67
	N	21	21
	% of Total N	20.0%	20.0%
Total	Mean	4.50	4.53
	N	105	105
	% of Total N	100.0%	100.0%

Table 11- Acting Autonomously by Role

Adaptability & Flexibility: Explanation

For *adaptability & flexibility* we have tried to do the same analysis and check if the role, age, gender, or education are affecting the results. However, we have not noticed anything odd or strange, which justifies why there is no correlation in this group category. The only significant observation was that 5 respondents, who have a PhD Degree (only 4.8% of total 105 respondents of the Total Group), believe that *adaptability & flexibility* are less important for the future (Table 12). Nevertheless, this small sample is not enough to make any conclusions. There is, moreover, a high chance that the consistency of our sample is not valid enough.

What is your education level?		adaptability & flexibility: Present	adaptability & flexibility:Future
PhD Degree	Mean	5.20	4.80
	N	5	5
	% of Total N	4.8%	4.8%

Table 12 - Adaptability & Flexibility for PhD Degree Holders

5.2.3 PART II: Learning Agility

This part of the survey is focusing on Learning Agility as perceived at an individual or organizational level. The part regarding the individual level is divided into 5 sub-categories, and each section focuses accordingly on:

1. Feedback seeking
2. Information seeking
3. Reflecting
4. Experimenting
5. Agility

The last part of the survey, focusing on Learning Agility at the organizational level, is divided into 3 sub-categories:

1. Measuring learning in organization
2. Organization supports learning
    a. As an individual
    b. As a team or group

The scale that has been used for this part of the survey ranges from (1) as “not at all” to (6) “very much”.

Overview of the three sub-groups

An analysis has been run for the three subgroups, Group 1, Group 2 and Total Group. Hereunder, the reader can find the results of this analysis, as well as a broad table (Table 13) with all the means per group.

	Group 2		Group 1		Total Group	
	N	Mean	N	Mean	N	Mean
Seek feedback from manager about performance	34	3.88	71	4.42	105	4.25
Ask my peers to provide me with feedback on my performance	34	4.18	71	4.01	105	4.07
Directly ask others on how to improve my performance	34	4.09	71	3.96	105	4.00
Discuss my mistakes with others	34	4.35	71	4.32	105	4.33
Discuss potential for advancement in organization with my manager	34	3.91	71	3.96	105	3.94
Seek info on topics related to my job	34	4.91	71	4.99	105	4.96
Read books articles, journals, etc. to stay informed	34	4.71	71	4.61	105	4.64
Update knowledge with training or education	34	4.47	71	4.46	105	4.47
Collect data to increase knowledge evaluate progress	34	4.68	71	4.58	105	4.61
Bring up problems and tough issues when needed	34	5.00	71	4.72	105	4.81
Consider the reason for and consequences of my actions	34	4.47	71	4.80	105	4.70

Take time to reflect on how to be more effective	34	4.32	71	4.76	105	4.62
Stop to reflect on work processes and projects	34	3.65	71	4.14	105	3.98
Evaluate work related events with others to understand what happens	34	4.35	71	4.61	105	4.52
Collaborate with people in other parts of the organization	34	4.88	71	4.90	105	4.90
Work with colleagues with different backgrounds, jobs, etc. for sharing experience	34	4.79	71	4.72	105	4.74
Ask others for help when needed	34	4.53	71	4.68	105	4.63
Jump into action and learn by error trial	34	4.79	71	4.66	105	4.70
Volunteer for projects that are possible to fail	34	4.62	71	4.27	105	4.38
Take on roles that are challenging	34	4.94	71	4.68	105	4.76
Try different approaches to see which generates best results	34	4.56	71	4.63	105	4.61
Evaluate new techniques or different ways of solving problems	34	4.53	71	4.65	105	4.61
Consider different options before taking actions	34	4.32	71	4.75	105	4.61
Switch between tasks jobs if needed	34	4.68	71	4.75	105	4.72
Find common themes among opposing point of view	34	4.50	71	4.42	105	4.45
Articulate seemingly competing ideas or perspectives when needed	34	4.76	71	4.44	105	4.54
Propose solutions that other see as innovative	34	4.82	71	4.54	105	4.63
Quickly develop solutions to problems	34	4.56	71	4.54	105	4.54
Get up to speed quickly on new tasks problems	34	4.56	71	4.73	105	4.68
Acquire new skills knowledge rapidly and easily	34	4.68	71	4.80	105	4.76
React well to unexpected problems	34	4.59	71	4.48	105	4.51
Rapidly gasp new ideas concepts	34	4.94	71	4.76	105	4.82
Average productivity is greater than last year	34	3.50	71	4.17	105	3.95
Number of suggestions implemented is greater than last year	34	3.53	71	4.24	105	4.01

Percentage of skilled workers is greater than last year	34	3.59	71	4.39	105	4.13
Spending time to IT is greater than last year	34	4.12	71	4.28	105	4.23
Individuals learning new skills is greater than last year	34	3.88	71	4.25	105	4.13
People openly discuss mistakes to learn from it	34	3.47	71	4.20	105	3.96
People help each other to learn	34	4.24	71	4.79	105	4.61
People get money resources to support learning	34	4.38	71	4.21	105	4.27
People see problems opportunity to learn	34	3.82	71	4.23	105	4.10
People give open honest feedback to each other	34	3.76	71	4.31	105	4.13
People encouraged to ask why regardless rank	34	3.71	71	4.42	105	4.19
People spend time building trust with each other	34	4.15	71	4.35	105	4.29
Teams groups freedom to adapt their goals as needed	34	3.79	71	4.32	105	4.15
Teams groups treat members as equals	34	4.32	71	4.76	105	4.62
Teams groups focus on group task and how good team working	34	3.85	71	4.68	105	4.41
Teams groups revise thinking as a result of group discussions	34	4.09	71	4.68	105	4.49

Table 13 - Distribution of means for the Learning Agility questions

Table 13 is a broad table with the means of each question that was part of the second part of the survey, including questions for the Learning Agility. It is divided per each group, Group 2, Group 1 and Total Group. Most of the questions that have been answered by the respondents show an insignificant gap among the three groups/samples. The range of the mean value in general is between 3.5 and 5, which indicates that the most common answers were “only partially”, “somewhat” and “a fair amount”.

Nevertheless, it is noticeable that the following questions had a gap, over 0.3, regarding one of the sub-categories. Those questions are the following and have also been highlighted in the above table. “Seeking feedback from my manager about performance” seems to be having the lowest mean value for Group 2 compared to the other two groups. This means that Group 2 employees

do not seek for feedback often. However, the sample is very small to give a valid explanation. In the Reflecting category, in four out of four questions, it has been also noticed that there is again a difference between Total Group and Group 2 for:

- Consider the reason for and consequences of my actions or recent events
- Take time to reflect on how to be more effective
- Stop to reflect on work processes and projects
- Critically evaluate work-related events with others to understand what happens

As a result, it seems that the employees in Group 2 are not engaging with those behaviors, and it is not usual for them to reflect on corresponding behaviors in their daily work life. Hence, we could say that UBR is not very agile on the reflecting category.

On the question if the individual is volunteering on projects that might fail, we see that UBR employees/Group 2 are having the highest mean value compared the other two groups, Group 1 and Total Group, which means that most of them seem to be more agile in experimenting on risky projects (Table 14).

Group	Mean
Group 2	4.62
Group 1	4.27
Total Group	4.38

Table 14 - Means: Do you volunteer for projects that possible to fail

On the agility category we notice again that in question "Consider many different options before taking actions", Group 2 has the lowest mean value. Correspondingly, this indicates that the employees are not checking many different options in order to choose the best possible solution or strategy for their project or decision. However, we observed during the previous step that they are taking part in projects that might fail, which brings up some interesting questions; for instance, how often do their projects fail or succeed? In addition, for the questions "Articulate seemingly competing ideas or perspectives when needed' and "Propose solutions that others see as innovative", it seems that again Group 2 has the highest gap compared to Total Group. Therefore,

we could possibly say that people who are working in UBRijks are positively behaving against the agility category.

Furthermore, we noticed that in the category of “Learning Agility in the organizational level aspect: Measuring Learning Organization”, employees of Group 2 are not rating their organization high regarding the productivity, the percentage of skilled workers, the number of individuals learning new skills and the number of suggestions implemented compared to last year, compared to the other two groups we have. This comes in contrast with the agility category where we saw some flexibility on that. Nevertheless, respondents are not feeling very comfortable with what the organization is currently offering regarding the workforce, compared to last year. Thus, it is noteworthy that “the percentage of skilled workers are higher than last year” is one of the higher gaps among the three groups (0.8).

Regarding the category of “how supportive is the individual’s organization in learning and learning resources”, the results are very positive in general for the three groups. It seems that the organizations are supporting their employees to widen their knowledge. However, Group 2 seems to lack in:

- view problems in their work as an opportunity to learn
- people give open and honest feedback to each other
- people are encouraged to ask "why" regardless of rank (0.71 gap compared to Total Sample group)

The last category in the survey was about how the organization supports and uses learning at a team or group level. It is noticeable that organizations are also supportive, but in Group 2 we observed that in three out of four questions the mean value is the lowest among the three groups, which lead us to the conclusion that Group 2 is not very agile with continuous support to its employees regarding knowledge and learning. Groups and teams seem to act somehow individually, with lack of team spirit and with clear division of the roles and hierarchy within the team.

ANOVA for survey Part II

Having completed the analysis of the observations above, it is regarded important to also examine how the participants are engaging with specific behaviors in their professional life at an individual and organizational level. We run an analysis to find the total means for each category: feedback, information seeking, reflecting, experimenting and agility. The analysis has been done per each group sample, Group 1, Group 2 and Total Group. Table 15 and Table 16 below show a summary of the categories in agility by comparing them with gender, education, and role.

Total Group					
	Feedback Seeking	**Information Seeking**	**Reflecting**	**Experimenting**	**Agility**
Gender					
Male	4.16	4.79	4.41	4.67	4.65
Female	4.02	4.54	4.53	4.62	4.55
Other	5.00	4.00	5.00	6.00	6.00
Education					
<High school	1.40	2.00	1.25	1.50	1.85
High school	4.48	5.24	4.45	4.88	4.78
Bachelor	4.08	4.62	4.47	4.65	4.71
Master	4.18	4.82	4.62	4.83	4.73
PhD	4.60	4.84	4.30	4.45	4.58
Other	3.33	3.20	3.17	3.38	3.27
Role					
Staff	4.30	4.52	4.78	4.69	4.49
Advisor	4.40	5.16	4.57	4.94	4.88
Consultant	3.42	4.54	4.22	4.50	4.46
Project Manager	4.07	4.51	4.09	4.47	4.56
Team Manager	4.60	4.57	4.67	4.85	4.90
Board Manager	4.87	5.07	3.58	5.00	4.53
Manager	4.48	4.88	4.85	4.88	5.08
Other	4.28	4.78	4.58	4.63	4.64
Total	4.12	4.70	4.45	4.67	4.63

Table 15 – Total Group: Total Means grouped by Gender/Education/Role

Group 1 and Group 2						
		Feedback Seeking	**Information Seeking**	**Reflecting**	**Experimenting**	**Agility**
Gender						
Group 1	Male	4.20	4.76	4.54	4.65	4.63
	Female	4.02	4.52	4.64	4.65	4.60
Group 2	Male	4.08	4.83	4.17	4.72	4.68
	Female	4.00	4.62	4.19	4.53	4.39
	Other	5.00	4.00	5.00	6.00	6.00
Education						
Group 1	Bachelor	4.07	4.47	4.44	4.49	4.62
	Master	4.12	4.73	4.68	4.77	4.67
	PhD	4.50	5.05	4.13	4.06	4.23
	Other	4.60	4.00	3.75	4.00	3.90
	<High school	1.40	2.00	1.25	1.50	1.85
Group 2	High school	4.48	5.24	4.45	4.88	4.78
	Bachelor	4.13	5.07	4.54	5.13	5.00
	Master	4.36	5.08	4.44	4.99	4.91
	PhD	5.00	4.00	5.00	6.00	6.00
	Other	2.70	2.80	2.88	3.06	2.95
Role						
Group 1	Staff	4.30	4.52	4.78	4.69	4.49
	Advisor	4.80	5.00	4.50	5.00	4.60
	Consultant	3.55	4.61	4.30	4.61	4.59
	Project Manager	4.56	4.84	4.40	4.80	4.76
	Team Manager	4.40	4.65	4.63	4.53	4.60
	Manager	4.48	4.88	4.85	4.88	5.08
	Other	4.27	4.76	4.63	4.55	4.62
Group 2	Advisor	4.37	5.17	4.58	4.93	4.90
	Consultant	2.92	4.28	3.90	4.10	3.98
	Project Manager	3.80	4.33	3.92	4.29	4.44
	Team Manager	5.00	4.40	4.75	5.50	5.50
	Board Manager	4.87	5.07	3.58	5.00	4.53
	Other	4.30	5.00	4.13	5.38	4.80
Total Group 1		4.14	4.67	4.58	4.65	4.62
Total Group 2		4.08	4.75	4.20	4.71	4.64

Table 16- Group 1 & Group 2: Total Means grouped by Gender/Education/Role

After calculating the means, we tried to fit an one-way ANOVA. Since there was imbalance in our data with respect to Group 1/Group 2 we used the complete Group 2 (34 subjects) and we drew a random sample of 34 subjects from Group 1. After the random sample was drawn, we inspected the histograms of each of the 5 variables of interest, namely Feedback, Information, Reflecting, Experimenting and Agility. ANOVA must be in groups that are not a part of the other group. As a result, the only ANOVA test we could run was for Group 1 and Group 2 samples.

The histograms did not indicate normality (Figure 19 to Figure 23), but ANOVA was used in order to assess whether there was significant difference between the means of the two groups for each one of the aforementioned variables. As observed in the 5 ANOVA tables (Table 17) below the source of the samples for Group 1 and Group 2 was not significant, meaning that the means in these two groups did not differ for any of the variables.

	Df	Sum Sq	Mean Sq	F value	**Pr(>F)**
Feedback Seeking					
Group (between groups)	1	0.68	0.68	0.669	**0.416**
Residuals (within groups)	66	67.06	1.016		
Information Seeking					
Group (between groups)	1	0.24	0.2353	0.255	**0.615**
Residuals (within groups)	66	60.92	0.9231		
Reflecting					
Group (between groups)	1	1.94	1.9449	2.054	**0.157**
Residuals (within groups)	66	62.49	0.9468		
Experimenting					
Group (between groups)	1	0	0.0037	0.004	**0.949**
Residuals (within groups)	66	59.97	0.9087		
Agility					
Group (between groups)	1	0.08	0.0778	0.105	**0.746**
Residuals (within groups)	66	48.67	0.7374		

Table 17 - ANOVA for Group 1 and Group 2

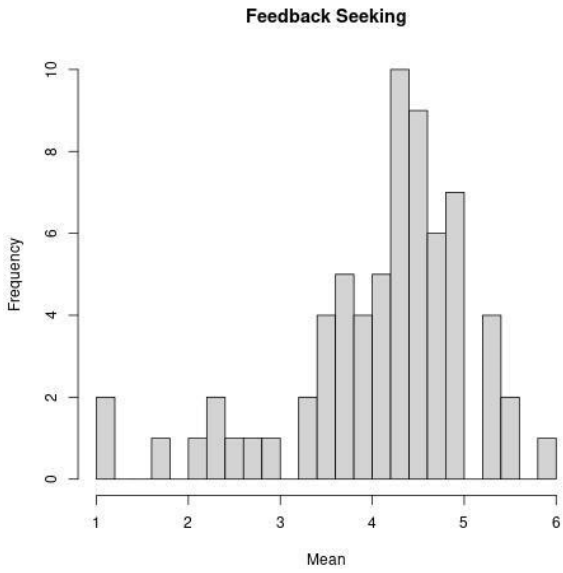


Figure 19 - Histogram Feedback Seeking

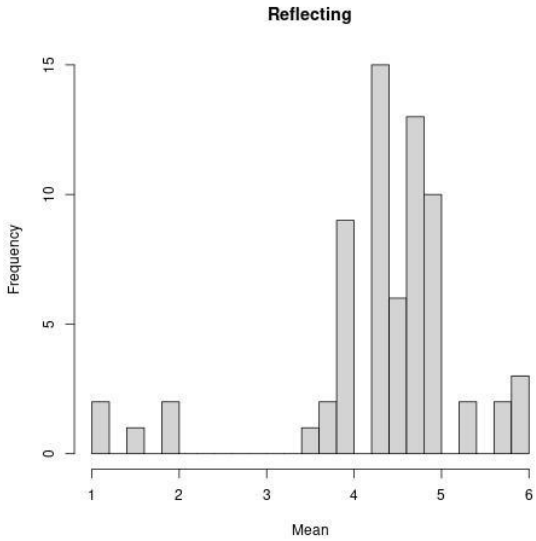


Figure 21 - Histogram Reflecting

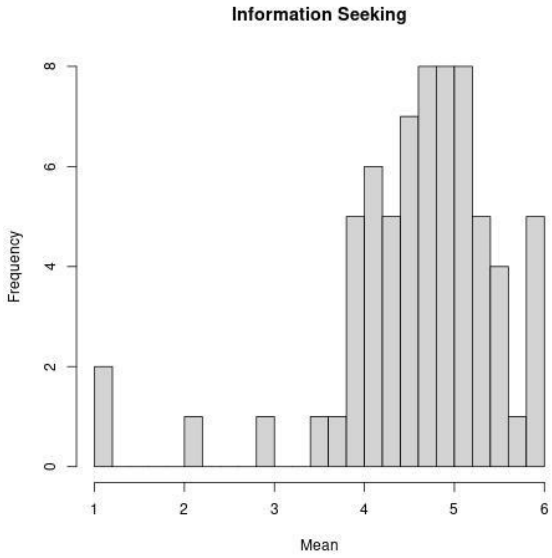


Figure 20 - Histogram Information Seeking

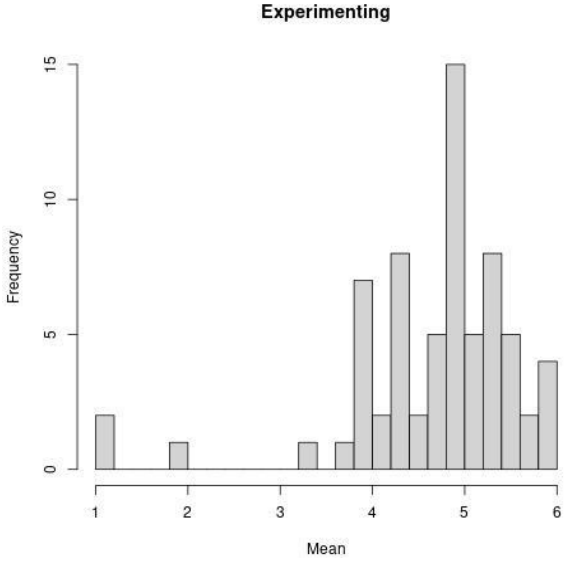


Figure 22 - Histogram Experimenting

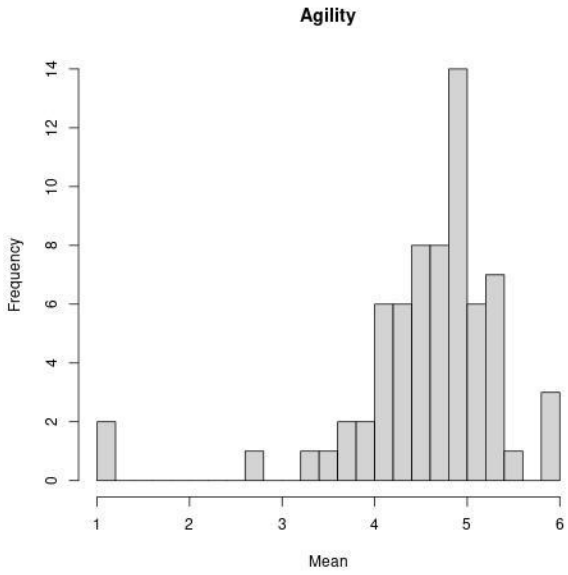


Figure 23 - Histogram Agility

The last part of the questionnaire is dedicated to Learning Agility and the engagement with specific behaviors of the respondents at the organizational level. As we mentioned previously, histograms should have an ordinary distribution in order to show normality or significance (Figure 24 to Figure 26). As observed in the following graphs, histograms do not indicate normality. However, even though we do not see normality, it seems like organizations are supporting learning at both team and individual level.

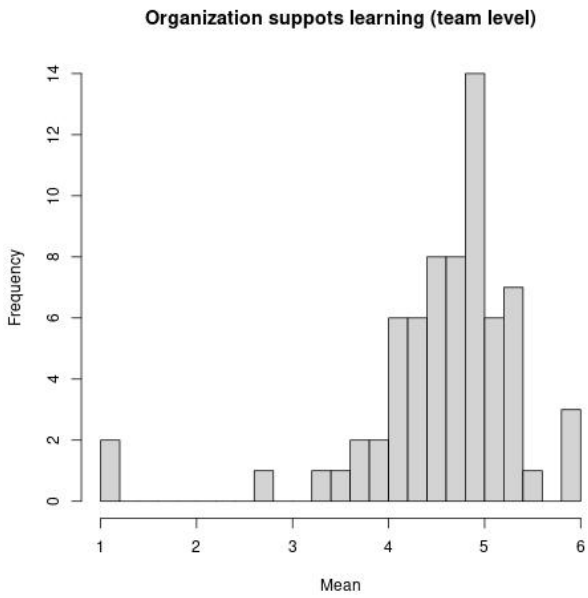


Figure 25 - Histogram Organization supports learning (team)

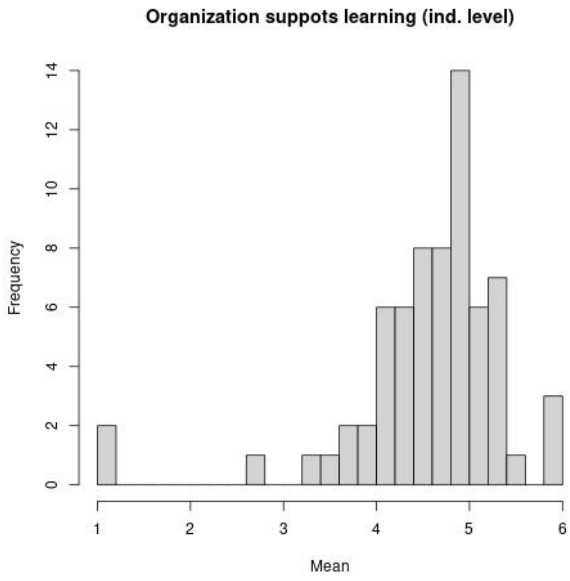


Figure 24 - Histogram Organization supports learning (individual)

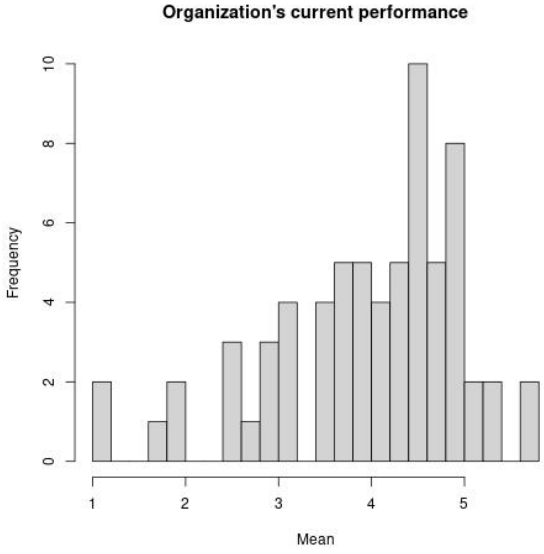


Figure 26 - Histogram Organization's current performance

5.2.4 Correlations: skills and Learning Agility

Having completed the analysis of the observations above, it is regarded important to also examine if there are any correlations between the skills and the Learning Agility parts of the questionnaire, and if the 105 respondents (Total Group) have correlation or not from the defined skills.

For this reason, we have used R-language to help us create tables, which show the skills, and the correlations of each of the 5 categories we have on how Learning Agility is perceived at an individual level.

Generally, for all 5 sub-categories (Feedback seeking, Information seeking, Reflecting, Experimenting and Agility), the p-value is less than 0.05 for all the cases and most of the cases have less than 0.01, which means that there is significance between the groups. Those pointed with "*" have a p-value less than 0.05 and those with "**" less than 0.01. The following Table 20 indicates the correlation on Learning Agility and the skills. In addition, those skills pointed with "F" are the skills that are perceived as important for the future. Those pointed by bold are those skills which are more correlated than the rest. The rest of the tables can be found in the appendix.

Skills	Correlation Estimate	P. value
Creativity**	**0.557**	<<0.01
Critical Thinking**	**0.625**	<<0.01
Problem Solving**	0.47	<<0.01
Communication**	0.44	<<0.01
Social Civic Resp.**	0.506	<<0.01
Decision Making**	**0.55**	<<0.01
Collaboration**	0.512	<<0.01
Creativity F**	**0.557**	<<0.01
Critical Thinking F**	**0.62**	<<0.01
Problem Solving F**	0.504	<<0.01
Communication F**	**0.54**	<<0.01
Social Civic Resp. F**	0.511	<<0.01
Decision Making F**	0.421	<<0.01
Collaboration F**	0.351	<<0.01
Managing Complexity**	**0.641**	<<0.01
Manage & Solve Conflict**	**0.603**	<<0.01
Risk Taking**	**0.54**	<<0.01
Effective use of RWT**	0.451	<<0.01
Interacting in heterogeneous group**	0.475	<<0.01
Acting Autonomously**	**0.624**	<<0.01
Physical Well-being**	0.419	<<0.01
Managing Complexity F**	**0.581**	<<0.01
Manage & Solve Conflict F**	**0.577**	<<0.01
Risk Taking F**	0.459	<<0.01
Effective use of RWT F**	0.448	<<0.01
Interacting in heterogeneous group F**	0.508	<<0.01
Acting Autonomously F**	0.363	<<0.01
Physical Well-being F**	**0.548**	<<0.01
Media & Tech Skills**	0.513	<<0.01
Tech/Digital Literacy**	0.503	<<0.01
Global Awareness**	**0.604**	<<0.01
Adaptability & Flexibility**	**0.593**	<<0.01
Self-Direction**	**0.552**	<<0.01
Leadership**	**0.583**	<<0.01
Productivity/Accountability**	**0.647**	<<0.01
Media&Tech Skills F**	0.356	<<0.01
Tech/Digital Literacy F**	0.406	<<0.01
Global Awareness F**	**0.581**	<<0.01
Adaptability&Flexibility F**	**0.628**	<<0.01
Self-Direction F**	**0.575**	<<0.01

Leadership F**	0.494	<<0.01
Productivity/Accountability F**	0.454	<<0.01

Table 18 - Correlations: Skills and Agility 1

To sum up, regarding the agility group of questions, out of 42 skills – 21 on how they are perceived now and 21 on how important they are for the future – 28 of them are showing a higher correlation with agility. Among those 28, 16 are on how the respondents see the skills now and 12 on their importance in the future. Table 19 shows these observations. Those highlighted with color are common for skills both now and in the future.

Skills now	**Skills in the future**
Creativity	Creativity
Critical thinking	Critical thinking
Social and civic responsibility	Problem solving
Decision Making	Communication
Collaboration	Social and civic responsibility
Managing Complexity	Managing Complexity
Manage & Solve Conflict	Manage & Solve Conflict
Risk Taking	Interacting in heterogeneous group
Acting Autonomously	Physical Well-being
Media & Tech Skills	Global Awareness
Tech/Digital Literacy	Adaptability & Flexibility
Global Awareness	Self-Direction
Adaptability & Flexibility	
Self-Direction	
Leadership	
Productivity/Accountability	

Table 19 - Correlations: Skills and Agility 2

6. Discussion

The skills under examination where selected based on the literature review, which can be summarized on the table below. This table illustrates which skills are represented in each of the five frameworks.

Length / Amount of Questions	Owner/Creators	Purpose	Skills																					
			creativity	*critical thinking*	*problem solving*	*communication*	*social & civic responsibility*	*decision making*	*collaboration*	*media & technology skills*	*technology/digital litercy*	*global awarness*	*adaptability & flexibility*	*self direction*	*leadership/ responsibility*	*productivity/accountability*	*managing complexity*	*manage and solve conflicts*	*risk taking*	*effective use of real world tools*	*interacting in heterogenous groups*	*acting autonomously*	*physical well-being*
no information	Battelle for Kids - non profit organization	Create enduring impact for every child	x	x	x	x			x	x	x		x	x	x	x								
research on emerging characteristics of the Net	the North Central Regional Educational Laboratory	necessary to give students the education they require in a	x			x	x		x	x	x	x	x	x		x	x		x	x				
no information	Organization for Economic Co-operation and Development	policy-makers, reserchers, educators with orientations for the design of educational	x	x		x			x	x	x							x			x	x		
gathering data through assesment	University of Melburne Sponsored by CISCO, INTEL and Microsoft	Empowering Students to Succeed	x	x	x	x		x	x	x		x								x				
modules, courses	UNESCO and Microsoft	identify common set of qualifications needed for the integration of ICT in teaching and learning	x	x	x	x	x		x	x	x	x	x			x					x			x

Figure 2- Comparison Table for 21st Century Skills' Frameworks

6.1.1 Skills for the future

The frameworks we have used to collect the targeted skills, differ in their goals. OECD by the European Union is one of those which highlights upmost significance of the skills a context of a workplace. European Parliament and Council's framework discuss the importance of the skills for a productive employee with successful integration and fulfilment. On the contrary, the rest of the frameworks argue about the matter of importance in positioning 21st-century skills in an educational context. The existing frameworks show a guideline on which skills should be taught but do not show what is really being taught in schools. Essentially the list of the skills is an idealized list of competencies for a successful individual. However, all the frameworks indicate the important role of the technology which changed school and education by given unlimited access to information. Nevertheless, they do not give any evidence of the critical skills one needs in the workplace. Following, we present the skills we believe that are most and least important in an IT work environment.

The most valuable skills for the Total Group consist of skills that are not related to technology or tech-skills, while 50% of the Total Group are working in IT roles, and the rest are a part of an IT organization. This comes in contrast with a recent research made by van Laar *et al.* (2017) where he concludes that digital skills are equally important. The aforementioned one shows a very interesting trend given that technology is becoming more and more integral to professional daily life while skills such as *communication, critical thinking* and *problem solving* are among the top skills. These skills require effort and time devoted to identifying and constantly sharping them in order to apply them in different problems and contexts in the working environment. Therefore, the extra time and effort needed for the development of those skills attributes them a higher value in contrast to the IT skills which the respondents naturally employ on a daily basis.

In addition, most of the top 5 skills, *communication, critical thinking, problem solving, collaboration, creativity*, are characterized as soft skills, which frequently are affected by the personality of each person. Therefore, it is noteworthy that the majority of the most picked valuable skills are strongly associated with professional co-operation, which features how an individual sees functioning within a group so as to effectively solve a problem or task. In addition, *communication, collaboration, creativity* and *critical thinking,* are among skills which are the most mentioned in the frameworks.

On the other hand, in the question *"According to your point of view, which of the following are the least valuable skills to be successful in a workplace",* it seems that respondents see the world with no common aspect of the society, as they have *social & civic responsibility and global awareness* at the top of the least valuable skills. Moreover, the fact that *use of real-world-tools* is within the least valuable skills, is very interesting, since people are not considering as useful the ability to use hardware, software, networking, and peripheral devices or part of them, which supports the evidence we received regarding the most valuable skills – the absence of IT skills. Similarly, the low ranking of *acting autonomously* underscores the inclination of the respondents to behave autonomously within a group. Notably, *acting autonomously* as a skill, was only reported in OECD framework. In addition, most of the respondents who think that the said skill is important are either Board Members or Managers/Directors, which is a very small figure in our survey. Supporting evidence is the absence of *self-direction* as a skill, which indicates a potential inability in stepping up just as defining goals and objectives related to individual. Both *acting autonomously*

and *self-direction* have been mentioned the least times in the frameworks.

Moreover, we found interesting the fact to check the behaviour of gender regarding the most and least valuable skills. Both males and females, have both picked as most significant skills *critical thinking, communication, creativity, collaboration,* and *decision making*. This is in accordance with the overall discussion part of the Total Group and shows the significance of teamwork and collaboration. Similarly, males and females chose both as least valuable skills *social & civic responsibility, acting autonomously, global awareness, risk taking, leadership* and *interacting in heterogeneous groups*, where most of the skills except for *global awareness*, are a part of a framework less than 2 times. It can be noted that both males and females see the world as individuals, without shared aspect of society. It is interesting for both, that engaging in heterogeneous groups is among the least useful skills, rather than the most useful, considering that society needs diversity and inclusiveness. Given this, we might consider the fact that the sample of 105 total respondents are a part of a conservative environment. However, as said before the sample of the survey is small and does not reflect to the whole of society. It does not surprise us that both males and females provide the same result, because professional equality has marked tremendous progress in the past decades. Females have stepped up with success and have adapted to the fast paced and changing world where mere used to be dominant, especially within the IT roles which represents more than 53% of our respondents.

Moving forward with the analysis, it is critical to present the findings regarding the perception of the participants on how valuable they see 21st Century Skills now compared to the future. For this reason, we run a gap analysis. According to Davis, Misra and Van Auken (2002) measuring competencies are basic for evaluation of any gaps that may exist between the present and the future needs. The bigger the mean gap value depicts the variance between what is perceived as important skill now and in the future. Nonetheless, negative results indicate that the respondents give less importance to the said skills.

Regarding the Group 2, we notice an importance and preference in *real world tools* and *interacting in heterogeneous groups*, followed by *physical wellbeing* and *manage & solve conflicts*, and according to Kalantzis and Cope (2008), most of these skills are related to technology, and also

include social and cultural understanding. Least gap is for *leadership, decision making, productivity & accountability and social & civic responsibility*. On the other hand, Group 1 shows that *managing complexity, manage & solve conflict* and *decision making* are among skills that are perceived as more valuable for the future, followed by *communication*, *creativity,* and *leadership*. Smaller gap has been noted for *social & civic responsibility, media tech skills* and *tech and digital literacy*. However, the Total Group consists of the previous two groups, and the differences are not that large. Nevertheless, an interesting fact is that *creativity* gap is on average 0.85 for the 3 sub-groups followed by *collaboration* at 0.77, and *adaptability & flexibility* at 0.76. Those are the skills that we could possibly say that are being seeing equally significant for the future and are in line with Kalantzis and Cope (2008) perspective.

On that note, for the three groups of the survey, Group 1, Group 2 and Total Group, it is noteworthy that *acting autonomously* has negative or 0 gap, indicating the insignificance of this skill in the future. During the literature review this skill was a part of only 1 out of the 5 frameworks we focused on, OECD- DeSeCo. *Acting autonomously* might be a skill that is important for the questionnaire and for the consistency in the group. In more detail, we have seen that more than 60% of the respondents are having roles that do not include high level tasks. For instance, participants with high level roles believe that *acting autonomously* is very important for the future. Those people are normally overseeing the employees, people are reporting directly to them and normally working on high-level tasks. On the other hand, employees who have a lower rank in hierarchy of their companies, such as Staff Members, they often need the approval of their Manager or Director in order to proceed in decisions.

6.1.2 Skills and Learning Agility as a dynamic capability

The frameworks we identified in Chapter 2, were only available as consultancy products, with an average cost of 200$ per assessment, and the interested parties could find them online. thus, we have included questions from the Learning Agility Assessment Inventory (*LAAI*). These frameworks highlighted the importance of identifying the strengths and weaknesses of individuals and provided with diagnostic guidance on the success of the team, individual and managerial roles.

Moving forward with our analysis, it is regarded important to also examine if there are any correlations between the skills and the Learning Agility parts of the questionnaire. Out of the 5

subcategories identifying the Learning Agility part, Feedback seeking, Information seeking, Reflecting, Experimenting and Agility, we saw a relationship with each one of the skills and each one of the five categories.

To begin with, the agility category, is the one which has most of the correlations with skills and shows a stronger relationship with 29 skills. The correlations and the list of the skills can be found in the appendix. Those skills marked with "F" represent the said skill in the future. The strongest relationship has been noticed with *productivity & accountability, managing complexity and adaptability & flexibility F*. These results remain within the bounds of reason. Regarding the experimenting category, 24 skills are showing a stronger relationship, with the strongest correlations being with *adaptability & flexibility F, manage & solve conflict* and *self-direction F*. Reflecting subcategory is showing 8 strong correlations among the 42 skills, with *problem solving, creativity* and *productivity & accountability* having the most efficiency. To continue with, we only see 5 skills having stronger correlation among 42, regarding the information seeking, with dominant those with *problem solving, creativity F and productivity & accountability.*

On the other hand, the feedback seeking category is not showing a very strong relationship with any of the skills, with all of them having less than 0.5 estimated value. Although, we have a correlation with low estimate values, lead us to the point that the sample of respondents are not representative of the population and that the sub questions we have used to observe this category, are not appropriate to explore the strength of the relationship.

To continue with, the following Table 20 summarizes the top 5 skills of each category, based on the estimated value, since all the p-values are showing a correlation with the five categories and the skills. It is noteworthy, that the estimated value for all the categories is over 0.507 for all the categories except for Feedback Seeking.

Agility		Experimenting		Feedback Seeking		Information Seeking		Reflecting	
Productivity/Accountability	**0.647**	Adaptability&Flexibility F	**0.616**	Interacting in heterogenous group	**0.472**	Problem Solving	**0.526**	Communication F	**0.564**
Managing Complexity	**0.641**	**Manage&Solve Conflict**	**0.613**	**Manage&Solve Conflict**	**0.461**	Creativity F	**0.518**	Adaptability&Flexibility F	**0.562**
Adaptability&Flexibility F	**0.628**	Self Direction F	**0.597**	Productivity/Accountability	**0.456**	Productivity/Accountability	**0.517**	Self Direction F	**0.552**
Critical Thinking	**0.625**	Critical Thinking F	**0.596**	Managing Complexity F	**0.401**	Self Direction	**0.514**	Physical Well-being F	**0.541**
Acting Autonomously	**0.624**	Productivity/Accountability	**0.594**	**Physical Well-being**	**0.389**	Tech/Digital Literacy	**0.507**	Critical Thinking	**0.539**

Table 20 - Top 5 skills by Learning Agility Categories

Based on the gap analysis, we did, we see that out of those with the highest gap, which represents highest importance on how participants perceive the skills now and how important they are for the future, only *managing complexity* and *manage & solve conflict* are being seen in the table above. On the other hand, if we look at it from the point of the most valuable skills view, where there is no distinguishment between skills now and in the future, it can be noticed that among others, *communication, critical thinking, problem solving, managing complexity, adaptability & flexibility* as well as *productivity & accountability* are part of both lists.

To sum up, it can be said, that *managing complexity, manage and solve conflicts, productivity & accountability, adaptability & flexibility, critical thinking* as well as *self-direction and physical wellbeing*, are among those skills that can help the individual to build his Learning Agility. Most of these skills are in line with what was found in literature review, where most of the articles mentioned that for someone to be agile in learning, they should also need adaptability in learning, critical thinking in order to have open and receptive mindset as well as to productivity and self-direction in order to develop effective behaviors as Hofkes (2017) mentioned in his article.

6.1.3 How different are Group 1 and Group 2

Having completed the analysis of the observations above, it is regarded important to also determine whether there are any statistically significant differences between the Group 1 and Group 2. We run an analysis to find the total means by each category, feedback, information seeking, reflecting, experimenting and agility. Since there is imbalance in our data with respect to Group 1/Group 2 we will use the complete Group 2 group (34 subjects) and we will draw a random sample of 34 subjects from Group 1. Firstly, we have used histograms which do not indicate normality, but we have also used one-way ANOVA in order to assess whether there is significant difference between the means of the two groups for each one of the aforementioned variables. As it was observed in the 5 ANOVA tables, the source of the samples (Group 1 & Group 2) is not significant, meaning that the means in these two groups do not differ for any of the variables.

Based on the groups we compared, it can be noticed that the Group 1 consists of employees who work in the private sector, in IT companies and organizations. In addition, this group includes respondents from many different organizations, and they do not represent one solid group with common aspect. On the other hand, participants of Group 2, are particularly a part of a public Dutch organization, with most of the employees working in UBR for decades. Therefore, this explains why these two groups differ statistically. In addition, there is a high chance that if the participants of the questionnaire were primarily at senior or leadership level, the results would be different. Employees high in hierarchy level, such as managers, seniors or directors, get more exposure across different teams and departments, thus why for them, skills such as acting autonomously, are more important than middle level employee.

6.2 Limitations & Threats to validity

The limitations of the study are those characteristics of the layout or the methodology that have influenced the implementation of the research. To begin with, the size of the survey participants is not negligible but remains small. Total number of respondents was 105, if we combine both sub-groups of Group 1 and Group 2. However, we can consider that the Group 2 group is relatively small, with only 34 respondents. This also limits the generalizability of the discoveries for this target group. Another limitation of this research is that the author distributed the survey mainly in

The Netherlands and Greece. In addition, the participant selection was from 2 different groups as it was mentioned before, one from a specific organization and one from random organizations which raises an important threat to validity which is the fact that participants might be biased of the research, since in order to have them answer the questionnaire we had first sent a summary of what the survey included. As a result, participants might change their behavior because they know that they are being a part of a survey.

During the questionnaire, closed questions have been used. While this method gives a variety of string points such as the respondents can easily provide data which can be translated to quantitative data allowing statistical analysis or that all respondents are asked the same questions in the same order, it can also offer many limitations. First of all, there is the possibility of dishonest answers or even to get unconscientious responses, since there is no way to know if respondents have really understood the questions or read the intro in with the explanation of terms before each question. In addition, respondents may face some difficulties to understand the meaning of some questions or the terms of the skills we gave them. Without someone explaining the questionnaire fully, everyone has a subjective perspective.

Moreover, there were some cases where respondents refused to continue answering the questions, or they did not answer until the end or it took them very little time. This means, that in many cases participants found the survey too long, or they could not fully understand the questions as we explained before, or the questions we had were too many and we did not keep the attention of the respondents. In addition, for this study, we have mainly used Likert scale questions (ratio-button) to measure all the variables.

Finally, for this study, we have tried to include most of the interesting questions we could find so we could have as much data as possible for analysis. Thus, the survey constituted with too many questions making the survey long and time consuming. There is the possibility that those who responded might have lost their concentration. As a result, we might have misplaced an expansive sample of important answers, particularly towards the end.

7. Conclusions

Our society is the result of the continuity of time and technology. In an eternally competitive, agile, and fast-changing world, it is important for organizations to deliver great value. Moreover, organizations need to improve competitiveness, increase productivity and efficiency, accelerate growth, support innovation and reduce costs (Atkinson, 2013). Hence, due to the highlighted importance of the growing interest in Learning Agility and 21st Century Skills, this study aims to contribute on how important Learning Agility is to the individuals and provide ways and measures on how these can be integrated into the process. The main question of this research study is:

What is the Relationship of Learning Agility and 21st Century Skills in the IT Industry?

Throughout the project, quantitative research methods have been used in order to explain the main research question and the sub-questions. In the preparation stage, the literature review is conducted. In the research stage, we used questionnaires to answer the main research question that was defined in the Introduction chapter. In order to collect the data, we used Qualtrics, which is a software that allows to create online surveys. After the data cleaning, one hundred and five (105) responses have been analyzed. This is followed by an explanation of the data collection, where we used three different statistical tools, SPSS, R, Excel to help analyze the data of the survey. Our main research samples were employees of the one specific organization, and employees of random organizations.

In essence, we have noticed that males and females have similar skills regarding the top and the least 5 skills, both males and females, have picked as most significant skills *critical thinking, communication, creativity, collaboration,* and *decision making*, while males and females chose both as least valuable skills *social & civic responsibility, acting autonomously, global awareness, risk taking, leadership* and *interacting in heterogeneous groups*. Based on our analysis of our total dataset vs the sub-case we see that the groups differ statistically based on ANOVA. Finally, according to our participants, the most important skills of the 21st century are *communication, critical thinking, problem solving, collaboration* and *creativity*.

Looking at the Learning Agility, we uncovered 5 meta-skills, which will help employees to be responsive and adaptable in the future. While the above skills can be seen as most important for knowledge by the workforce in order to improve themselves, and to perform successfully in the future, *managing complexity*, *manage and solve conflicts*, *productivity & accountability*, *adaptability & flexibility* and *critical thinking*, are likely to be important for the management. The importance of Learning Agility in the workforce is also very critical, further indicating a strong relationship with the skills. Employees must learn and adapt in this fast-paced environment. Companies need leaders who thrive on every new challenge or experience and by evaluating the skills and the agility of their workforce organizations can maximize every potential to success.

7.1 Recommendation for practice

According to the literature review, there is no existing framework specifically designed for working individuals. The educational benefits, however, should not be limited according to age. The findings of this study show the strong relationship of how skills are perceived now and how important are in the future, and at the same time the importance of Learning Agility. Therefore, organizations should try to evaluate more often the skills of their employees in order to focus on those that lack within an organization. It would be advisable to have open-source trainings to provide their workforce not only with access to unlimited information, but also with the opportunity to sharpen and strengthen their skills, with an emphasis in digital technologies and social networking tools, which evolve continuously. Organizations need to cultivate their employees' ability and willingness to learn from their own experience. Ultimately, to motivate them to apply this learning through practice, in order to perform successfully in new challenges.

7.2 Recommendations for future research

This study is also limited and, accordingly, several aspects for future research have been identified. As we have mentioned in the limitation section, the size of the survey is not negligible but remains small, to 105 respondents. Future research is needed to gain more insights and to provide a better understanding on the differences of these two groups, by getting a bigger sample which would probably enhance the reliability of the research.

The sample of the survey mainly consists of participants out of The Netherlands or Greece. Thus, future research should focus either on more countries, by possibly presenting a complete image continent-wise, or on a single country, and to get more insights on the respondent's behavior within the IT industry, so we could potentially compare the results of different countries or different organizations.

As we discussed in the limitations section, for this study we have mainly used Likert scale questions (ratio-button) to measure all the variables. For future research, it would be better to use sliding scale in order to capture all the values among two or more ratios.

Moreover, during the data analysis part, some of the skills have been noted as not correlated with the future and at the same time not very important. Thus, for future research it would be highly interesting to test those skills with other groups, or with a bigger sample. If the result is the same, then those skills should be removed from research and be replaced with others.

In addition, as discussed in the limitations of this survey, we have included the most interesting questions we could find in order to get as much data as possible.

Finally, even though we have included most of the well-known frameworks that are available for tracking the 21st Century Skills and measuring Learning Agility, as discussed in the limitations of this survey, we have also included the most interesting questions we could find in order to get as much data as possible. Thus, a potentially intriguing future research would be to have separate surveys, one for the skills and one for Learning Agility, and as an endpoint to compare those two.

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Appendix

List of skills used for the survey

1. Creativity
2. Critical Thinking
3. Problem Solving
4. Communication
5. Social & Civic Resp.
6. Decision Making
7. Collaboration
8. Managing Complexity
9. Manage & Solve Conflict
10. Risk Taking
11. Effective use of real-world tools
12. Interacting in heterogenous group
13. Acting Autonomously
14. Physical Well-being
15. Media & Tech Skills
16. Tech/Digital Literacy
17. Global Awareness
18. Adaptability & Flexibility
19. Self-Direction
20. Leadership
21. Productivity/Accountability

List of skills found on frameworks

Figure 2- Comparison Table for 21st Century Skills' Frameworks

Name of Framework	Year	Target group	Length / Amount of Questions	Owner/Creators	Purpose	Skills																				
						creativity	*critical thinking*	*problem solving*	*communication*	*social & civic responsibility*	*decision making*	*collaboration*	*media & technology skills*	*technological/digital litercy*	*global awarness*	*adaptability & flexibility*	*self direction*	*leadership/ responsibility*	*productivity/accountability*	*managing complexity*	*manage and solve conflicts*	*risk taking*	*effective use of real world tools*	*interacting in heterogenous groups*	*acting autonomously*	*physical well-being*
P21 for 21st Centuty Learning	2001	students, innovative education	no information	Battelle for Kids - non profit organization	Create enduring impact for	x	x	x	x			x	x	x		x	x	x	x							
EnGauge 21st century skills	2003	educators	literature reviews, input from educators, data from educator surveys, and reactions from constituent groups	Metiri Group and the North Central Regional Educational Laboratory	practices necessary to give students the education they require in a knowledge-based, global society	x			x	x		x	x	x	x	x	x		x	x		x	x			
OCED (DeSeCo)	2005	educators	no information	Organization for Economic Co-operation and Development	policy-makers, reserchers, educators with orientations for the design of educational	x	x		x			x	x	x							x			x	x	
European Parliament & Coucil	2012	students, educators	gathering data through assesment	University of Melburne Sponsored by CISCO, INTEL and	Empowering Students to Succeed	x	x	x	x		x	x	x		x							x				
UNESCO	2013	teachers, studens	modules, courses	UNESCO and Microsoft	identify common set of qualifications needed for the integration of ICT in teaching and learning	x	x	x	x	x		x	x	x	x	x			x					x		x

Screenshots of survey

Entry Index

Survey: 21st-century skills and learning agility

This survey gives you the opportunity to compare your 21st century and learning agility skills to a baseline across other organizations. It shouldn't take longer than 15 minutes.

The questions are divided in three parts of multiple choice and close-ended questions. In Part 1 we ask you to monitor your skills during the past five years comparing to your colleagues and o how important are those skills for the future. In Part 2 we ask you to consider on how often you have engaged in specific behaviors in your professional life in an individual level and in Part 3 in an organizational level.

All responses will be kept anonymous and your answers will not be traceable to you. In the end of the survey there is the possibility to leave your email address in order to get the overall results. Hence, you will have the chance to compare your results among other organizations.

Thank you for your participation.

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I consent ○

I do not consent ○

Introduction Questions

Personal Information

What is your gender?

- ◯ Male
- ◯ Female
- ◯ Other

Which of the following categories describe your age?

- ◯ 18 - 24
- ◯ 25 - 34
- ◯ 35 - 44
- ◯ 45 - 54
- ◯ 55 - 64
- ◯ Above 65

What is your educational experience?

- ◯ Less than high school
- ◯ High school graduate
- ◯ Bachelor's Degree
- ◯ Master's Degree
- ◯ Doctorate
- ◯ Other

What is your primary responsibility?

- ◯ Information Technology
- ◯ Operations/Production
- ◯ Human Resources
- ◯ Financial/ Accounting, Logistics, or Administration
- ◯ Marketing/Sales
- ◯ Technical /R&D
- ◯ Other

What is your role?

- ◯ Staff Member
- ◯ Policy Officer/ Advisor
- ◯ Consultant / Implementation Officer
- ◯ Project Manager
- ◯ Team / Department Manager
- ◯ Board Member
- ◯ Manager / Director
- ◯ Other

21st cs 1-7

PART I: 21st Century Skills

Block 1:

In this question, we would like to ask you **how confident you are** with the following skills **now:**

- creativity: the ability to perceive the world in new ways, to make connections between seemingly unrelated phenomena, and to generate solutions
- critical thinking: the ability to think clearly and rationally about what to do or what to believe
- problem solving: the ability to handle difficult or unexpected situations in the workplace as well as complex business challenges
- communication: the process of passing information and understanding from one person to another
- social and civic responsibility: the skills relating to or of a citizen, city, or citizenship
- decision making: the ability to make a good decisions with available information is vital
- collaboration: the behaviors that help two or more people work together and function well in the process

	Extremely unconfident (1)	Very unconfident (2)	Unconfident (3)	Confident (4)	Very confident (5)	Extremely confident (6)
creativity	○	○	○	○	○	○
critical thinking	○	○	○	○	○	○
problem solving	○	○	○	○	○	○
communication	○	○	○	○	○	○
social & civic responsibility	○	○	○	○	○	○
decision making	○	○	○	○	○	○
collaboration	○	○	○	○	○	○

Now we ask you to assess **how important you think** this skill will be in the **future**.

	Not at all important (1)	A fair amount important (2)	Somewhat important (3)	Moderate important (4)	Important (5)	Very important (6)
creativity	○	○	○	○	○	○
critical thinking	○	○	○	○	○	○
problem solving	○	○	○	○	○	○
communication	○	○	○	○	○	○
social & civic responsibility	○	○	○	○	○	○
decision making	○	○	○	○	○	○
collaboration	○	○	○	○	○	○

Block 2:

In this question, we would like to ask you **how confident you are** with the following skills **now:**

- managing complexity: the analysis and optimization of complexity in enterprises
- manage and solve conflicts: the process of limiting the negative aspects of conflict while increasing the positive aspects of conflict
- risk taking: the act or fact of doing something that involves danger or risk in order to achieve a goal
- effective use of real world tools: The ability to use real-world tools—the hardware, software, networking, and peripheral devices used by information technology (IT) workers
- interacting in heterogeneous groups: team members all contain significant differences
- acting autonomously: the behavior of acting separately of other people within a team
- physical well-being: relates to all aspects of working life, from the quality and safety of the physical environment, to how workers feel about their work, their working environment, the climate at work and work organization

	Extremely unconfident (1)	Very unconfident (2)	Unconfident (3)	Confident (4)	Very confident (5)	Extremely confident (6)
managing complexity	○	○	○	○	○	○
manage and solve conflicts	○	○	○	○	○	○
risk taking	○	○	○	○	○	○
effective use of real world tools	○	○	○	○	○	○
interacting in heterogeneous groups	○	○	○	○	○	○
acting autonomously	○	○	○	○	○	○
physical well-being	○	○	○	○	○	○

Now we ask you to assess **how important you think** this skill will be in the **future:**

	Not at all important (1)	A fair amount important (2)	Somewhat important (3)	Moderate important (4)	Important (5)	Very important (6)
managing complexity	○	○	○	○	○	○
manage and solve conflicts	○	○	○	○	○	○
risk taking	○	○	○	○	○	○
effective use of real world tools	○	○	○	○	○	○
interacting in heterogeneous groups	○	○	○	○	○	○
acting autonomously	○	○	○	○	○	○
physical well-being	○	○	○	○	○	○

Block 3;

In this question, we would like to ask you **how confident you are** with the following skills **now:**

- media & technology skills: Media is what we use to run the technology
- technology / digital literacy: the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills
- global awareness: an understanding of how environmental, social, cultural, economic and political factors impact the world
- adaptability & flexibility: the ability to adjust or change to best meet the needs of the situation or environment
- self direction: the ability to set goals related to learning, plan for the achievement of those goals, independently manage time and effort
- leadership: the art of motivating a group of people to act towards achieving a common goal (or company's needs)
- productivity / accountability: the ability to build on a teamwork and a shared vision of where a business is heading

	Extremely unconfident (1)	Very unconfident (2)	Unconfident (3)	Confident (4)	Very confident (5)	Extremely confident (6)
media & technology skills	○	○	○	○	○	○
Technology / digital literacy	○	○	○	○	○	○
global awareness	○	○	○	○	○	○
adaptability & flexibility	○	○	○	○	○	○
self direction	○	○	○	○	○	○
leadership	○	○	○	○	○	○
productivity / accountability	○	○	○	○	○	○

Now we ask you to assess **how important you think** this skill will be in the **future:**

	Not at all important (1)	A fair amount important (2)	Somewhat important(3)	Moderate important (4)	Important (5)	Very important (6)
media & technology skills	○	○	○	○	○	○
technology / digital literacy	○	○	○	○	○	○
global awareness	○	○	○	○	○	○
adaptability & flexibility	○	○	○	○	○	○
self direction	○	○	○	○	○	○
leadership	○	○	○	○	○	○
productivity / accountability	○	○	○	○	○	○

self preference on skills

According to your point of view, which of the following, are the **most valuable skills** to be successful in a work place? Please select up to 5.

☐ creativity	☐ media & technology skills	☐ managing complexity
☐ critical thinking	☐ Technology / digital literacy	☐ manage and solve conflicts
☐ problem solving	☐ global awareness	☐ risk taking
☐ communication	☐ adaptability & flexibility	☐ effective use of real world tools
☐ social & civic responsibility	☐ self direction	☐ interacting in heterogeneous groups
☐ decision making	☐ leadership	☐ acting autonomously
☐ collaboration	☐ productivity / accountability	☐ physical well-being

According to your point of view, which of the following, are the **least valuable skills** to be successful in a work place? Please select up to 5.

☐ creativity	☐ media & technology skills	☐ managing complexity
☐ critical thinking	☐ Technology / digital literacy	☐ manage and solve conflicts
☐ problem solving	☐ global awareness	☐ risk taking
☐ communication	☐ adaptability & flexibility	☐ effective use of real world tools
☐ social & civic responsibility	☐ self direction	☐ interacting in heterogeneous groups
☐ decision making	☐ leadership	☐ acting autonomously
☐ collaboration	☐ productivity / accountability	☐ physical well-being

Feedback Seeking

PART II: Learning Agility; Individual Level

Below you will find a list of behaviors that people perform at work. Thinking back over the past 6 months, please consider **how often you have engaged in each behavior** in your professional life.

	Not at all (1)	Very rarely (2)	Rarely (3)	Occasionally (4)	Frequently (5)	Very frequently (6)
Seek feedback from manager about my performance	◯	◯	◯	◯	◯	◯
Ask my peers to provide me with feedback on my performance	◯	◯	◯	◯	◯	◯
Directly ask others for their thoughts on how I can improve my performance	◯	◯	◯	◯	◯	◯
Discuss my mistakes with others	◯	◯	◯	◯	◯	◯
Appropriately discuss my potential for advancement within the organization with my manager	◯	◯	◯	◯	◯	◯

Information Seeking

Below you will find a list of behaviors that people perform at work. Thinking back over the past 6 months, please **consider how often you have engaged in each behavior** in your professional life.

	Not at all (1)	Very rarely (2)	Rarely (3)	Occasionally (4)	Frequently (5)	Very frequently (6)
Seek information on topics related to my job	○	○	○	○	○	○
Read books, articles, journals, or other sources to stay informed	○	○	○	○	○	○
Update my knowledge through formal training or education	○	○	○	○	○	○
Collect data to increase my knowledge, evaluate my progress and inform my next steps	○	○	○	○	○	○
Bring up problems and tough issues with others when needed	○	○	○	○	○	○

Reflecting

Below you will find a list of behaviors that people perform at work. Thinking back over the past 6 months, please **consider how often you have engaged** in each behavior in your professional life.

	Not at all (1)	Very rarely (2)	Rarely (3)	Occasionally (4)	Frequently (5)	Very frequentl (6)
Consider the reason for and consequences of my actions or recent events	○	○	○	○	○	○
Take time to reflect on how to be more effective	○	○	○	○	○	○
Click to write Statement 5	○	○	○	○	○	○
Stop to reflect on work processes and projects	○	○	○	○	○	○
Critically evaluate work-related events with others in order to understand what happens	○	○	○	○	○	○

Experimenting

Below you will find a list of behaviors that people perform at work. Thinking back over the past 6 months, please consider **how often you have engaged in each behavior** in your professional life.

	Not at all (1)	Very rarely (2)	Rarely (3)	Occasionally (4)	Frequently (5)	Very frequently (6)
Collaborate with people in other parts of the organization	◯	◯	◯	◯	◯	◯
Work with colleagues from different backgrounds or job functions to share perspectives	◯	◯	◯	◯	◯	◯
Ask others for help when needed	◯	◯	◯	◯	◯	◯
Jump into action and learn by trial and error	◯	◯	◯	◯	◯	◯
Volunteer for assignments or projects that involve the possibility of failure	◯	◯	◯	◯	◯	◯
Take on new roles or assignments that are challenging	◯	◯	◯	◯	◯	◯
Try different approaches to see which one generates the best results	◯	◯	◯	◯	◯	◯
Evaluate new techniques or different ways of solving problems	◯	◯	◯	◯	◯	◯

Agility

Please evaluate how well each statement describes **how you engage** with your work:

	Not at all (1)	Hardly (2)	Only partially (3)	Somewhat (4)	A fair amount (5)	Very much (6)
Consider many different options before taking action	◯	◯	◯	◯	◯	◯
Switch between different tasks or jobs as needed	◯	◯	◯	◯	◯	◯
Find common themes among opposing point of view	◯	◯	◯	◯	◯	◯
Articulate seemingly competing ideas or perspectives when needed	◯	◯	◯	◯	◯	◯
Propose solutions that others see as innovative	◯	◯	◯	◯	◯	◯
Quickly develop solutions to problems	◯	◯	◯	◯	◯	◯
Get up to speed quickly on new tasks or projects	◯	◯	◯	◯	◯	◯
Acquire new skills and knowledge rapidly and easily	◯	◯	◯	◯	◯	◯
React well to unexpected problems	◯	◯	◯	◯	◯	◯
Rapidly grasp new ideas or concepts	◯	◯	◯	◯	◯	◯

Measuring Learning Organization

PART III: Learning Agility: Organizational Level

In this section, we ask you to reflect on the relative performance of the organization. You will be asked to **rate** the extent to which each statement is accurate about the **organization's current performance** when compared to the **previous year**.

	Not at all (1)	Hardly (2)	Only partially(3)	Somewhat (4)	A Fair Amount(5)	Very much (6)
In my organization, average productivity per employee is greater than last year	◯	◯	◯	◯	◯	◯
In my organization, the number of suggestions implemented is greater that last year	◯	◯	◯	◯	◯	◯
In my organization, the percentage of skilled workers compared to the total workforce is greater than last year	◯	◯	◯	◯	◯	◯
In my organization, the percentage of total spending devoted to technology and information processing is greater than last year	◯	◯	◯	◯	◯	◯
In my organization, the number of individuals learning new skills is greater than last year	◯	◯	◯	◯	◯	◯

Organization suppots learning

In this question, we ask you to think about **how your organization supports and uses learning** at an **individual level.**

	Not at all (1)	Hardly (2)	Only partially (3)	Somewhat (4)	A fair amount (5)	Very much (6)
In my organization, people openly discuss mistakes in order to learn from them	◯	◯	◯	◯	◯	◯
In my organization, people help each other to learn	◯	◯	◯	◯	◯	◯
In my organization, people can get money and other resources to support their learning	◯	◯	◯	◯	◯	◯
In my organization, people view problems in their work as an opportunity to learn	◯	◯	◯	◯	◯	◯
In my organization,, people give open and honest feedback to each other	◯	◯	◯	◯	◯	◯
In my organization,, people are encouraged to ask "why"regardless of rank.	◯	◯	◯	◯	◯	◯
In my organization, people spend time building trust with each other	◯	◯	◯	◯	◯	◯

In this question, we ask you to think about how your **organization supports and uses learning** at a **team or group** level.

	Not at all (1)	Hardly (2)	Only partially (3)	Somewhat (4)	A fair amount (5)	Very much (6)
In my organization, teams/groups have the freedom to adapt their goals as needed	○	○	○	○	○	○
In my organization, teams/groups treat members as equals, regardless of rank, culture, or other differences.	○	○	○	○	○	○
In my organization, teams/groups focus both in the group's task and on how well the group is working	○	○	○	○	○	○
In my organization, teams/groups revise their thinking as a result of group discussions or information collected	○	○	○	○	○	○

Sharing results

This is the end of this survey. Thank you for participating.
If you are interested in the summary of the research findings, **click here** (new window) to leave your email address.
Please don't forget to return in this page to submit your answers.

Email Form

Universiteit Leiden
The Netherlands

You were directed here because you are interested in the summary of the research findings.
Please don't forget to return in the previous window to submit your answers.

Please type your email address in the following field:

Tables of correlations skills and agility part

Skills & Agility	Correlation Estimate	P. value
Creativity**	**0.557**	<<0.01
Critical Thinking**	**0.625**	<<0.01
Problem Solving**	0.47	<<0.01
Communication**	0.44	<<0.01
Social Civic Resp.**	**0.506**	<<0.01
Decision Making**	**0.55**	<<0.01
Collaboration**	**0.512**	<<0.01
Creativity F**	**0.557**	<<0.01
Critical Thinking F**	**0.62**	<<0.01
Problem Solving F**	**0.504**	<<0.01
Communication F**	**0.54**	<<0.01
Social Civic Resp. F**	**0.511**	<<0.01
Decision Making F**	0.421	<<0.01
Collaboration F**	0.351	<<0.01
Managing Complexity**	**0.641**	<<0.01
Manage & Solve Conflict**	**0.603**	<<0.01
Risk Taking**	**0.54**	<<0.01
Effective use of RWT**	0.451	<<0.01
Interacting in heterogenous group**	0.475	<<0.01
Acting Autonomously**	**0.624**	<<0.01
Physical Well-being**	0.419	<<0.01
Managing Complexity F**	**0.581**	<<0.01
Manage & Solve Conflict F**	**0.577**	<<0.01
Risk Taking F**	0.459	<<0.01
Effective use of RWT F**	0.448	<<0.01
Interacting in heterogenous group F**	**0.508**	<<0.01
Acting Autonomously F**	0.363	<<0.01
Physical Well-being F**	**0.548**	<<0.01
Media & Tech Skills**	**0.513**	<<0.01
Tech/Digital Literacy**	**0.503**	<<0.01
Global Awareness**	**0.604**	<<0.01
Adaptability & Flexibility**	**0.593**	<<0.01
Self-Direction**	**0.552**	<<0.01
Leadership**	**0.583**	<<0.01
Productivity/Accountability**	**0.647**	<<0.01
Media&Tech Skills F**	0.356	<<0.01
Tech/Digital Literacy F**	0.406	<<0.01
Global Awareness F**	**0.581**	<<0.01
Adaptability&Flexibility F**	**0.628**	<<0.01
Self-Direction F**	**0.575**	<<0.01
Leadership F**	0.494	<<0.01
Productivity/Accountability F**	0.454	<<0.01

Table 21 - Correlation: Skills and Agility

Skills & Reflection	Correlation Estimate	P. value
Creativity**	0.421	<<0.01
Critical Thinking**	**0.539**	<<0.01
Problem Solving**	0.309	<<0.01
Communication**	0.321	<<0.01
Social Civic Resp.**	0.417	<<0.01
Decision Making**	0.381	<<0.01
Collaboration**	0.383	<<0.01
Creativity F**	0.493	<<0.01
Critical Thinking F**	**0.524**	<<0.01
Problem Solving F**	**0.506**	<<0.01
Communication F**	**0.564**	<<0.01
Social Civic Resp. F**	0.389	<<0.01
Decision Making F**	0.492	<<0.01
Collaboration F**	0.414	<<0.01
Managing Complexity**	0.416	<<0.01
Manage & Solve Conflict**	0.483	<<0.01
Risk Taking**	0.397	<<0.01
Effective use of RWT**	0.339	<<0.01
Interacting in heterogenous group**	0.428	<<0.01
Acting Autonomously**	0.441	<<0.01
Physical Well-being**	0.404	<<0.01
Managing Complexity F**	0.459	<<0.01
Manage & Solve Conflict F**	0.468	<<0.01
Risk Taking F**	0.37	<<0.01
Effective use of RWT F**	0.468	<<0.01
Interacting in heterogenous group F**	0.449	<<0.01
Acting Autonomously F**	0.272	<<0.01
Physical Well-being F**	**0.541**	<<0.01
Media & Tech Skills**	0.379	<<0.01
Tech/Digital Literacy**	0.403	<<0.01
Global Awareness**	0.484	<<0.01
Adaptability & Flexibility**	0.47	<<0.01
Self-Direction**	0.438	<<0.01
Leadership**	0.466	<<0.01
Productivity/Accountability**	0.49	<<0.01
Media&Tech Skills F**	0.306	<<0.01
Tech/Digital Literacy F**	0.405	<<0.01
Global Awareness F**	0.431	<<0.01
Adaptability&Flexibility F**	**0.562**	<<0.01

Self-Direction F**	**0.552**	<<0.01
Leadership F**	**0.507**	<<0.01
Productivity/Accountability F**	0.479	<<0.01

Table 22: Correlations: Skills and Reflection

Skills & Information Seeking	**Correlation Estimate**	**P. value**
Creativity**	0.351	<<0.01
Critical Thinking**	0.481	<<0.01
Problem Solving**	**0.526**	<<0.01
Communication**	0.363	<<0.01
Social Civic Resp.**	0.419	<<0.01
Decision Making**	0.454	<<0.01
Collaboration**	0.372	<<0.01
Creativity F**	**0.518**	<<0.01
Critical Thinking F**	0.477	<<0.01
Problem Solving F**	0.444	<<0.01
Communication F**	0.496	<<0.01
Social Civic Resp. F**	0.417	<<0.01
Decision Making F**	0.339	<<0.01
Collaboration F**	0.381	<<0.01
Managing Complexity**	0.489	<<0.01
Manage & Solve Conflict**	0.487	<<0.01
Risk Taking**	0.419	<<0.01
Effective use of RWT**	0.372	<<0.01
Interacting in heterogenous group**	0.324	<<0.01
Acting Autonomously**	0.415	<<0.01
Physical Well-being**	0.398	<<0.01
Managing Complexity F**	0.478	<<0.01
Manage & Solve Conflict F**	0.416	<<0.01
Risk Taking F**	0.399	<<0.01
Effective use of RWT F**	0.342	<<0.01
Interacting in heterogenous group F**	0.329	<<0.01
Acting Autonomously F**	0.321	<<0.01
Physical Well-being F**	0.426	<<0.01
Media & Tech Skills**	**0.507**	<<0.01

Tech/Digital Literacy**	0.355	<<0.01
Global Awareness**	0.378	<<0.01
Adaptability & Flexibility**	0.435	<<0.01
Self-Direction**	**0.514**	<<0.01
Leadership**	0.479	<<0.01
Productivity/Accountability**	**0.517**	<<0.01
Media&Tech Skills F**	0.303	<<0.01
Tech/Digital Literacy F**	0.251	<<0.01
Global Awareness F**	0.352	<<0.01
Adaptability&Flexibility F**	0.479	<<0.01
Self-Direction F**	0.45	<<0.01
Leadership F**	0.411	<<0.01
Productivity/Accountability F**	0.405	<<0.01

Table 23 - Correlations: Skills and Information Seeking

Skills & Feedback Seeking	**Correlation Estimate**	**P. value**
Creativity**	0.333	<<0.01
Critical Thinking**	0.346	<<0.01
Problem Solving**	0.296	<<0.01
Communication**	0.261	<<0.01
Social Civic Resp.**	0.253	<<0.01
Decision Making*	0.237	<<0.05
Collaboration**	0.302	<<0.01
Creativity F**	0.358	<<0.01
Critical Thinking F**	0.369	<<0.01
Problem Solving F**	0.289	<<0.01
Communication F**	0.356	<<0.01
Social Civic Resp. F**	0.261	<<0.01
Decision Making F*	0.214	<<0.05
Collaboration F**	0.278	<<0.01
Managing Complexity**	0.239	<<0.05
Manage & Solve Conflict**	0.461	<<0.01
Risk Taking**	0.262	<<0.01
Effective use of RWT*	0.204	<<0.05
Interacting in heterogenous group**	0.472	<<0.01
Acting Autonomously**	0.327	<<0.01
Physical Well-being**	0.389	<<0.01
Managing Complexity F**	0.401	<<0.01
Manage & Solve Conflict F**	0.292	<<0.01

Risk Taking F*	0.245	<<0.05
Effective use of RWT F**	0.311	<<0.01
Interacting in heterogenous group F**	0.352	<<0.01
Acting Autonomously F**	0.225	<<0.05
Physical Well-being F**	0.339	<<0.01
Media & Tech Skills**	0.338	<<0.01
Tech/Digital Literacy*	0.198	<<0.05
Global Awareness**	0.386	<<0.01
Adaptability & Flexibility**	0.293	<<0.01
Self-Direction**	0.379	<<0.01
Leadership**	0.324	<<0.01
Productivity/Accountability**	0.456	<<0.01
Media&Tech Skills F*	0.246	<<0.05
Tech/Digital Literacy F*	0.244	<<0.05
Global Awareness F**	0.259	<<0.01
Adaptability&Flexibility F**	0.35	<<0.01
Self-Direction F**	0.343	<<0.01
Leadership F**	0.252	<<0.01
Productivity/Accountability F**	0.304	<<0.01

Table 24 - Correlations: Skills and Feedback Seeking

Skills & Experimenting	**Correlation Estimate**	**P. value**
Creativity**	0.439	<<0.01
Critical Thinking**	**0.536**	<<0.01
Problem Solving**	0.371	<<0.01
Communication**	**0.5**	<<0.01
Social Civic Resp.**	**0.583**	<<0.01
Decision Making**	0.487	<<0.01
Collaboration**	0.471	<<0.01
Creativity F**	**0.532**	<<0.01
Critical Thinking F**	**0.596**	<<0.01
Problem Solving F**	0.453	<<0.01
Communication F**	**0.558**	<<0.01
Social Civic Resp. F**	**0.54**	<<0.01
Decision Making F**	0.4	<<0.01
Collaboration F**	0.371	<<0.01
Managing Complexity**	**0.536**	<<0.01
Manage & Solve Conflict**	**0.613**	<<0.01

Risk Taking**	**0.5**	<<0.01
Effective use of RWT**	0.382	<<0.01
Interacting in heterogenous group**	0.437	<<0.01
Acting Autonomously**	**0.557**	<<0.01
Physical Well-being**	0.417	<<0.01
Managing Complexity F**	**0.594**	<<0.01
Manage & Solve Conflict F**	**0.576**	<<0.01
Risk Taking F**	**0.518**	<<0.01
Effective use of RWT F**	0.491	<<0.01
Interacting in heterogenous group F**	0.478	<<0.01
Acting Autonomously F**	0.377	<<0.01
Physical Well-being F**	**0.553**	<<0.01
Media & Tech Skills**	0.408	<<0.01
Tech/Digital Literacy**	0.349	<<0.01
Global Awareness**	**0.511**	<<0.01
Adaptability & Flexibility**	**0.553**	<<0.01
Self-Direction**	**0.563**	<<0.01
Leadership**	**0.552**	<<0.01
Productivity/Accountability**	**0.594**	<<0.01
Media&Tech Skills F**	0.403	<<0.01
Tech/Digital Literacy F**	0.448	<<0.01
Global Awareness F**	**0.565**	<<0.01
Adaptability&Flexibility F**	**0.616**	<<0.01
Self-Direction F**	**0.597**	<<0.01
Leadership F**	0.455	<<0.01
Productivity/Accountability F**	**0.507**	<<0.01

Table 25 - Correlations: Skills and Experimenting

Code in R

```
library(tidyverse)
rm(list = ls())

if(!require("readxl")){install.packages("readxl")};library("readxl")

#### Read Data ####
my_data <- read_excel("My_Merge.xlsx")
names(my_data)

#### Prepare Data ####
part2_data <- my_data[,c(20:24,69:100,117)]
part2_data <- part2_data[-1,]

colnames(part2_data)[1:5] <- c("Gender", "Age",
"Education","Responsibility","Role")
part2_data$Gender <- factor(part2_data$Gender, levels =
c("1","2","3"), labels = c("Male", "Female", "Other"))
part2_data$Age <- factor(part2_data$Age, levels =
c("1","2","3","4","5"),
                         labels = c("18-24", "25-34", "35-44","45-
54","55-64"))
part2_data$Education <- factor(part2_data$Education, levels =
c("1","2","3","4","5","6"),
                               labels = c("<Highschool", "Highschool",
"Bachelor","Master","Phd","Other"))
part2_data$Responsibility <- factor(part2_data$Responsibility, levels
= c("1","2","3","4","5","6","7","8","9"))
part2_data$Role <- factor(part2_data$Role, levels =
c("1","2","3","4","5","6","7","8"),
                          labels =
c("Staff","Advisor","Consultant","Project Manager","Team
Manager","Board Manager",
                                      "Manager","Other"))
part2_data$CLASS <- factor(part2_data$CLASS)
colnames(part2_data)
```

```
#### Part 3 ####
part3_data <- my_data[,c(20:24,101:117)]
part3_data <- part3_data[-1,]


colnames(part3_data)[1:5] <- c("Gender", "Age",
"Education","Responsibility","Role")
part3_data$Gender <- factor(part3_data$Gender, levels =
c("1","2","3"), labels = c("Male", "Female", "Other"))
part3_data$Age <- factor(part3_data$Age, levels =
c("1","2","3","4","5"),
                         labels = c("18-24", "25-34", "35-44","45-
54","55-64"))
part3_data$Education <- factor(part3_data$Education, levels =
c("1","2","3","4","5","6"),
                               labels = c("<Highschool", "Highschool",
"Bachelor","Master","Phd","Other"))
part3_data$Responsibility <- factor(part3_data$Responsibility, levels
= c("1","2","3","4","5","6","7","8","9"))
part3_data$Role <- factor(part3_data$Role, levels =
c("1","2","3","4","5","6","7","8"),
                          labels =
c("Staff","Advisor","Consultant","Project Manager","Team
Manager","Board Manager",
                                    "Manager","Other"))
part3_data$CLASS <- factor(part3_data$CLASS)


part2_data[,6:(ncol(part2_data)-1)] <-
apply(part2_data[,6:(ncol(part2_data)-1)], 2, as.numeric)
part3_data[,6:(ncol(part3_data)-1)] <-
apply(part3_data[,6:(ncol(part3_data)-1)], 2, as.numeric)


colnames(part2_data)
colnames(part3_data)


part2_data$Feedback <- rowMeans(part2_data[,c(6:10)])
part2_data$Information <- rowMeans(part2_data[,c(11:15)])
part2_data$Reflecting <- rowMeans(part2_data[,c(16:19)])
part2_data$Experimenting <- rowMeans(part2_data[,c(20:27)])
```

```
part2_data$Agility <- rowMeans(part2_data[,c(28:37)])


part3_data$L_organ <- rowMeans(part3_data[,c(6:10)])
part3_data$Organ_supp_ind <- rowMeans(part3_data[,c(11:17)])
part3_data$Organ_supp_team <- rowMeans(part3_data[,c(18:21)])


#### MEANS ####
m1 <- aggregate(part2_data[, 39:ncol(part2_data)],
list(part2_data$Gender, part2_data$CLASS), mean)
m2 <- aggregate(part2_data[, 39:ncol(part2_data)],
list(part2_data$Education, part2_data$CLASS), mean)
m3 <- aggregate(part2_data[, 39:ncol(part2_data)],
list(part2_data$Role, part2_data$CLASS), mean)
m4 <- aggregate(part2_data[, 39:ncol(part2_data)],
list(part2_data$CLASS), mean)
write.table(m1, file = "m1.csv")
write.table(m2, file = "m2.csv")
write.table(m3, file = "m3.csv")
write.table(m4, file = "m4.csv")


Total <- sapply(part2_data[, 39:ncol(part2_data)], mean)
G <- aggregate(part2_data[, 39:ncol(part2_data)],
list(part2_data$Gender), mean)
E <- aggregate(part2_data[, 39:ncol(part2_data)],
list(part2_data$Education), mean)
R <- aggregate(part2_data[, 39:ncol(part2_data)],
list(part2_data$Role), mean)
write.table(Total, file = "Tot.csv")
write.table(G, file = "G.csv")
write.table(E, file = "E.csv")
write.table(R, file = "R.csv")


#### ANOVA ####
set.seed(111)
anova_data_part2 <- part2_data[c(sample(71, 34, replace =
F),72:nrow(part2_data)),c(1:5, 38:ncol(part2_data))]
set.seed(111)
```

```
anova_data_part3 <- part3_data[c(sample(71, 34, replace =
F),72:nrow(part3_data)),c(1:5, 22:ncol(part3_data))]


jpeg(file="Feedback.jpeg")
hist(anova_data_part2$Feedback, breaks = 20, main = "Feedback
Seeking", xlab = "Mean")
dev.off()


jpeg(file="Information.jpeg")
hist(anova_data_part2$Information, breaks = 20, main = "Information
Seeking", xlab = "Mean")
dev.off()


jpeg(file="Reflecting.jpeg")
hist(anova_data_part2$Reflecting, breaks = 20, main = "Reflecting",
xlab = "Mean")
dev.off()


jpeg(file="Experimenting.jpeg")
hist(anova_data_part2$Experimenting, breaks = 20, main =
"Experimenting", xlab = "Mean")
dev.off()


jpeg(file="Agility.jpeg")
hist(anova_data_part2$Agility, breaks = 20, main = "Agility", xlab =
"Mean")
dev.off()


jpeg(file="Current Performance.jpeg")
hist(anova_data_part3$L_organ, breaks = 20, main = "Organization's
current performance", xlab = "Mean")
dev.off()


jpeg(file="Organization_suppots_learning_ind.jpeg")
hist(anova_data_part2$Agility, breaks = 20, main = "Organization
suppots learning (ind. level)", xlab = "Mean")
dev.off()
```

```
jpeg(file="Organization_suppots_learning_team.jpeg")
hist(anova_data_part2$Agility, breaks = 20, main = "Organization
suppots learning (team level)", xlab = "Mean")
dev.off()

colnames(anova_data_part2)[6] <- "Group"
colnames(anova_data_part3)[6] <- "Group"

Feed <- summary(aov(Feedback ~ Group, data = anova_data_part2))
Info <- summary(aov(Information ~ Group, data = anova_data_part2))
Ref <- summary(aov(Reflecting ~ Group, data = anova_data_part2))
Exp <- summary(aov(Experimenting ~ Group, data = anova_data_part2))
Agi <- summary(aov(Agility ~ Group, data = anova_data_part2))

#### Graph ####
colnames(my_data)
graph_data <- my_data[,c("Q29","Q33")]
graph_data <- graph_data[-1,]
most_valuable <- as.numeric(unlist(strsplit(graph_data$Q29, ",")))
least_valuable <- as.numeric(unlist(strsplit(graph_data$Q33, ",")))
custom_labs <- c("creativity","critical thinking","problem
solving","communication",
                 "social&civic resp.","decision making",
"collaboration",
                 "media&tech","Tech/Digital literacy","Global
awareness","adaptability",
                 "self
direction","leadership","productivity","managing complexity",
                 "manage/solve conflicts","risk taking","use of
R.W.T","Interact in het. groups",
                 "acting autonomously","phys. well-being")

for (i in 1:21) {
  most_valuable[most_valuable==i] <- custom_labs[i]
  least_valuable[least_valuable==i] <- custom_labs[i]
```

```
}

most_vals <- sort(table(most_valuable), decreasing = T)
jpeg(file = "most_val.jpeg")
par(mar = c(10,4,4,2))
m_val_plot <- barplot(most_vals, ylab = "Frequency", xlab = "", las =
2, ylim = c(0,60), main = "Most Valuable Skils")
text(m_val_plot,most_vals, labels = most_vals, pos = 3)
dev.off()

least_vals <- sort(table(least_valuable), decreasing = T)
jpeg(file = "least_val.jpeg")
par(mar = c(10,4,4,2))
l_val_plot <- barplot(least_vals, ylab = "Frequency", xlab = "", las =
2, ylim = c(0,50), main = "Least Valuable Skils")
text(l_val_plot,least_vals, labels = least_vals, pos = 3)
dev.off()

new_part2 <- data.frame(cbind(part2_data,my_data[-1,c(25:66)]))
colnames(new_part2)
new_part2 <- new_part2[,c(1:5,38:ncol(new_part2))]

correlations_feed <- matrix(nrow = 42, ncol = 2)
correlations_info <- matrix(nrow = 42, ncol = 2)
correlations_reflec <- matrix(nrow = 42, ncol = 2)
correlations_exp <- matrix(nrow = 42, ncol = 2)
correlations_agil <- matrix(nrow = 42, ncol = 2)

for (i in 12:ncol(new_part2)) {
  correlations_feed[i-11,] <- c(cor.test(new_part2$Feedback,
as.numeric(new_part2[,i]))$estimate,cor.test(new_part2$Feedback,
as.numeric(new_part2[,i]))$p.value)
  correlations_info[i-11,] <- c(cor.test(new_part2$Information,
as.numeric(new_part2[,i]))$estimate,cor.test(new_part2$Information,
as.numeric(new_part2[,i]))$p.value)
```

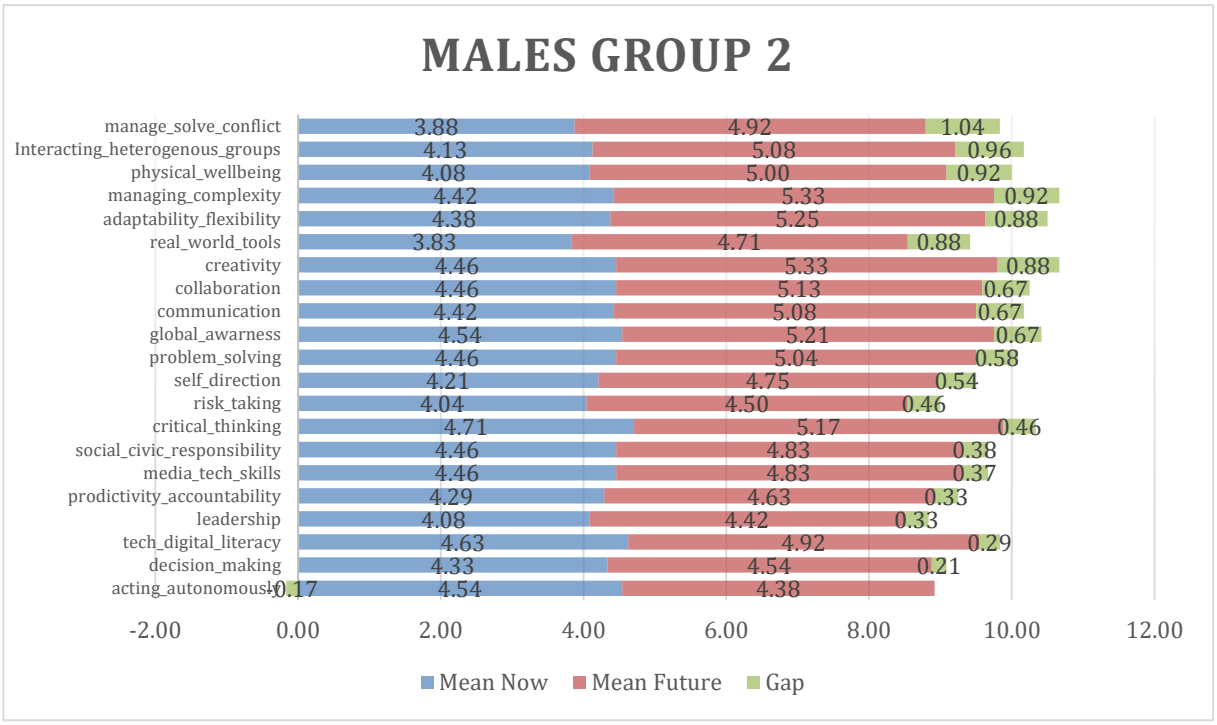
```
  correlations_reflec[i-11,] <- c(cor.test(new_part2$Reflecting,
as.numeric(new_part2[,i]))$estimate,cor.test(new_part2$Reflecting,
as.numeric(new_part2[,i]))$p.value)
  correlations_exp[i-11,] <- c(cor.test(new_part2$Experimenting,
as.numeric(new_part2[,i]))$estimate,cor.test(new_part2$Experimenting,
as.numeric(new_part2[,i]))$p.value)
  correlations_agil[i-11,] <- c(cor.test(new_part2$Agility,
as.numeric(new_part2[,i]))$estimate,cor.test(new_part2$Agility,
as.numeric(new_part2[,i]))$p.value)
}


a <- c("Correlation Estimate", "P value")
colnames(correlations_agil) <- a
colnames(correlations_exp) <- a
colnames(correlations_feed) <- a
colnames(correlations_info) <- a
colnames(correlations_reflec) <- a


b <- c("Creativity", "Critical Thinking","Problem Solving",
"Communication", "Social&Civic Resp.",
                       "Decision Making", "Collaboration",
                       "Creativity F", "Critical Thinking F","Problem
Solving F", "Communication F", "Social&Civic Resp. F",
                       "Decision Making F", "Collaboration F",
                       "Managing Complexity", "Manage&Solve Conflict",
"Risk Taking", "Effective use of RWT", "Interacting in heterogenous
group",
                       "Acting Autonomously", "Physical Well-being",
                       "Managing Complexity F", "Manage&Solve Conflict
F", "Risk Taking F", "Effective use of RWT F", "Interacting in
heterogenous group F",
                       "Acting Autonomously F", "Physical Well-being
F",
                       "Media&Tech Skills", "Tech/Digital Literacy",
"Global Awareness", "Adaptability&Flexibility", "Self Direction",
"Leadership",
                       "Productivity/Accountability",
                       "Media&Tech Skills F", "Tech/Digital Literacy
F", "Global Awareness F", "Adaptability&Flexibility F", "Self
Direction F", "Leadership F",
```

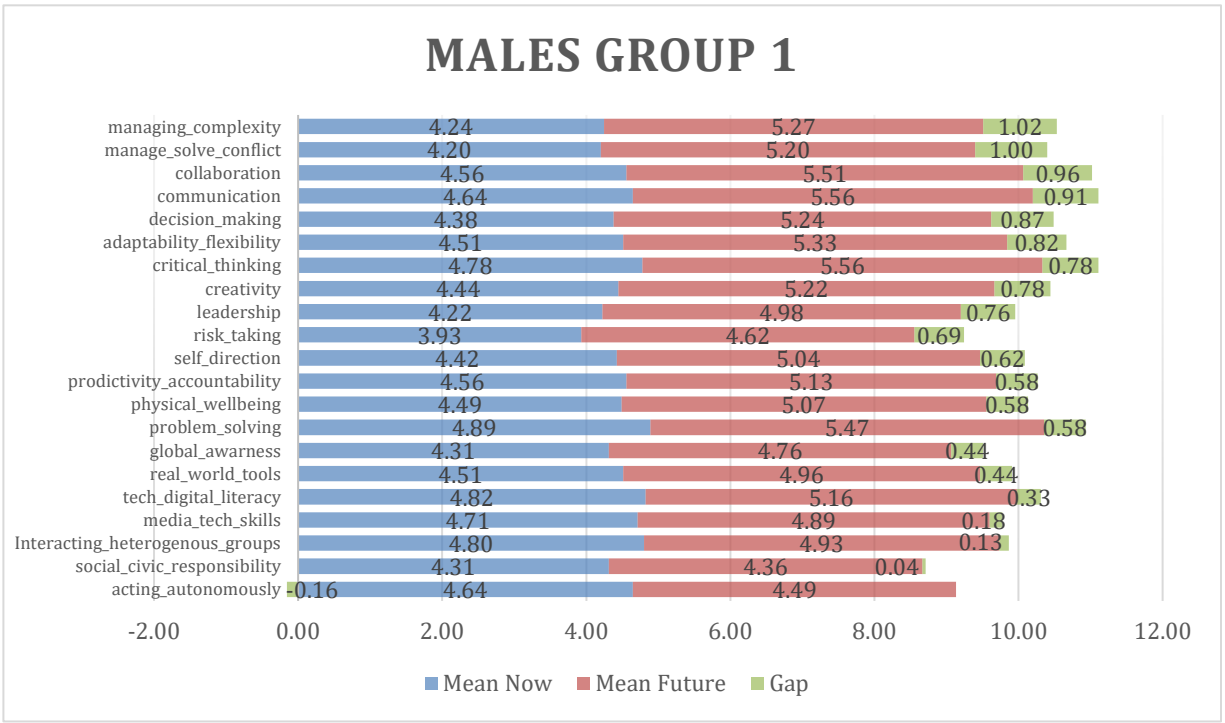
```
                    "Productivity/Accountability F")

rownames(correlations_agil) <- b
rownames(correlations_exp) <- b
rownames(correlations_feed) <- b
rownames(correlations_info) <- b
rownames(correlations_reflec) <- b


correlations_agil <- data.frame(correlations_agil)
correlations_exp <- data.frame(correlations_exp)
correlations_feed <- data.frame(correlations_feed)
correlations_info <- data.frame(correlations_info)
correlations_reflec <- data.frame(correlations_reflec)


correlations_agil[,2] <- ifelse(correlations_agil[,2] < 0.05,
"<<0.05", paste(correlations_agil[,2]))
correlations_exp[,2] <- ifelse(correlations_exp[,2] < 0.05, "<<0.05",
paste(correlations_exp[,2]))
correlations_feed[,2] <- ifelse(correlations_feed[,2] < 0.05,
"<<0.05", paste(correlations_feed[,2]))
correlations_info[,2] <- ifelse(correlations_info[,2] < 0.05,
"<<0.05", paste(correlations_info[,2]))
correlations_reflec[,2] <- ifelse(correlations_reflec[,2] < 0.05,
"<<0.05", paste(correlations_reflec[,2]))


correlations_agil[,1] <- round(correlations_agil[,1],3)
correlations_exp[,1] <- round(correlations_exp[,1],3)
correlations_feed[,1] <- round(correlations_feed[,1],3)
correlations_info[,1] <- round(correlations_info[,1],3)
correlations_reflec[,1] <- round(correlations_reflec[,1],3)


correlations_agil[,1] <- ifelse(correlations_agil[,1] > 0.5,
paste(correlations_agil[,1],"*", sep = ""),
paste(correlations_agil[,1]))
correlations_exp[,1] <- ifelse(correlations_exp[,1] > 0.5,
paste(correlations_exp[,1],"*", sep = ""),
paste(correlations_exp[,1]))
```

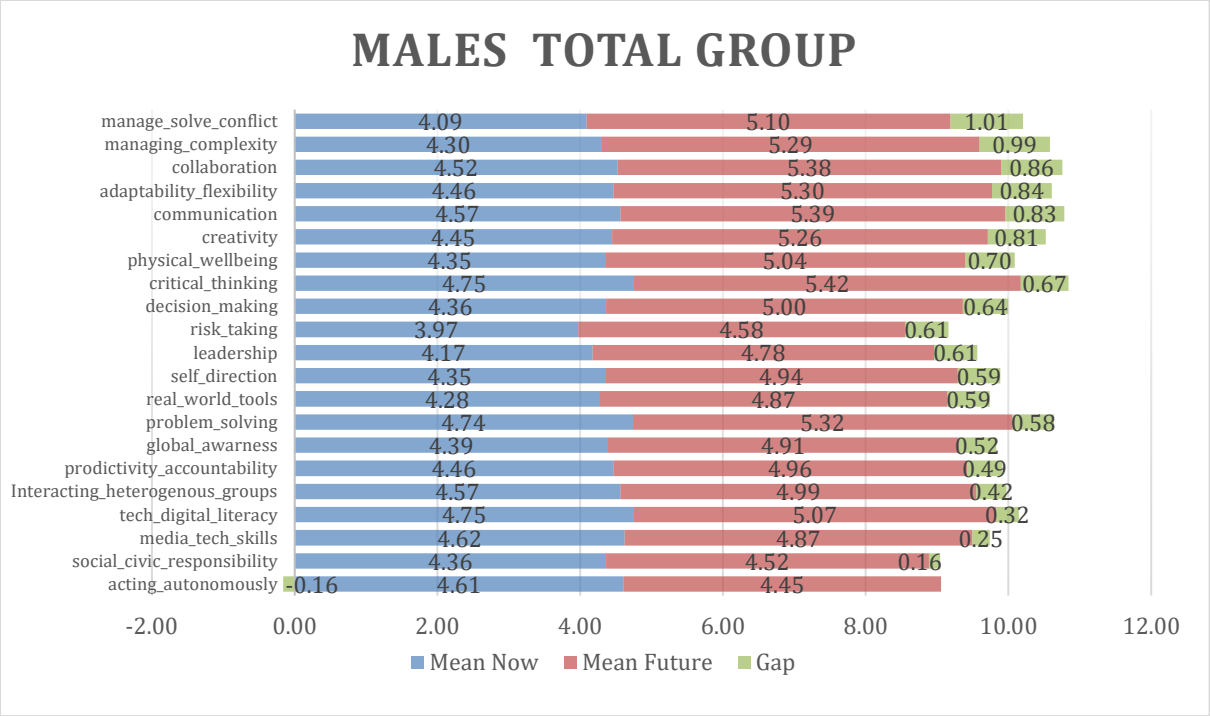
```
correlations_feed[,1] <- ifelse(correlations_feed[,1] > 0.5,
paste(correlations_feed[,1],"*", sep = ""),
paste(correlations_feed[,1]))
correlations_info[,1] <- ifelse(correlations_info[,1] > 0.5,
paste(correlations_info[,1],"*", sep = ""),
paste(correlations_info[,1]))
correlations_reflec[,1] <- ifelse(correlations_reflec[,1] > 0.5,
paste(correlations_reflec[,1],"*", sep = ""),
paste(correlations_reflec[,1]))


write.table(correlations_agil, file = "cor1.csv")
write.table(correlations_exp, file = "cor2.csv")
write.table(correlations_feed, file = "cor3.csv")
write.table(correlations_info, file = "cor4.csv")
write.table(correlations_reflec, file = "cor5.csv")



###CORRELATIONS###
library(corrplot)
cors_mat <- new_part2 %>%
  select(Agility,Experimenting,Feedback,Information,Reflecting)

library(Hmisc)
corss <- rcorr(as.matrix(cors_mat))

flattenCorrMatrix <- function(cormat, pmat) {
  ut <- upper.tri(cormat)
  data.frame(
    row = rownames(cormat)[row(cormat)[ut]],
    column = rownames(cormat)[col(cormat)[ut]],
    cor  =(cormat)[ut],
    p = pmat[ut]
  )
}
flattenCorrMatrix(corss$r, corss$P)
```

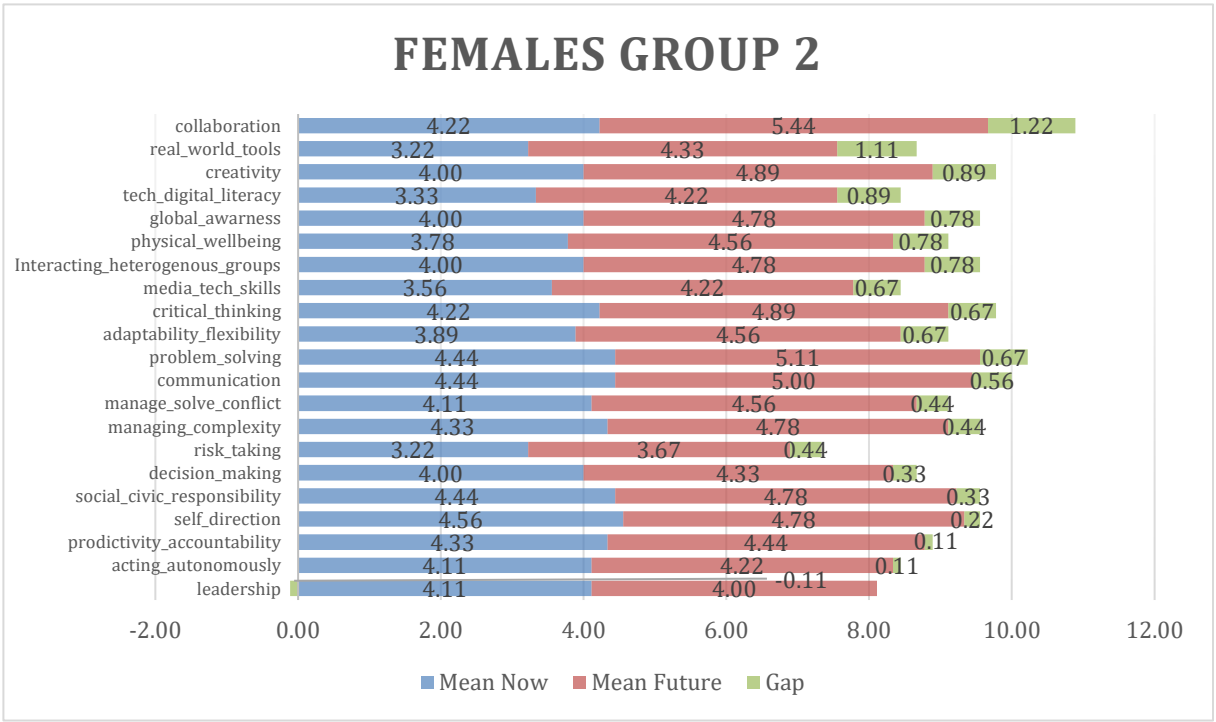
```
full_cor <-
cbind(correlations_agil,correlations_exp,correlations_feed,correlation
s_info,correlations_reflec)
colnames(full_cor)[c(1,3,5,7,9)] <- c("Agility", "Experimenting",
"Feedback", "Information", "Reflecting")
write.table(full_cor, file = "Full_corr_matrix.csv")


colnames(new_part2) <- c(colnames(new_part2[1:11]),b)


future_sk <- new_part2[grep("F$", colnames(new_part2))]
now_sk <- new_part2[-c(grep("F$", colnames(new_part2)),1:11)]


fn_d <- data.frame(cbind(future_sk,now_sk))
fn_cr <- rcorr(as.matrix(fn_d))
fn_cors <- round(fn_cr$r[22:nrow(fn_cr$r),1:21],3)
fn_ps <- round(fn_cr$P[22:nrow(fn_cr$P),1:21],3)


write.table(fn_cors, file = "Fut_now_cors_est.csv")
write.table(fn_ps, file = "Fut_now_cors_ps.csv")
write.table(round(fn_cr$r,3), file = "All_skills_est.csv")
write.table(round(fn_cr$P,3), file = "All_skills_ps.csv")


fulls <- rcorr(as.matrix(new_part2[,7:ncol(new_part2)]))
write.table(round(fulls$r,3), file = "Fulls_est.csv")
write.table(round(fulls$P,3), file = "Fulls_ps.csv")
```

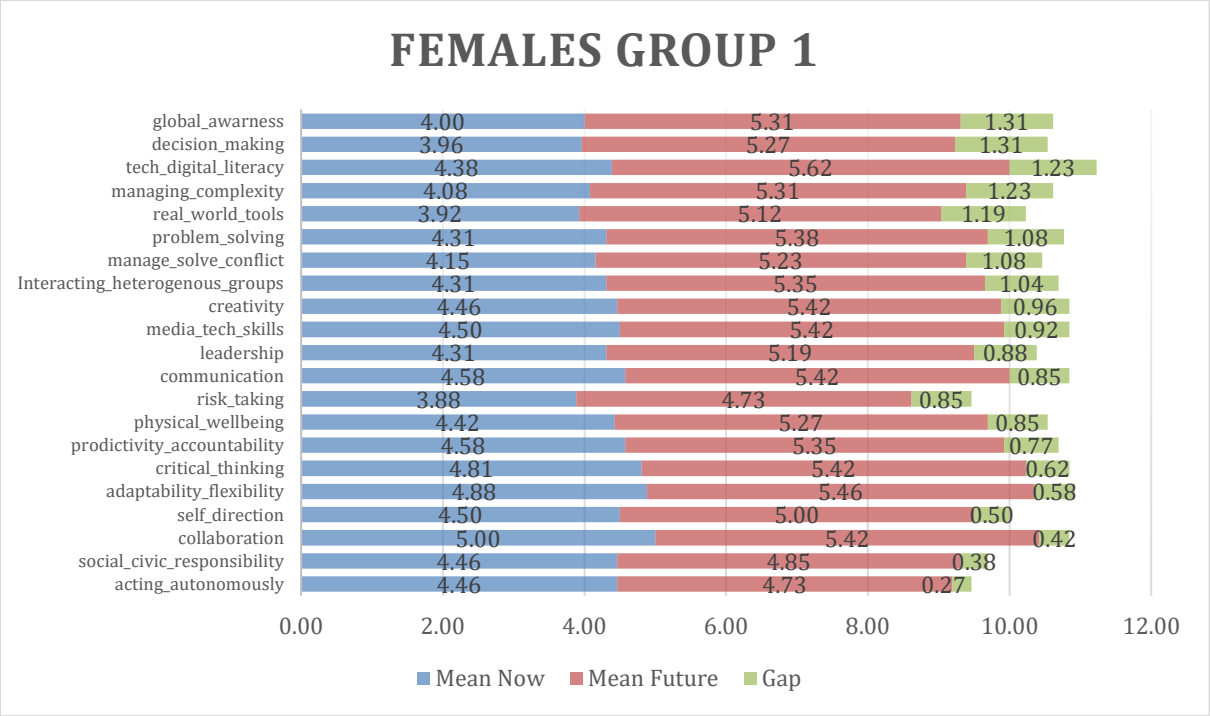
Gap Analysis graphs

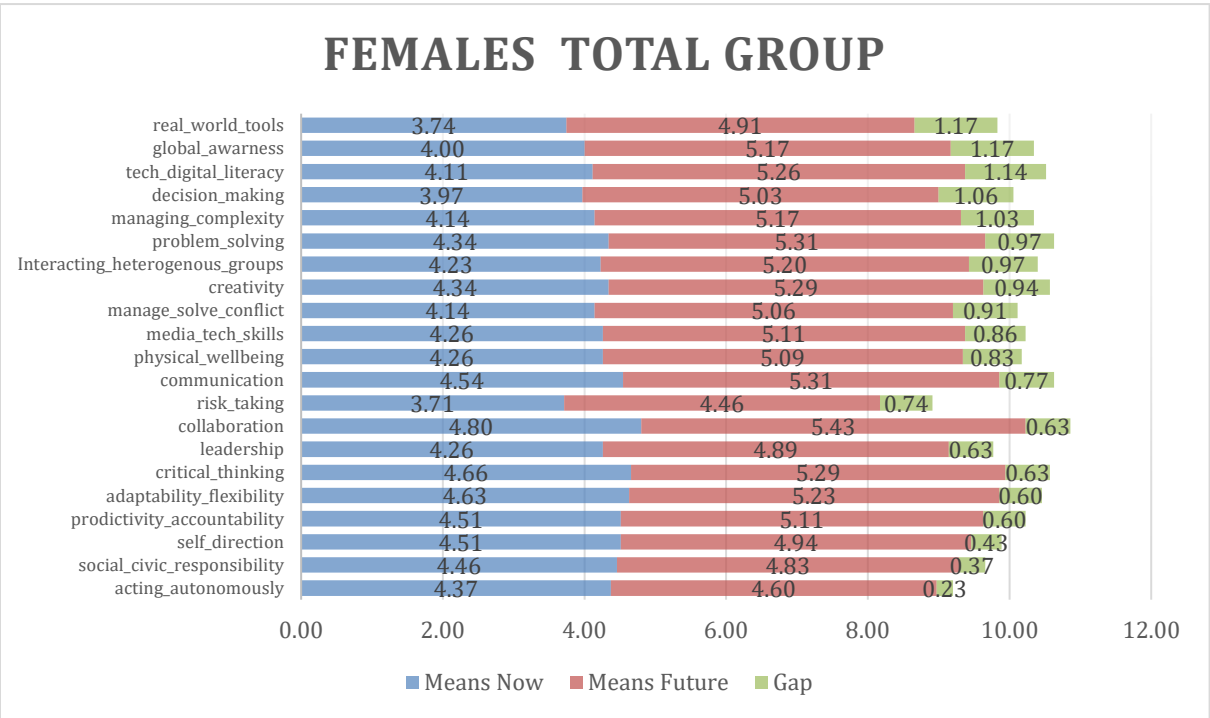


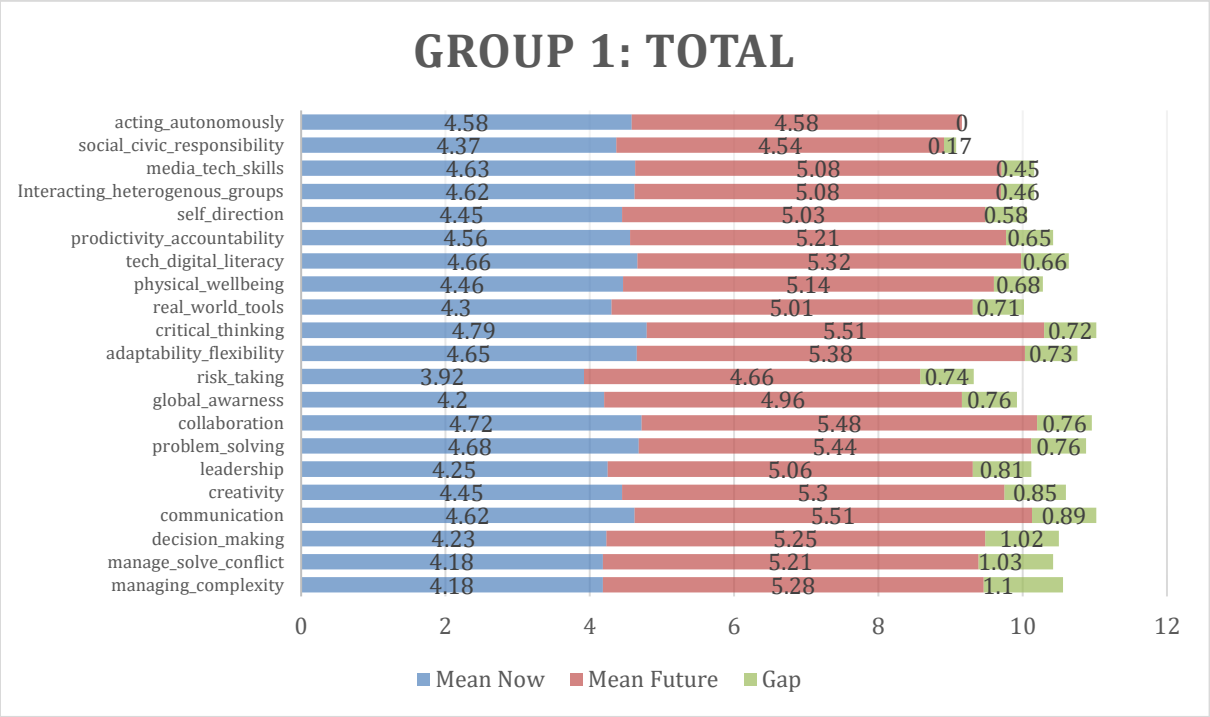


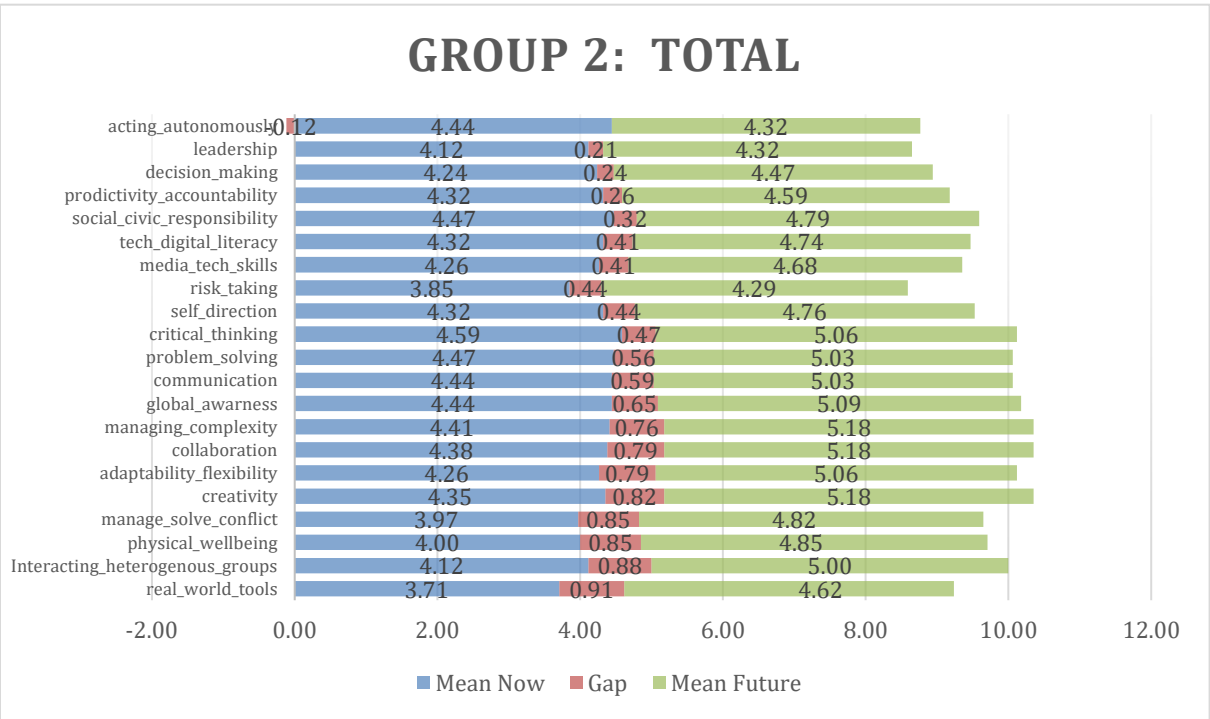

MALES TOTAL GROUP
manage_solve_conflict 4.09 5.10 1.01
managing_complexity 4.30 5.29 0.99
collaboration 4.52 5.38 0.86
adaptability_flexibility 4.46 5.30 0.84
communication 4.57 5.39 0.83
creativity 4.45 5.26 0.81
physical_wellbeing 4.35 5.04 0.70
critical_thinking 4.75 5.42 0.67
decision_making 4.36 5.00 0.64
risk_taking 3.97 4.58 0.61
leadership 4.17 4.78 0.61
self_direction 4.35 4.94 0.59
real_world_tools 4.28 4.87 0.59
problem_solving 4.74 5.32 0.58
global_awarness 4.39 4.91 0.52
prodictivity_accountability 4.46 4.96 0.49
Interacting_heterogenous_groups 4.57 4.99 0.42
tech_digital_literacy 4.75 5.07 0.32
media_tech_skills 4.62 4.87 0.25
social_civic_responsibility 4.36 4.52 0.16
acting_autonomously -0.16 4.61 4.45
-2.00 0.00 2.00 4.00 6.00 8.00 10.00 12.00
Mean Now
Mean Future
Gap

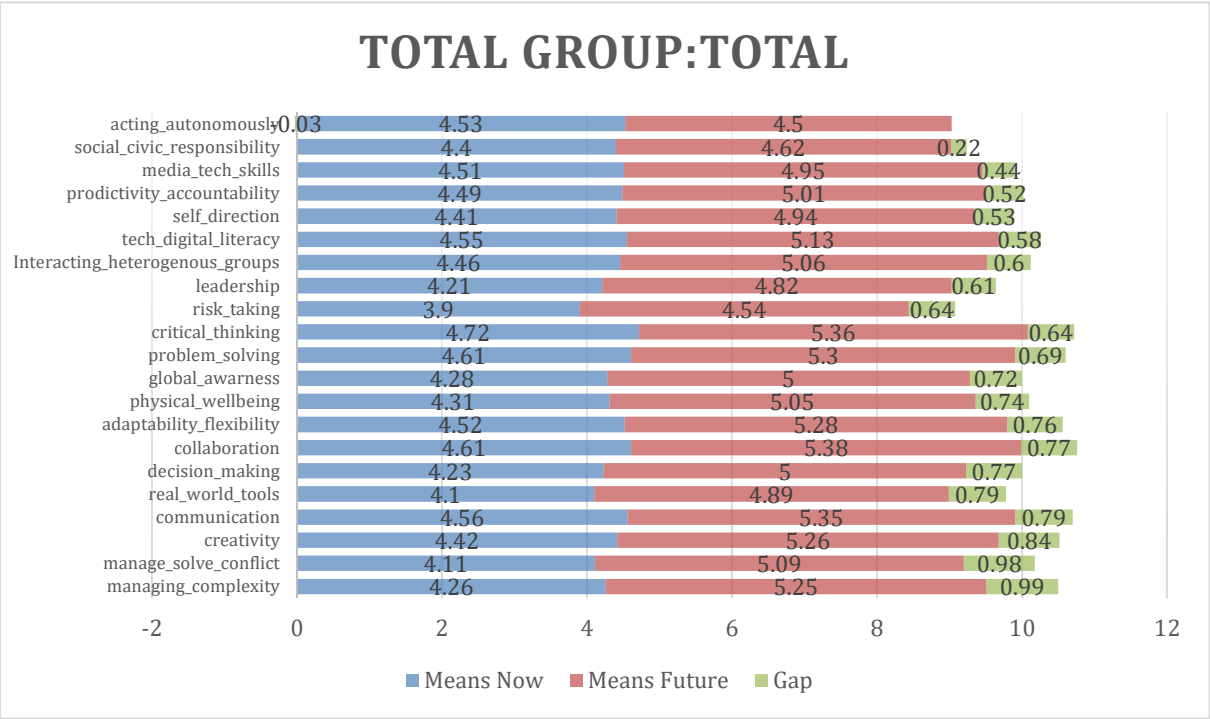

FEMALES GROUP 2
collaboration 4.22 5.44 1.22
real_world_tools 3.22 4.33 1.11
creativity 4.00 4.89 0.89
tech_digital_literacy 3.33 4.22 0.89
global_awarness 4.00 4.78 0.78
physical_wellbeing 3.78 4.56 0.78
Interacting_heterogenous_groups 4.00 4.78 0.78
media_tech_skills 3.56 4.22 0.67
critical_thinking 4.22 4.89 0.67
adaptability_flexibility 3.89 4.56 0.67
problem_solving 4.44 5.11 0.67
communication 4.44 5.00 0.56
manage_solve_conflict 4.11 4.56 0.44
managing_complexity 4.33 4.78 0.44
risk_taking 3.22 3.67 0.44
decision_making 4.00 4.33 0.33
social_civic_responsibility 4.44 4.78 0.33
self_direction 4.56 4.78 0.22
prodictivity_accountability 4.33 4.44 0.11
acting_autonomously 4.11 4.22 0.11
leadership 4.11 4.00 -0.11
-2.00 0.00 2.00 4.00 6.00 8.00 10.00 12.00
Mean Now
Mean Future
Gap


FEMALES GROUP 1
global_awarness 4.00 5.31 1.31
decision_making 3.96 5.27 1.31
tech_digital_literacy 4.38 5.62 1.23
managing_complexity 4.08 5.31 1.23
real_world_tools 3.92 5.12 1.19
problem_solving 4.31 5.38 1.08
manage_solve_conflict 4.15 5.23 1.08
Interacting_heterogenous_groups 4.31 5.35 1.04
creativity 4.46 5.42 0.96
media_tech_skills 4.50 5.42 0.92
leadership 4.31 5.19 0.88
communication 4.58 5.42 0.85
risk_taking 3.88 4.73 0.85
physical_wellbeing 4.42 5.27 0.85
prodictivity_accountability 4.58 5.35 0.77
critical_thinking 4.81 5.42 0.62
adaptability_flexibility 4.88 5.46 0.58
self_direction 4.50 5.00 0.50
collaboration 5.00 5.42 0.42
social_civic_responsibility 4.46 4.85 0.38
acting_autonomously 4.46 4.73 0.27
0.00 2.00 4.00 6.00 8.00 10.00 12.00
Mean Now
Mean Future
Gap


FEMALES TOTAL GROUP
real_world_tools 3.74 4.91 1.17
global_awarness 4.00 5.17 1.17
tech_digital_literacy 4.11 5.26 1.14
decision_making 3.97 5.03 1.06
managing_complexity 4.14 5.17 1.03
problem_solving 4.34 5.31 0.97
Interacting_heterogenous_groups 4.23 5.20 0.97
creativity 4.34 5.29 0.94
manage_solve_conflict 4.14 5.06 0.91
media_tech_skills 4.26 5.11 0.86
physical_wellbeing 4.26 5.09 0.83
communication 4.54 5.31 0.77
risk_taking 3.71 4.46 0.74
collaboration 4.80 5.43 0.63
leadership 4.26 4.89 0.63
critical_thinking 4.66 5.29 0.63
adaptability_flexibility 4.63 5.23 0.60
prodictivity_accountability 4.51 5.11 0.60
self_direction 4.51 4.94 0.43
social_civic_responsibility 4.46 4.83 0.37
acting_autonomously 4.37 4.60 0.23
0.00 2.00 4.00 6.00 8.00 10.00 12.00
Means Now
Means Future
Gap


GROUP 1: TOTAL
acting_autonomously 4.58 4.58 0
social_civic_responsibility 4.37 4.54 0.17
media_tech_skills 4.63 5.08 0.45
Interacting_heterogenous_groups 4.62 5.08 0.46
self_direction 4.45 5.03 0.58
prodictivity_accountability 4.56 5.21 0.65
tech_digital_literacy 4.66 5.32 0.66
physical_wellbeing 4.46 5.14 0.68
real_world_tools 4.3 5.01 0.71
critical_thinking 4.79 5.51 0.72
adaptability_flexibility 4.65 5.38 0.73
risk_taking 3.92 4.66 0.74
global_awarness 4.2 4.96 0.76
collaboration 4.72 5.48 0.76
problem_solving 4.68 5.44 0.76
leadership 4.25 5.06 0.81
creativity 4.45 5.3 0.85
communication 4.62 5.51 0.89
decision_making 4.23 5.25 1.02
manage_solve_conflict 4.18 5.21 1.03
managing_complexity 4.18 5.28 1.1
0 2 4 6 8 10 12
Mean Now
Mean Future
Gap


GROUP 2: TOTAL
acting_autonomously -0.12 4.44 4.32
leadership 4.12 0.21 4.32
decision_making 4.24 0.24 4.47
prodictivity_accountability 4.32 0.26 4.59
social_civic_responsibility 4.47 0.32 4.79
tech_digital_literacy 4.32 0.41 4.74
media_tech_skills 4.26 0.41 4.68
risk_taking 3.85 0.44 4.29
self_direction 4.32 0.44 4.76
critical_thinking 4.59 0.47 5.06
problem_solving 4.47 0.56 5.03
communication 4.44 0.59 5.03
global_awarness 4.44 0.65 5.09
managing_complexity 4.41 0.76 5.18
collaboration 4.38 0.79 5.18
adaptability_flexibility 4.26 0.79 5.06
creativity 4.35 0.82 5.18
manage_solve_conflict 3.97 0.85 4.82
physical_wellbeing 4.00 0.85 4.85
Interacting_heterogenous_groups 4.12 0.88 5.00
real_world_tools 3.71 0.91 4.62
-2.00 0.00 2.00 4.00 6.00 8.00 10.00 12.00
Mean Now
Gap
Mean Future


TOTAL GROUP:TOTAL
acting_autonomously
social_civic_responsibility
media_tech_skills
prodictivity_accountability
self_direction
tech_digital_literacy
Interacting_heterogenous_groups
leadership
risk_taking
critical_thinking
problem_solving
global_awarness
physical_wellbeing
adaptability_flexibility
collaboration
decision_making
real_world_tools
communication
creativity
manage_solve_conflict
managing_complexity
4.53 4.5 0.03
4.4 4.62 0.22
4.51 4.95 0.44
4.49 5.01 0.52
4.41 4.94 0.53
4.55 5.13 0.58
4.46 5.06 0.6
4.21 4.82 0.61
3.9 4.54 0.64
4.72 5.36 0.64
4.61 5.3 0.69
4.28 5 0.72
4.31 5.05 0.74
4.52 5.28 0.76
4.61 5.38 0.77
4.23 5 0.77
4.1 4.89 0.79
4.56 5.35 0.79
4.42 5.26 0.84
4.11 5.09 0.98
4.26 5.25 0.99
-2 0 2 4 6 8 10 12
Means Now
Means Future
Gap