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Teamwork In Academia
An empirical study

DOCTORAL THESIS

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DOCTORATE IN PSYCHOLOGY

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Teamwork In Academia - An Empirical Study

Abstract

The Bologna Process introduced some changes in the curriculum of higher education institutions (HEIs) and defined that academic learning should consider the needs of the labour market. HEIs and employers agree that personal skills are the most important set of competence of graduates (Pavlin, Akkuyunlu, Kovacic, & Svetlik, 2009).

The goals of this work were to explore how the work experienced by teams of students in HEIs might help them improve their personal skills, namely empirically explore the perception of teamwork and personality into two groups of students. The study was based on the theoretical model of Team Evolution and Maturation (TEAM, Fransen, 2012). The sample consisted of 99 students of the 3rd year of the degree (1st cycle) in Computer Science (49 students) and the 2nd year of the Bachelor's Degree (1st cycle) in Psychology (50 students), from the University of Madeira, Portugal. Areas of personality and team collaboration were evaluated with a Pre- and Post-test. Findings show that the perception of the teamwork collaboration of students in Computer Science and Psychology majors seems to be influenced by their scientific area, by gender, by the selection method of the time-organiser, the self-perceived personality of the time-organiser, the self-perceived personality of the non-time-organiser, and the size of the team. It is expected that this data will contribute to further theoretical and practical reflection on the teamwork among college students and their performance in the labour market.

Keywords: teamwork, teamwork collaboration, personality

Trabalho em Equipa na Academia – Um estudo empírico

Resumo

O Processo de Bolonha introduziu algumas mudanças no currículo das instituições de ensino superior (IES) e definiu que a aprendizagem académica devia considerar as necessidades do mercado laboral. Quer as IES, quer os empregadores, concordam que as competências pessoais são o mais importante conjunto de competência dos alunos graduados (Pavlin, Akkuyunlu, Kovacic, & Svetlik, 2009).

Assim, os objetivos desta dissertação foram os de explorar como o trabalho em equipa vivenciado em IES pode ajudar os estudantes a melhorar as suas competências pessoais, nomeadamente explorar de forma empírica a perceção de trabalho em equipa e personalidade em duas turmas de alunos. O estudo foi baseado no modelo teórico do *Team Evolution and Maturation* (TEAM, Fransen, 2012). A amostra é constituída por 99 estudantes do 3º ano da Licenciatura (1º ciclo) em Engenharia Informática (49 alunos) e do 2º ano do curso de Licenciatura (1º ciclo) em Psicologia (50 alunos), da Universidade da Madeira, Portugal. Os domínios da personalidade e colaboração em equipa foram avaliados com um Pré- e um Pós-teste. Os dados mostram que a perceção da colaboração no trabalho em equipa dos estudantes de Engenharia Informática e de Psicologia pode ser influenciada pela sua área científica, pelo género, pelo método de seleção do *time-organiser*, pela evolução ao longo do tempo do trabalho em equipa, pela auto-perceção da personalidade do *time-organiser*, pela auto-perceção da personalidade do *non-time-organiser* e pelo tamanho da equipa. Espera-se que estes dados contribuam para a reflexão teórico-prática acerca do trabalho em equipa nos estudantes do Ensino Superior e a sua performance no mercado de trabalho.

Palavras-chave: trabalho em equipa, colaboração no trabalho em equipa, personalidade

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Introduction

Introduction

Teams are becoming the primary means for organising work in today's labour market (Sundstrom, McIntyre, Halfhill, & Richards, 2000) and teamwork skills have become imperative in the workforce (Casner-Lotto, Barrington, & Wright, 2006). Nowadays tasks are more complex and mentally demanding than before (Robbins, Judge, & Campbell, 2010), hence the expertise needed to accomplish the institutional goals seems to be distributed between a number of employees. The most common approach is to organise the work by interdisciplinary teams that are created to act in specific projects. These teams operate under the supervision of a leader that usually has only basic field knowledge, but good guiding skills (Casner-Lotto et al., 2006; Nunes & Costa, 2005; Robbins et al., 2010).

With my personal work experience of 10+ years in different corporations, in private and public sectors, it seemed to me that teamwork skills are a key factor to success. Moreover, individuals' behaviour within a team seemed to be a reflection of its leadership. Moving to University of Madeira to work as a project manager, I have had the opportunity to work with faculty and students from all over the world. This experience has caused me to hypothesise that cultural factors may also influence teamwork, as some cultures seem to be more focused on self and others in the group. This prompted me to look out for behavioural differences. Soon I got to the hypothesis that, in these highly competitive multicultural and multidisciplinary learning environments, each student had to adhere to a specific role within the team. My observations led me to conclude that these students were truly committed to performing well, either individually or as a team.

One of the singularities of these multicultural and multidisciplinary teams is that they usually comprise a time-organiser, i.e. a team member whose role is to control deadlines, assign tasks to his/her peers, make sure that the project is on track, and deal with problems or unexpected issues. It seemed to mirror what we could find in most teams in formal work contexts, a leader who facilitates the teamwork and ensures that deadlines are met. Consequently, these learning teams seemed to be putting into practice some management techniques that might allow students to gain or improve skills. These competencies could be highly valuable for entry into the labour market (Casner-Lotto et al., 2006). This model seemed to work well for the student.

Portuguese students were also included in multicultural and multidisciplinary teams and reported the experience as very positive and enriching. However, when in teams of just Portuguese students, they seemed not to follow this model of organisation, and did not define time-organisers. They often reported conflicts between the team members and some difficulties in meeting the deadlines. The model of having a time-organiser seems not to be a common practice amongst other students at the University of Madeira, even though working in teams occurs frequently.

The Bologna Process[1] introduced some changes in the curricula of the higher education institutions (HEI), as it established that universities should educate their students with the required tools and skills to ensure the full development of their human potential. Moreover, it says that academic learning should consider the needs of the labour market (Official Journal of the European Union, 2013). Bologna established that college students ought to engage in an active learning, highlighting the relevance of the learning outcomes. HEIs and employers highlight the personal proficiency competency as the most important central competence cluster required for graduates to function well in the

[1] Bologna Declaration, 1999. Available in http://www.ehea.info/Uploads/Declarations/BOLOGNA_DECLARATION1.pdf

workplace and in society in general (Pavlin, Akkuyunlu, Kovacic, & Svetlik, 2009). HEIs and employers both agree that this is even more important than field expertise (Pavlin et al., 2009). Personal proficiency includes teamwork, not only with regard to its general aspects, but also leadership, time management, and the ability to work productively with others (Pavlin et al., 2009). The Bologna Process supports this idea, identifying teamwork as one of the competence clusters to emphasise during the higher education period (Official Journal of the European Union, 2013) thus, European HEIs assume a relevant role in the preparation of students to enter the labour market with the right skills to ensure their employability.

The goal of this study was to explore how teamwork done at the HEI can help students improve their personal proficiency competence cluster, namely explore the perception of teamwork from two classes of students, in a pre and post-test assessment of their personality traits. It aims to contribute to the reflection on the apparent lack of preparedness of graduate students to effectively work in teams in industrial contexts (Hughes, 2002; Casner-Lotto et al., 2006).

This work, organised into five chapters, has in the first chapter the literature review of the themes of European Higher Education Area, teamwork, leadership, personality, and teamwork effectiveness, including as well the research question and the hypotheses formulated. The second chapter describes the method, including participants, instruments and procedures used in this study. The results can be found in the third chapter, namely the preliminary results, exploratory results, and correlational analyses and variances analyses. The discussion is in the fourth chapter, with results analysis guided by the hypotheses. The last chapter contains the conclusions, limitations and further studies.

1. Literature review

1. Literature review

The aim of this study is to explore how teamwork developed at higher education institutions (HEI) can help students improve their personal proficiency competence cluster and, consequently, their employability. This is achieved by the exploration, from an empirical standpoint, of the perceived teamwork collaboration in two classes of students from different scientific areas, using both a pre and post-test. The study intends to assess the self-perceived personality traits of the students and explore how these correlate with teamwork collaboration. It also plans to reflect on how the apparent lack of preparation of the graduate students in the area of teamwork precludes them from working effectively in teams in industrial contexts (Hughes, 2002; Casner-Lotto et al., 2006). The main objective is to explore the factors that may underpin this trend and present suggestions that might contribute to a better understanding of teamwork in academia.

This chapter will revise the literature about the European Higher Education Area, teamwork, leadership, personality, and teamwork effectiveness. Finally, the research question and the hypotheses will be presented in the section Teamwork at the University of Madeira, a new approach.

When a complex project has to be addressed, teamwork is the most popular approach, not only in learning contexts, but also in industry (McCorkle, Reardon, Alexander, Kling, Harris, & Iyer, 1999; McKinney & Graham-Buxton, 1993). Likewise, Nunes and Costa (2005) explained in the report Bologna Project (*Projecto de Bolonha*, about the implementation of the Bologna Process at the University of Madeira), that nowadays, work is organized in interdisciplinary teams, by projects. These teams have a

leader that masters the basis of different fields of knowledge, has guidance skills, and is able to encourage teamwork, under strict deadlines (Nunes & Costa, 2005). Past studies have shown that people operating in a team-based setting have better interpersonal skills, obtain a better sense of accomplishment and develop better critical thinking skills (Michaelsen, Knight, & Fink, 2002), which lead to greater work satisfaction. However, there are still reports on the lack of support from the HEI in preparing their students to build effective teamwork skills throughout their studies (Casner-Lotto et al., 2006; Hughes, 2002; Pavlin et al., 2009). Employers expect colleges and universities to prepare students to work in teams (Association of American Colleges and Universities [AACU], 2006; American Institute of Certified Public Accountants [AICPA], 2008; Landrum & Harrold, 2003; National Association of Colleges and Employers [NACE], 2008; Pavlin et al., 2009) and college graduates agree that teamwork is a skill highly sought-after by employers (AACU, 2006; Pavlin et al., 2009). Some HEIs have been approaching this issue, but more can still be made to improve the eventual employability of students once they have graduated.

Identifying relevant knowledge, skills and abilities of team players can affect the entire job placement process, impacting how organisations select, train, and retain their employees (Stevens & Campion, 1994). Enhancing more effective teams, with less conflict amongst the members, may improve not only employee performance, but also employer satisfaction levels. Personality characteristics seem to influence the perception of teamwork (Myers et al., 2009), as well as leadership (Tabernero, Chambel, Curral, & Arana, 2009). Thus, being in an academic context, where individuals are about to enter their adult life (Fransen, 2012), provides an opportunity to explore the influence that personality and leadership might have in the perception of teamwork collaboration.

It is necessary that HEI offer broader academic programmes with solid scientific foundations, which give priority to active learning and acquisition of new competencies

(Nunes & Costa, 2005). This might be a system where teaching, learning, and assessment are part of a continuum that could be fundamental to the development of student-centred learning (Adam, 2008). Yet, according to the HEGESCO project's findings (Pavlin et al., 2009), not only do employers have very little knowledge of what to expect from graduates, but HEI have a similar lack of insight concerning the employers' needs (Melink, Pusnik, & Pavlin, 2014). This seems to reveal a gap between what is taught at HEI and what employers need. It might damage not only student employability, as their competencies do not meet what is expected, but also the enrolment number at the HEI, as some students may not understand the benefit of having a college degree. Innovative capacities within industry improve with the competency clusters brought in by college graduates (Melink et al., 2014). Thus, students coming out of universities should have the basic skills to build the competences that they will need to succeed in the contemporary labour market.

1.1. The European Higher Education Area

The Bologna Declaration states, "we must in particular look at the objective of increasing the international competitiveness of the European system of higher education", reinforcing the concept that it has to acquire a worldwide degree of attraction equal to Europe's extraordinary cultural and scientific traditions (Bologna Declaration[2], p. 2), as this is a key ingredient of European Union priorities: competitiveness, cohesion, and sustainability (Capano & Piattoni, 2011). With its emphasis on competitiveness and investment in human capital, the Lisbon Strategy subtly transformed the convergence agenda set out in Bologna into a process of continuous assessment and constant adaptation (Capano & Piattoni, 2011), where creativity and imaginative leaps are highly valued (Adam, 2008).

In 2003, the European Higher Education Area (EHEA) was created as part of the Bologna Process, with the awareness that "the importance of education and educational

co-operation in the development and strengthening of stable, peaceful and democratic societies, is universally acknowledged as paramount"[2]. The European Union has defined, as part of the Bologna Process, that HEI should equip individuals with the tools and skills required to ensure the full development of their human potential (Official Journal of the European Union, 2013). Moreover, academic learning should consider the needs of the labour market, with the goal of providing students with the skills they need to find a stable, well paid job (Official Journal of the European Union, 2013).

Expectations of higher education are rising and learning collaboratively in communities of inquiry to promote knowledge development is considered an important pedagogical approach (Garrison & Anderson, 2003; Garrison & Cleveland-Innes, 2005). Ideally, learning-teams collaborate to carry out complex open assignments, which have interdependency built in so as to facilitate and stimulate knowledge construction and conceptual change (Bereiter & Scardamalia, 1996; Blumenfeld, Marx, Soloway, & Krajcik, 1996; Harden & Davis, 1998). However, even when these requirements have been fulfilled, effective learning team performance is not guaranteed and the quality of learning outcomes might be suboptimal. As Hackman (1990) presents it, the main cause of this failure is that team members do not work effectively. Learning team effectiveness is expressed by the quality of group results, the quality of team performance, and perceived fulfilment of individual team members' needs (Hackman, 1990). Being a member of a group can have a powerful influence on individual behaviour and, in turn, the behaviour of the group is clearly affected by individual members (Rollinson, Broadfield, & Edwards, 1998).

The European Union emphasises that actions to promote employability, such as lifelong learning and the development of a broader range of skills suitable for the labour

[2] Bologna Declaration, 1999. Available in http://www.ehea.info/Uploads/Declarations/BOLOGNA_DECLARATION1.pdf

market should be top priorities in order to achieve sustainable growth and prosperity (Official Journal of the European Union, 2013). The focus on the learning outcomes has become a political concern in the European countries, either when "setting overall objectives for their education and training systems and when defining and describing qualifications" (Adam, 2008, p. 5). There is increasing emphasis being placed on what a learner knows and what they are actually able to achieve at the end of a learning process (Adam, 2008).

According to HEGESCO project's findings (Pavlin et al., 2009), reported by HEI and employers, the central competency cluster required for graduates to function well in the workplace, and in society in general, is personal proficiency (Pavlin et al., 2009). Personal proficiency includes teamwork, not only its general aspects, but also leadership, time management, and the ability to work productively with others (Pavlin et al., 2009). This cluster is considered by HEI and employers as even more important than field expertise (Pavlin et al., 2009). Both HEI and employers agree that teamwork competencies and the abilities connected to it should be taught at university (Pavlin et al., 2009)., furthermore the Bologna Process seconds this idea, establishing teamwork as one of the competencies to emphasize during the period of higher education (Official Journal of the European Union, 2013).

Therefore, the principles of the Bologna Process are aligned with the beliefs revealed by the administrators of the HEI and European employers, as everyone agrees that teamwork, leadership, and the ability to work productively with others are key competencies that ought to be concentrated on by students at a higher educational level.

1.2. Teamwork

Researchers have investigated the phenomenon of teams (Stout, Salas, & Fowlkes, 1997; Sundstrom, 1999; Sundstrom et al., 2000; Tesluk & Mathieu, 1999; Webber &

Klimoski, 2004; Wheelan, 2003) and their effectiveness (Sundstrom, Meuse, & Futrell, 1990; Klimoski & Zukin, 1999; Katzenbach & Smith, 1993b). Katzenbach and Smith (1993a) consider teamwork as something beyond simple collectives, where teams are not *ad-hoc* groups lacking a shared identity, but rather collectives with goals, organisational support and drive. Robbins et al. (2010) seconded this, saying that working in groups requires a certain amount of trust. Work groups are organised mobs, they have proprieties such as roles, norms, status, group size, and group cohesiveness (Robbins et. al., 2010). These proprieties shape the behaviour of members, which may allow for the prediction of a large portion of individual behaviour within the group and might even its performance (Robbins et. al., 2010). These proprieties also demand a set of behaviour patterns, expected of people occupying a given position in a social unit (Robbins et. al., 2010). According to Robbins et al., it would be simpler to understand if each person had just one regular and consistent role in the team. However, individuals are now required to play a number of diverse roles, both on and off their jobs (Robbins et. al., 2010).

Research already covers a broad range of factors related to teamwork, such as, for instance, how groups can be formed (Borges, Dias, & Cunha, 2009), the importance of training staff (Burbach, Matkin, Gambrell, & Harding, 2010), different types of group activity (Esmonde, 2009), measures of academic achievement (Nihalani, Wilson, Thomas, & Robinson, 2010), the importance of trust among group members (Mach, Dolan, & Tzafrir, 2010), the role of the personality of the student in the perception of teamwork (Myers et al., 2009), the importance of online collaboration (Thompson & Ku, 2010), team effectiveness (Fransen, 2012), leadership styles (Tabernero et al., 2009), approaches to team personality management (Prewett, Walvoord, Stilson, Rossi, & Brannick, 2009), perceived fit of the group and the organisation (Shin & Choi, 2010). These conclusions give some insights into the phenomena of mediating teams however, some of these seem

to have never been applied in Portugal, thus findings may not fit the Portuguese learning teams.

Although the behaviour of a group depends on the characteristics of its members, a group is more than just a collection of individuals (Rollinson et al., 1998). To become a group member, the subject usually adjusts to the group far more than the group adjusts to him/her (Rollinson et al., 1998). In return there is usually some degree of accommodation by the group of the idiosyncrasies of the individual (Rollinson et al., 1998). To function collectively, a team needs to have some key attributes like collective perception, shared aims, interdependence, social organisation, interaction, cohesiveness, and membership (Davies, 2009). A work group is a collection of individuals that interact primarily to share information and to make decisions to help each member to perform well, within his/her area of responsibility (Robbins et al., 2010).

A team consists of two or more individuals, with specific roles, who perform interdependent tasks, are adaptable, and share a common goal (Salas, Dickinson, & Converse, 1992). Throughout history, there have been various definitions of team (Humphrey & Aime, 2014). Recently Humphrey and Aime (2014, p. 450) developed a new definition: "Assembly of interdependent relations and activities organising shifting sets or subsets of participants embedded in and relevant to wider resource and institutional environments". In short, a team is a group of two or more subjects, with shared goals, but specific roles and tasks, which, in order to work as a team, need to hold particular knowledge, skills and abilities.

Most researchers agree that teams must develop shared mental models to set team goals, determine strategies, allocate subtasks to team members, monitor team processes and effectively communicate (Fransen, 2012; Klimoski & Mohammed, 1994; Salas, Sims, & Burke, 2005; Van den Bossche, Gijselaars, Segers, & Kirschner, 2006). Moreover, to be called teamwork, individuals should possess specific knowledge, skills, and attitudes, such

as the ability to monitor each other's performance, expertise, and a positive approach toward teamwork (Fransen, 2012; Salas et al., 2005). A team is not just a collection of individuals, the members need to have a positive attitude towards teamwork, be willing to share knowledge and develop a common mental model. This suggests that the team develops over time, and this may influence team dynamics and the interaction among all team members. The group development might change internal structures, processes, and culture, which might influence the members and, consequently, teamwork results. Thus, group development models should be considered when analysing teamwork.

1.2.1. Group development models.

One of the most commonly accepted definitions of group development is the one presented by Sarri and Galinsky (1974), where group development refers to "changes through time in the internal structures, processes, and culture of the group" (Sarri & Galinsky, 1974, p. 72), that is, group development involves trades within three different dimensions. The first one, the social dimension, is related to the organisation of the group's structure and the models of the roles and structures of the participants. The second dimension, activity, concentrates on the group's actions, tasks and the operative processes of the team. Group culture, the third category, includes properties such as group norms, values and a shared team goal.

Over time different authors have analysed group development and framed it in different models. Table 1 summarises group development frameworks.

Table 1

Group development framework (based on Smith, 2001)

Gibbard et al. (1974)	**Shambaugh (1989)**	**Poole (1989)**	**McCollom (1990)**	**Mennecke et al. (1992)**	**Smith (2001)**
Linear Progressive	Sequential	Unitary Phase	Performance	Progressive	Linear Progressive
Life Cycle	Recurring Phase	Non Phasic	Emotional	Cyclical	Cyclical and Pendular
Pendular or Recurring Cycle	Changing Centrality	Contingency	Revolt	Non-sequential	Non-sequential or Hybrid

The framework developed by Smith, commonly used in research, defines three models of classifying group development: linear progressive; cyclical and pendular; and non-sequential or hybrid. According to Smith (2001), linear progressive models are models that imply that groups exhibit an increasing degree of maturity and performance over time, and are perhaps the best-known and most widely cited developmental models (Smith, 2001). These models assume that groups develop in a definite linear fashion, comprising an order of progression from one phase to another (Mennecke, Hoffer, & Wynee, 1992). This seemed to be the model followed by the sample in this study, as they were formed to solve a problem. Moreover, teams had to progress over time, to discuss and exchange ideas, in order to solve the assigned problem.

Cyclical models are defined as models that "imply a recurring sequence of events" (Mennecke et al., 1992, p. 526). These models were developed based on observations and the notion that groups revisit stages and phases over and over, or swing between issues again and again during the developmental process (Smith, 2001). In this frame groups must constantly deal with similar issues and problems in multiple time periods and settings, for reasons ranging from changes in the external environment to in-group membership, or in some cases changes in the scope of the teamwork (Smith, 2001).

Non-sequential models are models that "do not imply any specific sequence of events; rather, the events that occur are assumed to result from contingent factors that change the focus of the group's activities" (Mennecke et al., 1992, p. 526-7). Hybrid models are those that combine several existing theories to form a new one (Smith, 2001). Smith grouped them with non-sequential models because they "also do not propose a specific, ordered pattern of group development" (Smith, 2001, p. 17). They do not have a described process of development and the reason that they have become known as contingency models of group development is because the observed patterns are largely the result of environmental factors, such as time (Smith, 2001).

Some researchers have shown that teams operate more effectively under linear progressive development (Johnson, Suriya, Won Yoon, Berrett, & La Fleur, 2002). An *ad-hoc* student learning team most probably follows a progressive developmental path, with a mix of students who have worked together already and students working together for the first time (Fransen, 2012). However, subjects still tend to operate pragmatically, which suggests the importance that is placed on delivering results on time and solving task-related problems (Chinn, O'Donnell, & Jinks, 2000). Scientists, such as Poole, Seibold and McPhee (1985), McGrath (1991) and McCollom (1990), see groups as open systems rather than closed systems, pointing out that groups do indeed find ways of dealing not only with internal group problems, but also with the difficulties in obtaining resources from the outside.

In retrospect, the cyclical and pendular models are more flexible, adaptable and capable of dealing with a dynamic world than the linear-progressive models (Smith, 2001), and as a result might be a better fit in the industrial settings. Many of the non-sequential/hybrid models are advancements over both these sets of models in that they emphasise, to an even greater extent, the fact that groups are open systems that are embedded in larger organisations and environments (Smith, 2001).

According to Fransen (2012), the Team Evolution and Maturation (TEAM) model is appropriate for application in the educational context, as it acknowledges that *ad-hoc* learning-teams have to develop by proceeding through stages. Yet, it also recognises the effect of deadlines on learning team development, the emergence of a transition phase (i.e. the re-norming stage), and the influence of past experiences with teamwork on the pattern of team development (Morgan, Salas, & Glickman, 1993). The TEAM model offers a framework for discussing the variables mediating learning-team effectiveness. It assumes that the impact of these variables may differ according to the stage of development in the learning team and may have a specific influence on learning team evolution and maturation (Morgan et al., 1993). Accordingly, this paradigm will be the theoretical guide of this study.

In order to become productive and deliver results, teams must develop a team-related and task-related shared mental model at the outset of their collaboration. However, learning teams tend to focus on the task, not on the team and act pragmatically (Fransen, Kirschner, & Erkens, 2011). This helps teams to adequately monitor their teamwork and effectively adapt it to changing circumstances during a transition phase (Fransen, 2012). To function optimally, teams need to find a balance between focussing on task-related skills and team-related skills, as both seem to be key components for the team to accomplish its goals.

Learning teams are a way of improving student employability, because these teams improve the personal proficiency competency cluster, considered by employers to be a key competency. The goal of this study is to explore how teamwork is done in academia and present some recommendations of what can be done by the HEI to improve student employability. Thus it is important to review the basic concepts of working in an industrial context.

1.2.2. Teamwork in an industrial context.

The challenges faced by corporations nowadays require them to implement new organisational models, change internal structures, and look for new skills (Pacheco, 2009). These are aimed at a more flexible arrangement with a bigger focus on teamwork and on dealing with the unknown (Pacheco, 2009). Teams were found to be more flexible and responsive to changing events than the traditional departmental structure, or other forms of permanent grouping. Teams have the ability to assemble quickly, deploy, refocus, and disband quickly (Robbins et. al., 2010), thus they are becoming more popular in the workplace (Sundstrom et al., 2000). Moreover, groups can be an effective mean to democratising businesses and increasing employee motivation, as they facilitate the participation of staff in organisational decisions (Robbins et al., 2010).

According to Porter (1996), not paying sufficient attention to the impact of the organisational context on the behaviour of individuals and groups is considered to be one of the most significant failures of organisational behaviour. In order to explain why individuals act the way they do, it is necessary to understand how individuals, groups, and organisations influence subject behaviour (Porter, 1996). Moreover, the way the organisation interacts with the outside world pressures subjects to behave in certain ways (Porter, 1996).

Corporations and groups play an important role and are a substantial influencer in individual behaviour. Teams can be a motivational factor, but the motivational proprieties of teams should not be overlooked, as stressed by Robbins et. al (2010). Therefore, Davies (2009) recommends developing a system of rewarding not only the group efforts, but also rewarding the individual contributions to the group. Verney's (1983) findings show that there is a positive relationship between role perception and employee performance evaluation.

Teams have proved to be important in the workplace. Thus, professionals tout the relevance of group work in schools and use such training as an assessment in terms of a student's later employability (Davies, 2009). Working in groups is an essential part of an individual's career (Davies, 2009), especially nowadays where problems are more complex thus, require multiple skills and field expertise to solve. Sometimes the level of competencies required can only be achieved with a multidisciplinary team of technicians, lead by a facilitator that coordinates the team and makes sure that the goals are accomplished.

1.2.3. Teamwork in academia.

Among students, teamwork is commonly understood as a process in which groups of people share responsibility for the tasks and projects, that will determine the outcome of a semester-long course (Strom & Strom, 2002). Learning collaboratively is considered an important pedagogical approach (Garrison & Anderson, 2003; Garrison & Cleveland-Innes, 2005) that arises in so-called communities of inquiry that facilitate the construction of personally meaningful and socially valid knowledge (Garrison & Anderson, 2003; Garrison & Cleveland-Innes, 2005). This is based on the constructivist paradigm that students must be involved in a process of knowledge construction through discussion, debate or argument if they are to establish profound learning and understanding (Bereiter, 2002; Bruffee, 1993; Geelan, 1997). This is widely appreciated especially in higher education (Bereiter, 2002; Bruffee, 1993; Geelan, 1997).

This tactic is employed to ensure that students learn how to collaborate in a setting that reflects what they will experience in their professional lives. However, knowledge construction in collaborative learning is also based upon a constructivist paradigm that it is either the focus or a side effect of its usage (Fransen, 2012).

In the context of academia, knowledge development activities are often intentional effects of problem-based or project-based assignments (Blumenfeld et al., 1996; Harden & Davis, 1998), where team effectiveness might influence the learning outcomes (Salomon & Globerson, 1989). Usually it means that students are given an assignment that must be carried out by collaborating in an *ad-hoc* team, over a restricted period of time, and which is usually aimed primarily at learning through knowledge development (Fransen, 2012). In this study the students received a problem-based assignment to be addressed within a certain deadline. The main goal is that students go through an active learning experience not only of scientific knowledge but also personal proficiency competencies.

The benefits of group learning are well identified and widely researched in literature. Shimazoe and Aldrich (2010) have found several benefits of teamwork such as promotion of profound learning, earning higher grades, promotion of social skills/civic values, developing a high level of thinking skills, promoting personal growth, and positive attitudes toward autonomous learning. Teamwork allows people to engage in discussion and take responsibility for their own ideas (Soares & Pacheco, 2014), furthermore it facilitates active exchange of thoughts, increases motivation among participants and develops better understanding of diverse cultural backgrounds (Soares & Pacheco, 2014).

Michaelsen et al. (2002) have shown positive results with regard to better content retention and learning, higher attendance and self-reflection/self-understanding, when using the teamwork approach. Irrespective of the teamwork benefits, Hughes (2002) argues that many HEIs are not adequately prepared to provide the essential requirements and support for effective teamwork. Thus, many employers still find college graduates ill-prepared to work in teams (Casner-Lotto et al., 2006; Pavlin et al., 2009), as they lack personal proficiency competencies such as, for instance, leadership, teamwork, and time management.

1.2.3.1. Learning teams.

There is a pressing demand for systematic development of teamwork skills in educational settings in order to create better workforce readiness (Burbach et al., 2010). This is because team projects in academia provide a realistic experience of cooperation, group decision making, and communication; enhance members' acquisition of discipline-related knowledge; and allow team members to accomplish more extensive and complex tasks than could be accomplished by one individual (McCorkle et al., 1999; McKinney & Graham-Buxton, 1993). Collaborative learning requires analysis and discussion to achieve thorough learning and conceptual change (Fransen, 2012). However, both the degree and type of argumentation/discussion in collaborative learning seem to be strongly influenced by contextual factors such as task characteristics, team formation, abilities and characteristics of team members, and role assignment within a team (Fransen, 2012). These factors influence the argumentation/discussion within the team that, most probably, influences team effectiveness. These contextual factors will be explored in this study, as findings might contribute to the team effectiveness.

Research shows that, in correlation with traditional lectures or individualistic learning environments, teamwork results in greater student accomplishment (Freeman, 1996; Hite, 1996; Hwang, Lui, & Tong, 2005; McKinney & Denton, 2005), an exceptional use of argumentation and critical thinking skills (Duffrin, 2003; Gabbert, Johnson, & Johnson, 1986), more positive attitudes toward the subject matter and satisfaction with the class (Dunaway, 2005; Trempy, Skinner, & Siebold, 2002; Willey & Freeman, 2006), greater interpersonal and communication abilities (Meyer, 1994; Williams, Beard, & Rymer, 1991), and enhanced motivation to learn (Frank, Lavy, & Elata, 2003). In addition, these findings have been corroborated by college students who have responded favourably to team projects and recognise that collective assignments are helpful in the acquisition of social skills (Adams, 2001; Deeter-Schmelz, & Ramsey, 1998; Lancellotti & Boyd, 2008; McCorkle et al., 1999; Hernandez, 2002). Faculty members can also benefit from positive

outcomes in team-based learning, such as increased pleasure of teaching, getting to know students better, and a greater sense of accomplishment (Michaelsen et al., 2002).

It must be remembered, however, that "merely putting students in groups with the hope that they learn how to work together effectively is not enough" (Burbach et al., 2010, p. 4). A group of students starting an assignment have to first become a team in order to become effective (Fransen, 2012). Therefore, professors should receive training in the pedagogies of teamwork and actively employ these techniques in the classroom (Burbach el al., 2010).

Apart from the value of team and task awareness, Fransen (2012) showed that learning teams in academia tend to be pragmatic by focusing fundamentally on task aspects of performance, and not on the collective aspects. The assumption is supported by the fact that learning teams act pragmatically because of the need for initial interpersonal trust and mutual expectations of team member reliability at the task-level (Fransen, 2012). This practical approach is also seconded by the grading, as students tend to focus on getting good grades, preferably with minimal effort (Mao & Zakrajsek, 1994). This has been demonstrated in studies of short-term teams (Bradley, White, & Mennecke, 2003; Druskat & Kayes, 2000), where groups tend to redirect conflicts to the task-level, hoping that they can be easily and efficiently resolved.

It is important to bear in mind that learning teams are not always effective (Fransen, 2012). Due to the existence of pre-set deadlines for result delivery, solving task-related problems will also influence learning team development, which means that they often experience a turning point, that is a transition phase when the deadline approaches (Gersick, 1988). It usually results in changing task strategies and performance in order to deliver final results on time (Gersick, 1988). Perceived satisfaction of the team members' needs is particularly important in learning teams, as interest in a group assignment will not

develop unless individual needs of the team members are satisfied (Minnaert, Boekaerts, De Brabander, & Opdenakker, 2011).

Learning teams usually collaborate for relatively short periods of time (usually only for one semester). Continuous assessment of integrity and trusting behaviour is of lesser importance for the emergence of learning team effectiveness (Fransen, 2012). It is important to keep in mind that students entering a new unit are affected by their prior experiences in teams, with members who have either similar or different qualifications, which affects team development (Hinsz, 1995; Rentsch, Heffner, & Duffy, 1994). Despite the fact that team composition may shift with a new assignment, it is common that students have already met and worked together on other projects. This results in a more stable mental model with groups having fewer developmental steps or proceeding quicker through the specific stages (Fransen, 2012). The quality of the team collaboration influences the quality of collaborative learning and, consequently, the learning-team effectiveness (Fransen, 2012).

1.2.4. Differences between teamwork in industry and academic settings.

Learning teams in educational settings have the same function as task/project teams in organisational settings, but are different regarding particular aspects and team characteristics (Fransen, 2012). Learning teams differ from teams in the workplace regarding the distribution of power and expertise and the influence on resources and environment (Furst, Blackburn, & Rosen, 1999), but also in the collaboration scope, the demand of efficiency and the duration of teamwork (Fransen, 2012). Learning teams do not need to be extremely efficient, because their primary goal is learning, which is often the result of debate and negotiation (Kapur & Kinzer, 2007), as effective team learning is influenced by both social and cognitive factors (Van den Bossche et al., 2006). In HEIs, specifically in the domain of applied sciences, learning teams focus both on learning and

delivering results, where the main objective is to learn either as a group or as an individual, not to concentrate on the actual product that the team is working on (Fransen, 2012). To the contrary paid project work teams also combine product development and learning as a team, but in these settings learning would be a side effect as the main focus is product delivery, whilst the primary goal of a learning team is learning and the product is secondary (Fransen, 2012).

Collaborative learning assignments are usually complex and sometimes students lack, at an early stage, the expertise to imagine the required outcomes, so they have to rely on each other's competencies to develop an effective work plan (Fransen, 2012). In educational settings all team members are learners and, as such, have the same power status, and the same limited knowledge. Also, learning teams have no influence on the environment and the resources, because the assignments are fixed and resources are absent and/or cannot be controlled. Learning teams do not have to be efficient with respect to the end product, since thorough learning may also be the result of costly debates and negotiations, and suboptimal production of a final task solution. Finally, most learning teams are short-term and its members are focused primarily on finishing the task in time for grading (Fransen, 2012).

For significant collaborative learning, students must be involved in a process of knowledge production through thought and debate ending in extensive learning, broad understanding, and sequentially conceptual mind shifts (Bereiter, 2002; Geelan, 1997). To accomplish this, pupils need to deal with conceptual artefacts on the basis of open assignments with built-in interdependency (Blumenfeld et al., 1996). One of the pedagogical benefits of using teams in academia is that students can improve knowledge, skills and abilities that later they can convey to the workplace (Ettington & Camp, 2002). Businesses increasingly rely on teams to enhance productivity and, therefore, they expect colleges to prepare graduates to adequately operate in teams (Burbach et al., 2010). If a

learning team could be tested for and trained in effectiveness before beginning the start-up phase of a collaborative learning practice, group performance might improve both quantitatively and qualitatively (Fransen, 2012).

Learning team evolution seems to be unique due to the restricted term of teamwork and the fact that pupils act pragmatically by balancing teamwork with opposing personal hobbies, as well as understanding that deadlines need to be fulfilled and that the final grades are the most important (Fransen, 2012). Learning team evolution is linear progressive to some degree and the developmental phase often includes a transition stage when assignment due dates are close (Fransen, 2012).

1.2.5. Teamwork constraints.

In order to become effective as a team it is important to develop both a task-related and team-related shared mental model in the early phases of collaboration (Fransen, 2012). Fransen argues that both models facilitate task execution by creating a framework that promotes shared understanding and action. This does not mean that all team members should have exactly the same understanding, because this could lead to a reduction in alternative perspectives (Johnson & Weaver II, 1992; Jones & Roelofsma, 2000; Paulus, 1998; Kellermanns, Floyd, Pearson, & Spencer, 2008; Van den Bossche et al., 2006). In teams where such models are not adequately developed, either centralised autocratic leadership is likely to emerge to deal with the critical situation, or learning teams will probably expect the tutor to show directive leadership behaviour (Fransen, 2012). There are several factors that influence teamwork and which need to be considered when analysing group collaboration. These factors include communication, mutual performance monitoring, back-up behaviour, adaptability, shared mental models, and trust, and will be explained in the following paragraphs.

Communication is important at all stages of teamwork, either to provide feedback on individual performance and task execution, or to decide, as a team, how resources should be allocated (DeShon, Kozlowski, Schmidt, Milner, & Wiechmann, 2004). Furthermore, team communication helps to build both shared mental models and interpersonal relationships that influence the teamwork results (Salas et al., 2005), as well as facilitate the creation of the ownership of the task (Tolmie & Boyle, 2000) and a sense of community (Wegerif, 1998). Nowadays it is common to work collaboratively through technological tools (i.e. email, real time communication channels, document sharing, task management applications, etc.). Several studies report that there are no significant differences between computer-mediated-communication and face-to-face conversation regarding the outcomes of the method of collaborative learning (Fjermestad, 2004; Ocker & Yaverbaum, 1999), but Luppicini (2007) concluded that the effectiveness of computer-mediated-communication relies on the context and task characteristics.

If a more complex task is presented to the team (Sweller, 1994), mutual performance monitoring is necessary for the team's accomplishments. Nonetheless, in stressful conditions with a team performing a complex task, mutual performance monitoring might not be sufficient and the need for team leadership may be uncovered (Fransen, 2012).

Back-up behaviour is the capacity to anticipate the needs of other team members through reliable knowledge about their obligations, and also includes the ability to distribute the workload among affiliates to obtain balance during periods of high workload or pressure (Salas et al., 2005). In learning teams this back-up behaviour may be counterproductive when it is in response to free-riding or social loafing, as the more motivated members in the team are left with the responsibility of finalising the project and the results (Salomon & Globerson, 1989).

Within learning teams, adaptability is not an issue in the context of knowledge construction, since a learning team may not have to adapt to changing conditions, and yet still benefit from a costly and time-consuming process (Kapur & Kinzer, 2007). Adaptability, however, is relevant when executing a problem-based or project-based learning task (Fransen, 2012).

Researchers use different concepts with respect to shared perception, for instance, Mohammed and Dumville (2001) classify it as team mental models; Stout, Cannon-Bowers, Salas and Milanovich (1999) refer to it as shared mental models; Beers, Boshuizen, Kirschner and Gijselaers (2006) call it common ground; and Mu and Gnyawali (2003) describe it as synergistic knowledge. These concepts refer mainly to shared understanding at a team level, and can be described as group awareness of the team itself and the task aspects required in order to succeed as a group. The perception of trust at the team level is related to the concept of psychological safety (Edmondson, 1999) since team members must feel safe in order to freely exchange information.

Teams with better-shared perception of the task demands will adapt their strategies more efficiently and make decisions more rapidly (Resick, et al., 2010). However, if a team does not agree on goals and tactics at an early stage, discussions concerning task-related shared mental models will presumably be resumed through the transition phase in order to ascertain strategy adaptations, divide roles, allocate subtasks, and decide on schemes for quality assurance and/or process management (Fransen, 2012). Time constraints, especially in learning teams, force teams to adopt a pragmatic approach to teamwork and to focus on getting the best out of what has been produced so far in order to present a final result (Fransen, 2012). Informal social interplay seems to compensate for not spending too much time in meetings but developing a team-related shared mental model also provides confirmation to the studies on the necessity of both task-related

interaction and social interaction, in order for a group to become productive (Kreijns, Kirschner, & Jochems, 2003; Van den Bossche et al., 2006).

Findings suggest that trust has a limited effect on learning team effectiveness, since *ad-hoc* short-lived learning teams often operate in a pragmatic and task-oriented way where only minimal levels of cognition-based trust (McAllister, 1995) appear to be necessary (Fransen et al., 2011). Trust emerging in early stages of teamwork allows for the development of interpersonal ties among group members and reduces the likelihood of task and relationship conflicts during later stages (Curşeu & Schruijer, 2010). Despite the great number of benefits, Davies (2009) has also shown that some problems that may arise with teamwork, such as motivational issues, the ethnic mixes, the complexity of the task, the recognition of individual effort, the group size, encouragements and penalties, or even the free-rider effect.

Group size is a factor that should be considered when analysing teamwork. There is no universal optimum size for a group, it depends on the common task (Rollinson et al., 1998). Nevertheless, large groups have a tendency to split into factions or cliques, which can lead to intra-group conflict (Rollinson et al., 1998). Conversely, while groups that are very small are often cohesive, they can sometimes lack the diversity of skills and the necessary points of view for creative problem solving (Rollinson et al., 1998). In this study 17 groups were used, with teams that had 4 to 8 members each. The size of the teams depended on the assigned task, as the Computer Science students had smaller teams (4 to 6 members) and Psychology students had bigger teams (5 to 8 members).

Researchers found that the learning styles are influenced by gender differences, as women and men do not have similar learning styles (Gallos, 1995) and, in formal learning contexts, females tend to under-evaluate their performance and learning abilities (Scheuneman, 1997). In relation to teamwork, it was revealed that male students weigh their teams' dynamics more positively than females (Ro & Choi, 2011), and that groups

may be more effective when women outnumber or equal men (Fenwick & Neal, 2001), however it has been also argued that females performed best when competing in same-sex teams against masculine teams, whereas males performed best when female were present (Ivanova-Stenzel & Kübler, 2005). Furthermore, these dissimilarities extend to the perceived performance when in a group as male students have a more positive attitude towards and evaluate their team performance higher than females (Ro & Choi, 2011). Women seem to experience effective teamwork less often than men and consequently develop a somewhat negative attitude towards it (Ro & Choi, 2011), however Gallos (1995) explains this may be based on the fact that female students have stronger needs for support, confirmation, and faculty interest to decrease fear, self-doubt, and loss of confidence.

Effective teams have shared components, such as adequate resources, effective leadership, an atmosphere of trust and a performance evaluation and compensation system that reflects group contributions (Robbins et. al., 2010), but which also contain members with technical expertise, problem-solving, decision-making, interpersonal abilities and a high level of conscientiousness and openness (Robbins et. al., 2010). Effective team members work with freedom and autonomy, and have the ability to use a large array of skills and talents, the knowledge to complete a whole and identifiable task/product, and their work has a firm impact on others (Robbins et. al., 2010). Lastly, effective teams have members who believe in team skills and are committed to joint planning and purpose, an authentic shared mental model of what is to be accomplished, specific team objectives, a manageable level of conflict and a negligible degree of social loafing (Robbins et. al., 2010).

Effective leadership influences team effectiveness (Fransen, 2012; Shimazoe & Aldrich, 2010) and it might be a determining factor in team collaboration. It seems that most learning teams do not establish a formal leadership role. However, in the

multicultural and multidisciplinary teams of the Professional Masters in Human-Computer Interaction at the University of Madeira, students usually assign a time-organiser role to one of the team members. According to informal observation and qualitative feedback from students, the satisfaction with team collaboration was high. Esmonde (2009) also relates positive experiences of students involved in learning teams with a facilitator in learning teams. This study will explore the influence of a facilitator/time-organiser on the teamwork of students at the University of Madeira. The facilitator/time-organiser should have a coordination role within the team and help teammates to achieve the required tasks. It is not a leadership role but as it has some similarities, we will review the main concepts and models, and will also explore the relevance that the facilitator/time-organiser might have within the team.

1.3. Concept of leadership

According to Robbins et al. (2010, p. 316), "leadership is the ability to influence a group toward the achievement of a vision or set of goals". Leaders can emerge from within a group, but can also be formally appointed to lead a group, thus the source of this influence may be formal, such as that provided by the possession of managerial rank in an organisation (Robbins et al., 2010) or informal. Trait theories and behavioural theories try to determine effective *versus* ineffective leaders, but they do not guarantee a leader's success, as the context plays an important role (Robbins et al., 2010). Robbins et al. (2010) point out five different theories in leadership: Trait Theories, Behavioural Theories, Contingency Theories, Leader-Member Exchange Theory and Decision Theory, yet also refers to two inspirational approaches to leadership: charismatic and transformational leadership, described as follows.

Trait Theories of leadership differentiate leaders from non-leaders by focusing on personal qualities and characteristics (Robbins et. al., 2010). The research into which

personality, social, physical or intellectual attributes were common among the greatest leaders started with the earliest stages of leadership research (Robbins et al., 2010), however these efforts, around the 1990s, were not very successful, and after copious studies and analyses, the best thing that could be said was that "leaders are not like other people" (Robbins et al., 2010, p. 331), but the particular traits that were isolated were not systematic (Kirkpatrick & Locke, 1991; Zaccaro, Foti, & Kenny, 1991). The breakthrough came when researchers began organising traits around the Big Five model (Judge, Bono, Ilies, & Werner, 2000; Judge, Bono, Ilies, & Gerhardt, 2002) and it became possible to subsume the dozens of traits emerging in various leadership reviews under one of the Big Five categories, resulting in consistent and solid support for traits as predictors of leadership (Robbins et al., 2010).

When the leadership literature was organised around the Big Five model it was found that extraversion is the most distinctive trait of effective leaders (Judge et al., 2002), while conscientiousness and openness to experience also proved to have a strong and consistent link with leadership, though not quite as strong as extraversion (Robbins et al., 2010). Contemporary studies show that emotional intelligence is also a trait that may indicate effective leadership (Robbins et. al., 2010). Champy (2003, p. 1) reinforces this by saying that the caring part of empathy "is what inspires people to stay with a leader when the going gets rough". Emotional intelligence is being viewed as a panacea for many organisational malaises with suggestions that it is essential for leadership effectiveness (Antonakis, 2003; Zeidner, Matthews, & Roberts, 2004).

According to Behavioural Theories, fashionable between the 1940s and 1960s, it was possible to teach leadership to anyone that wanted to be a leader (Robbins et. al., 2010). The Ohio State studies are the most comprehensive and replicated the leadership behaviour theory (Robbins et. al., 2010), as these researchers sought to identify two categories for the independent dimensions of leader behaviour: initiating structure and

consideration. Even though some researchers considered that the two-factor conceptualisation of leadership, behaviour was not able to predict effective leadership (Yulk & Van Fleet, 1992), some reviews of the studies made in this area suggest that both initiating structure and consideration were associated with effective leadership (Robbins et. al., 2010). Consideration was more strongly linked with the individual while initiating structure was more strongly linked with high levels of group/organisation productivity and positive performance evaluation.

The work developed at University of Michigan's Survey Research Centre wanted to identify behavioural attributes of leaders that could be linked to measures of performance effectiveness (Robbins et. al., 2010). They also discovered two aspects of leadership behaviour that they labelled 'employee-oriented' and 'production-oriented' (Kahn & Katz, 1960) and that are comparable to the ones found by Ohio State studies. Michigan researchers concluded that employee-oriented leaders were linked to higher team productivity and greater job satisfaction (Robbins et. al., 2010), and production-oriented leaders tended to be linked to low group productivity and lower job satisfaction (Robbins et. al., 2010). Blake and Mounton (1964) proposed a managerial grid, based on both Ohio State and University of Michigan studies, that included the styles "concern for people" and "concern for production", though the grid does not show results produced, rather it shows the dominating factors in a leader's thinking with regard to achieving results (Robbins et. al., 2010).

Predicting leadership success is more complicated than isolating a few traits or preferable behaviours (Robbins et. al., 2010) as situational conditions also play an important role. The Fiedler Contingency Model proposes that effective group performance varies with the proper match between the style of the leader and the level to which the situation gives power to the leader (Robbins et. al., 2010) and he goes on to consider an individual's basic leadership style, which is fixed, as a key factor in leadership success

(Robbins et. al., 2010). Fiedler argues that task-oriented leaders function better in situations of high and low power, while relationship-oriented leaders perform best in moderate control situations (House & Aditya, 1997). More recently Fiedler has reconceptualised his original theory and called it Cognitive Resource Theory as he concentrates on the role of stress as a form of situational unfavourableness and how the intelligence and experience of the leader influence his/her reaction to stress (Fiedler & Garcia, 1987).

Hersey and Blanchard (1974) have developed a leadership model called Situational Leadership Theory, a contingency theory that centres on the followers, advocating that successful leadership is achieved by selecting the right leadership style, which will depend on the level of readiness of the followers (Hersey & Blanchard, 1974; Hersey, Blanchard, & Johnson, 2001). Regardless of what the leader does, effectiveness will depend on the actions of the followers (Robbins et. al., 2010). The Path-Goal Theory was developed by House (House, 1971; House & Mitchell, 1974; House, 1996) who considered it to be part of the leader's job to supply followers with information, support or other resources necessary for them to achieve their goals. House (House, 1971; House & Mitchell, 1974; House, 1996) identified four leadership behaviours: directive leader, supportive leader, participatory leader and achievement-oriented leader.

The Leader-Member Exchange Theory argues that, as a result of time pressures the leader may establish a special relationship with a small group of members within the team (Liden, Wayne, & Stilwell, 1993; Liden, Sparrow, & Wayne, 1997; Schriesheim, Castro, Zhou, & Yammarino, 2001), that form part of the in-group, are trusted, receive the vast majority of the leader's time and attention, and are more likely to receive special privileges (Wayne, Shore, Bommer, & Tetrick, 2002; Masterson, Lewis, & Goldman, 2000). Remaining followers fall into the out-group, where they receive less of the leader's time, less preferential compensation, and have leader-follower relations based on approved

authority interactions (Wayne et al., 2002; Masterson et al., 2000). It is not clear how the leader selects who falls into each category, but there is evidence that leaders tend to favour in-group members because they have the same demographic, attitude, and personality characteristics as themselves, or hold higher qualifications than out-group members (Liden et al., 1993; Uhl-Bien, 2003).

Decision Theory argues, the way leaders make decisions is as important as what is decided (Vroom & Yetton, 1973; Vroom & Jago, 2007). Vroom and Yetton (1973) developed a leader-participation model that relates behaviour and participation to decision-making. This model was later reviewed (Vroom & Jago, 1988; Vroom & Jago, 1995), retained the same five alternative leadership styles but added a set of problem types and expanded the contingency variables to twelve. The leader-participation model focuses on the leader's role as decision-maker and considers how leaders make decisions (Robbins et. al., 2010).

Max Weber (1947, p. 241) defined charisma as "a certain quality of an individual personality, by virtue of which he or she is set apart from ordinary people and treated as endowed with supernatural, superhuman, or at least specifically exceptional powers or qualities. These are not accessible to the average person, but are regarded as of divine origin or as exemplary and, on the basis of them, the individual concerned is treated as a leader". Awamleh and Gardner (1999) related four characteristics of a charismatic leader: has a vision, is willing to take personal risks to achieve his/her vision, is sensitive to follower needs, and exhibits behaviour that is out of the ordinary.

Personality seems also to be linked to charismatic leadership, as charismatic leaders are expected to be extroverted, self-confident, and achievement-oriented (House & Howell, 1992; Den Hartog & Koopman, 2002). Some correlations have been found between charismatic leadership and high performance/satisfaction among followers (Waldman, Bass, & Yammarino, 1990; Kirkpatrick & Locke, 1996). But charisma seems

to be more advantageous when the follower's task has an ideological component or when the environment involves a high degree of stress and uncertainty (House, 1977; House & Aditya, 1997). Some researchers found that some people's personalities are especially susceptible to Charismatic Leadership (Cohen, Solomon, Maxfield, Psyzczynski, & Greenberg, 2004; Ehrhart & Klein, 2001), for instance individuals that lack self-esteem are more likely to absorb a leader's direction rather than establish their own way of thinking.

According to Bass (1985a), there are two distinct types of leadership: Transactional and Transformational, both of which effective leaders display to varying degrees (Bass & Avolio, 1993). Robbins et al. (2010) defines transactional leaders as the ones that guide or motivate their followers in the direction of established goals by clarifying role and task requirements. Transformational leaders are described as the ones that inspire followers to transcend their own self-interests for the good of the organisation and are capable of having a profound and extraordinary effect on their followers. Transactional and Transformational Leadership should not be seen as opposing approaches (Bass, 1985b; Seltzer & Bass, 1990), as the best leaders are both transactional and transformational (Robbins et. al., 2010).

Transformational Leadership is more firmly correlated with lower turnover, higher productivity, lower employee stress/burnout, and greater employee satisfaction than Transactional Leadership (Hetland, Sandal, & Johnsen, 2007; Lowe, Kroeck, & Sivasubramaniam, 1996). However, the mechanisms underlying these processes are not entirely clear (Bass, 1985b). Tremblay (2010) states that one mechanism by which transformational leaders may be able to build commitment among their subordinates is through fair treatment, while Bass (1985a) considers charisma to be an element of Transformational Leadership and claims that Transformational Leadership is broader than charisma (House & Podsakoff, 1994; Bass, 1985a). Although many investigators believe that Transformational Leadership is broader than Charismatic Leadership, studies show in

fact that a leader who scores highly on Transformational Leadership is also expected to score highly in charisma consequently, in practice, measures of charisma and Transformational Leadership may be roughly equivalent, according to Robbins et. al. (2010).

Traits can predict leadership, but seem to do a better job in predicting the rise of leaders and the appearance of leadership, than truly distinguishing between effective and ineffective leaders (Ames & Flynn, 2007; Lord, Vader, & Alliger, 1986; Smith & Foti, 1998). Leaders who have certain traits and who demonstrate consideration and structuring behaviours do appear to be more effective (Robbins et. al., 2010). None of the contingency theories proved to be accurate in predicting leader behaviour, as leadership is a symbiotic association between leaders and followers (Bennis, 2007). One limitation present in the traits, behavioural, and contingency theories is that they do not consider followers. According to the Leader-Member Exchange Theory, leaders invest their resources in those they expect to perform best (Eden, 1992), whereas the Decision Theory argues that the way the decision is made, is as important as what has been decided.

Leadership development is now part of the curricula in almost all HEIs, all over the world, with courses and activities scattered throughout the learning experience (Posner, 2004). Astin (1993) claims that it is important to strengthen young men and women during their college years to help them to mature into future leaders, especially because leadership development encompassing various activities, perspectives, and experiences enhances the ability to make a meaningful difference (Prosner, 2004). In spite of the inclusion of leadership development in most curricula, employers still consider graduate students ill-prepared in their teamwork and leadership skills (Casner-Lotto et al., 2006; Pavlin et al., 2009). This study will explore the role of facilitator/time-organiser in learning-teams, presenting some suggestions that might contribute to better understanding

teamwork in academia and thus, hopefully, result in a better level of employability for the students.

1.3.1. Relationship between teamwork and leadership.

The role of leadership in learning teams or problem-solving teams has not yet been clarified, as some investigators have found adverse effects of centralised leadership on performance (Durham, Knight, & Locke, 1997; Johnson et al., 2002; Kayes, 2004) if learning and/or problem solving is the goal, whereas others report that a leader or coordinator has positive results on team effectiveness (Henry & Stevens, 1999; Sivasubramaniam, Murry, Avolio, & Jung, 2002; Strijbos, Martens, Jochems, & Broers, 2004). Fransen considers that team leadership is not critical for effectiveness in learning teams, except when critical moments appear (e.g. fast-approaching deadlines). Shimazoe and Aldrich (2010) argue that the role of the leader is vital because they guide, monitor and frame group activities. Effects of leadership on team effectiveness are widely studied in research, in different surroundings, but the value of leadership in learning teams is questionable (Johnson et al., 2002; Kayes, 2004). Contingency theories of leadership indicate that the influence of team leadership may also depend on the type of team and task at hand (Rollinson et al., 1998).

Learning teams usually have a brief lifecycle and can be defined as democratic, as a consequence of equally distributed expertise (Fransen, 2012). Consequently, leadership in learning-teams will likely be of the coordinator-type, someone who is in charge of overseeing the team and task process (Fransen, 2012). All team members are expected to participate equally in the process of knowledge development, through discourse and negotiation, so that leadership is not critical in terms of merging and synchronising personal contributions and ensuring that members understand their interdependence (Rollinson et al., 1998). Leadership will probably emerge as collective leadership,

resulting in a learning team appointing some sort of coordinator (Sivasubramaniam et al., 2002).

Shifting the culture of an organisation requires senior leaders to change their behaviour and their interactional responses to one another and with the broader organisation (Jones, 2011). One mechanism by which leaders are able to facilitate commitment among their subordinates is by being trustworthy (Tremblay, 2010). Though trust helps explain the relationship between justice and commitment, there may be other processes that are likely to help further explain this relationship, such as subordinate characteristics (e.g., educational levels, gender; Lien-Tung, 2005) and organisational culture variables (e.g., individualism vs. collectivism; Tremblay, 2010). Based on the importance of leadership in fostering the development of employees, it makes sense to try to select and/or train leaders who are able to engender feelings of fair treatment (Tremblay, 2010). If leaders at all levels of the organisation are trained in the principles of justice, a climate of fair treatment might be created (Colquitt, Conlon, Wesson, Porter, & Ng, 2001) that may translate into higher levels of commitment and retention among the personnel (Tremblay, 2010).

The style of behaviour of the leader is an important factor that influences a group's effectiveness, in particular if the leader's styles of behaviour do not match the hopes of group members (Rollinson et al., 1998), but there are no universally applicable rules to help guide the commander of a group in selecting an appropriate form of behaviour. Some groups only work well under a democratic style of leadership, in which members have a degree of freedom to work with whom they choose, using the methods they favour and with some decision-making authority (Rollinson et al., 1998). An inappropriate style of leadership can result in so much resentment that an informal leader arises, one who is more capable of catering for the socio-emotive needs of group members (Bales, 1950). A more accurate predictive capability of leadership is valuable in improving group

performance (Robbins et. al., 2010). As Hogan, Curphy and Hogan (1994) stated in their complete review of leadership literature: leadership matters, it has not been proved but there are some investigations that explore the importance of the leader in the success of the teams, companies and nations.

1.4. Concept of personality

Gordon Allport produced the most frequently used concept of personality, he said personality is "the dynamic organisation within the individual of those psychophysical systems that determine his unique adjustments to his environment" (Allport, 1937, p. 48). Robbins et al. (2010) claims that personality should be considered as the sum total of ways in which an individual reacts to and interacts with others. The theories of both Allport (1937) and Robbins et. al. (2010) are based on the assumption that an individual's personality is relatively stable and unchanging.

Personality theories fall into two main groups: trait theories that describe individuals in terms of a number of personality dimensions, and type theories that categorise subjects as falling into one of a number of personality types (Rollinson et al., 1998). A number of early efforts tried to identify the primary traits that govern behaviour, however, for the most part, they produced long lists of traits that were hard to generalise from and provided little effective guidance to organisational decision makers, however there were two exceptions: Myers-Briggs Type Indicator, and the Big Five Model. Since the 1980's, these two approaches have become the dominant frameworks for identifying and classifying traits (Robbins et al., 2010).

The Myers-Briggs Type Indicator (MBTI) is the most widely used personality-assessment instrument in the world (Kennedy & Kennedy, 2004), it comprises a 100-question personality test with topics on how people usually feel or act in particular situations. Based on their answers, individuals are categorised as extraverted or introverted

(E or I), sensing or intuitive (S or N), thinking or feeling (T or F) and judging or perceiving (J or P), describing 16 personality types (Robbins et al., 2010). The MBTI is widely used in practice by worldwide organisations, hospitals, and educational institutions (Robbins et. al., 2010), but one of the major issues with this model is that it forces people into one type (that is, you are either sensing or intuitive), there is no in-between, though people can be both sensing and intuitive to some degree (Robbins et. al., 2010). MBTI can be a helpful tool for increasing self-awareness and providing career guidance (Robbins et. al., 2010).

An impressive body of research supports the thesis that five basic dimensions underlie all others and contain most of the significant variations in human personality (Digman, 1990). It began with Fiske (1949) and was later expanded upon by other researchers including Norman (1963), Goldberg (1981), McCrae, and Costa (1987). The Big Five factors are: extraversion, agreeableness, conscientiousness, emotional stability and openness (Matzler, Renzl, Muller, Herting, & Mooradian, 2008), also known as OCEAN (openness, conscientiousness, extraversion, agreeableness, neuroticism). The Big Five contain major dimensions of personality, although some personality researchers still argue that this list of principal traits is not exhaustive, and support has been found for two more factors: excellent/ordinary and evil/decent hence, no definitive conclusions have been established as yet (Santrock, 2008). McCrae and his team of investigators have also found that the Big Five traits are notably universal, as one research project that looked at people from more than 50 different cultures found out that the five dimensions could be accurately applied to describe personality, inferring that the five personality dimensions are not only universal, they may have biological origins (McCrae & Costa, 1987).

Psychologist David Buss (1995) proposed an evolutionary approach for these five core personality traits, implying that personality traits represent the most important qualities that shape our social landscape. The first instrument created to measure the Big

Five personality traits was the Revised NEO Personality Inventory, or NEO PI-R a 240-item measure, by Costa and McCrae, yet some years later the same authors created the NEO Five-Factor Inventory (NEO-FFI) reducing it to 60 questions (12 items per domain, Costa & McCrae, 1992). In the late 1980's, John, Donahue and Kentle (1991) created the Big Five Inventory with just 44 short-phrase items (also known as BFI-44). Additionally, there has been an accelerating trend towards having shorter and shorter personality instruments (Rammstedt & John, 2007) and researchers using BFI were asking for an even shorter version. Rammstedt and John (2007) developed the BFI-10, with just 10 items, 2 items per scale, showing acceptable reliability and validity.

1.4.1. Relationship between teamwork and personality.

Personality is commonly considered in team composition (Bell, 2007; Peeters, Van Tuijl, Rutte, & Reymen, 2006) and its measures are frequently useful because they can make a big contribution to new personnel recruitment decisions, while reducing the risk of adverse impact (Hough, Oswald, & Ployhart, 2001). In a mature group such matters should normally have been resolved as the team passes through its four stages of formation (Tuckman, 1965; Tuckman & Jensen, 1977), particularly the norming stage, in which individuals learn to accommodate each other. Individual differences are never completely absent and much can depend on how the leader of the group handles them (Rollinson et al., 1998).

Judge and Bono (2000) were the first to link Transformational Leadership with the Five-Factor model of personality (Costa & McCrae, 1992). The findings of Judge and Bono showed the predictive power of certain personality traits present in Transformational Leadership, suggesting the possible usage of the Big-Five personality traits to select transformational leaders (Shao & Webber, 2006). However, Ployhart, Lim, and Chan, (2001) extended the Judge and Bono research to Singapore and found that personality

constructs were not equally predictive of typical (will do) and maximum (can do) Transformational Leadership performance. Several academics in the world (Komarraju, Karau, & Schmeck, 2009; Noftle & Robins, 2007) analysed the role of the Big Five factors for predicting academic motivation, achievement, and attainment. Leung and Bozionelos (2004) examined the relationship between the Big Five personality traits and the prototypical picture of the effective leader in Confucian culture, as well as investigating the extent to which the prototypical notion of the effective leader was associated with the features of Transformational Leadership. Personality differences are inevitable and these can affect the cohesiveness of the group and ultimately its effectiveness if they are not handled sensitively.

Some researchers argue that teamwork is influenced by the social skills and personality characteristics of the team members (Baldwin, Bedell, & Johnson, 1997; Ellis et al., 2003; Halfhill, Nielson, Sundstrom, & Weilbaecher, 2005; Morgeson, Reider, & Campion, 2005) and that teams are more effective if members show commitment toward the group (i.e. the process) and towards the task (i.e. the product; Hirokawa, Cathcart, Samovar, & Henman, 2003). Reviews have suggested that personality traits hold weak overall relationships with team performance (Bell, 2007; Peeters et al., 2006), which appear to be related to the study setting. Personality characteristics theoretically form a proximal link to behavioural processes and a distal link to team outcomes (e.g., Driskell, Hogan, & Salas, 1987).

Stable characteristics of the individuals involved will influence knowledge sharing (Matzler et al., 2008) and critical behaviour in teamwork effectiveness. Team members or team leaders who score highly on agreeableness, openness, and conscientiousness are more willing to engage in sharing knowledge (Matzler et al., 2008). Critical knowledge is created within certain teams, which can then be shared. The ability to share knowledge depends on its own intrinsic properties, which influence how easily it can be shared and

accumulated, how much/where it is retained/stored and how easily it flows within/across an organisation (Argote, McEvily, & Reagans, 2003). As a consequence, management can compose teams or assign documentation according to these personality characteristics, or even share roles accordingly within the teams. The theory and results shown in this study may also support managers in identifying potential boundary spanners (e.g., Wenger, 2000) and, similarly, to identify others reluctant to share knowledge, which would influence knowledge sharing within and across teams (Matzler et al., 2008).

Some of the most popular criticisms of Trait Theory is centred on the fact that traits are often poor predictors of behaviour, while an individual may score highly on a specific trait, he/she may not always behave in that way in every circumstance. Another puzzle is that Trait Theories do not approach how or why individual differences in personality develop or emerge (Robbins et. al., 2010), but it has been revealed that teamwork is impacted by the social skills and personality characteristics of the team members.

1.5. Prediction of teamwork effectiveness

Learning teams are effective to the degree that learners intend to achieve learning goals, as their aim is to learn while working on a problem, a project and/or task (Fransen, 2012). Work teams, alternatively, are effective when they appropriately use their distributed expertise to effectively perform as a team and successfully finish a given task (Fransen, 2012), although learning may occur as a secondary product of this collaboration. Many employers even see this as an extra benefit of working in teams (Kayes, Kayes, & Kolb, 2005; Sessa & London, 2007). The variables mediating learning team effectiveness differ from variables mediating work team effectiveness while variables mediating effectiveness in both contexts may differ in their influence. The requirement to work more productively in teams is increasing exponentially (Burbach et al., 2010), and there are

many research studies on teamwork and team effectiveness, although mostly related to production teams or task groups in companies (Hackman, 1990; Halfhill et al., 2005; Shea & Guzzo, 1987; Stewart & Barrick, 2000).

Team commitment and team effectiveness are enhanced when positive interdependence is high, as the job is well done if team members adequately participate in the process and cooperate with each other (Katz-Navon & Erez, 2005). Fransen has shown that becoming effective, as a learning team is not something that just happens, even for university students who already have experience in collaborating in teams within organisational settings. It confirms that team skills are highly team/task-specific and can only be partly transferred when the team members are assigned to a new team (Prichard, Bizo, & Stratford, 2006). Students in learning teams need support at the early stages of teamwork to become fully aware of the importance of developing task-related and team-related skills to be effective as a team (Fransen, 2012).

Hackman's definition of group effectiveness distinguishes group performance, the satisfaction of the needs of individual team members, and the ability of a group to exist over time. It refers to the quality of team performance (effectiveness at the team level that incorporates quality of the product and the process), and the perceived satisfaction of individual needs (team member satisfaction). It also highlights that team goals and individual goals ought to merge or, at least, should be well balanced, if the team intends to be effective (Kasl, Marsick, & Dechant, 1997). In learning teams, the ability of a group to exist over time is not particularly relevant, however it could be evaluated by the willingness of the team members to collaborate again within the same group. Alternatively, Salomon and Globerson (1989) consider that learning teams that collaborate with the shared purpose of accumulating knowledge and achieving conceptual shifts are effective, ignoring the satisfaction of member's needs or the influence of social skills and personality characteristics.

Team effectiveness also depends on other circumstances such as team formation, team members' abilities and characteristics, role assignment within a team, decision-making approaches, team leadership, and interdependency (Fransen, 2012). Robbins et al. (2010) connects group performance with role perception, norms, status differences, size of the group and cohesiveness. A meta-analysis on the impact of conflicts within a team has revealed that both task and team conflicts negatively affect performance (De Dreu & Weingart, 2003). This study showed that task and relationship conflicts are strongly correlated in teams containing low levels of mutual trust, which creates minor conflicts on a cognitive level (considered conditional for collaborative learning, De Dreu & Weingart, 2003). Teams, especially *ad-hoc* learning teams, are often initially ineffective because team members lack necessary information about each other's competencies and do not exhibit mutual trust, having not experienced each other's behaviour in a team situation (Lewicki & Bunker, 1996).

The definitions of effective learning teams vary from 'establishing a joint problem-space as a team' to 'goal attainment with respect to the quality standards of the organisation and satisfaction of team member needs' (Fransen, 2012). Studies on effectiveness of learning teams often focus on one or more of these viewpoints and their possible effects on learning team performance (Barron, 2003; Fleming & Monda-Amaya, 2001; Rulke & Galaskiewics, 2000; Salomon & Globerson, 1989). Team effectiveness influences the quality of learning outcomes (Salomon & Globerson, 1989) and therefore is a function of the quality of a team's performance and the perceived fulfilment of the individual team members' needs (Hackman, 1990). Furthermore, team effectiveness can be influenced by the learning style or cognitive ability of the team members (Alfonseca, Carro, Martín, Ortigosa, & Paredes, 2006; Webb & Palincsar, 1996), decision-making style and intra-group interaction (Hirokawa et al., 2003), and leadership or role assignment within the teams (Johnson et al., 2002; Strijbos et al., 2004).

There are several different models that attempt to explain teamwork effectiveness. The use of collaborative learning is regularly based upon the social-constructivist paradigm that collaborative learners should be implicated in the processes of knowledge construction in order to gain profound learning, understanding and conceptual change, through discussion, debate and argumentation (Bereiter, 2002; Bruffee, 1993; Geelan, 1997; Smith, 2002; Hmelo-Silver, Chernobilsky, & Jordan, 2008). In order to achieve meaningful participation in knowledge construction activities a learner has to rely on built-in interdependency when working with conceptual artefacts (Blumenfeld et al., 1996). Research on work teams in organisational environments considers multiple perspectives of work team effectiveness such as speed, performance, accuracy, inventiveness, as well as attitudinal, and behavioural indicators within the input-process-output perspective (Bachmann, 2006). It is mostly related to long-term production teams or task groups in organisations focused on task-specific teamwork, relationships between teams and their companies, aspects of team leadership and effects of environmental features on team effectiveness (Hackman, 1990; Stewart & Barrick, 2000). With regard to these investigations, effective teams are described in terms of quality of the results with respect to organisational norms and satisfaction of the members' needs (Fransen, 2012). Cognitive skills of team members appear to positively influence team learning (Ellis et al., 2003), but learning teams "usually are not composed on the basis of differences in the cognitive ability of the students" (Fransen, 2012, p. 50). The fact that learning strategies are set and made operational in several ways complicates the process of clustering learners for collaborative learning practices (Sadler-Smith, 1997). Saavedra and Van Dyne (1999) found that team effectiveness is influenced by the emotional investment through social interaction, but too much emotional trade may lead to less effective groups as a result of closing the range of admitted ideas (Guzzo & Waters, 1982).

Two models related to team effectiveness are considered in this research, namely the TEAM model (Morgan et al., 1993) and the Big Five in Teamwork (Salas et al., 2005). In 2012, Fransen made public the Team Collaboration Evaluator, a framework developed to understand which variables mediate learning team effectiveness.

1.5.1. Team Evolution and Maturation model (TEAM).

The Team Evolution and Maturation model (TEAM), according to Fransen, is the most appropriate for describing the series of developmental stages through which newly formed, task-oriented learning teams are thought to evolve (Morgan et al., 1993). This model is an attempt to join existing theories into one team-development model, including Tuckman's stages model (Tuckman & Jensen, 1977) and Gersick's punctuated equilibrium model (Gersick, 1988). In addition, some of the ideas from Bales and Strodtbeck's (1951) work, specifically the issue of group development as being task related and socio-emotional, can also be seen in this model.

The periods of development, referred to as stages rather than phases, are considered to be relatively informal, indistinct, and overlapping, because sharp demarcations are not often characteristic of the dynamic situations in which operational teams work and develop (Morgan et al., 1993). These researchers postulated that different teams might begin a given period of development at different stages and spend different amounts of time in the various stages as teams are not always expected to progress in a linear fashion through all of the periods (Morgan et al., 1993). This model identifies a total of nine steps, seven core ones supplemented by an additional two. The seven central stages are forming, storming, norming, performing-I, reforming, performing-II and conforming. TEAM also identifies a pre-forming stage, where the environment constraints to forming the group are considered, as well as the de-formation that takes place after the team serves its purpose, where individuals exit the group, it loses its identity and ceases to exist. The

forming stage is the first one, encompassing the period where the team gets to know each other and the tasks, secondly storming is the phase when the roles and position of the team members are established, thirdly a consensus on goals and strategies is reached in the norming stage, fourthly we have performing-I and the attempt to reach to conclusions and delivering results, followed by a stage of reforming where the team achieves conclusions and results are analysed and discussed, leading to a perform-II period, where revised conclusions and results are set. The last central stage, conforming, is where the work is finished and some adjustments within the team may take place.

An interesting idea proposed by this model is that groups develop, within the seven steps, along two separate paths (Smith, 2001), one task-related and another team-related. The first path at the top of the chart indicates that groups must understand the task that they were asked to complete. This trail is specifically concerned with group or team members learning the skills, their ability to obtain the knowledge, and the ability to complete the task (Smith, 2001). The second path is concerned with the specific interactions that occur among team members. These are called teamwork skills because "they deal with issues relating to the interactions among team members and relationships that exist among the members" (Smith, 2001, p. 36). This can also be addressed as the group effort towards team building. Figure 1 displays both trails.

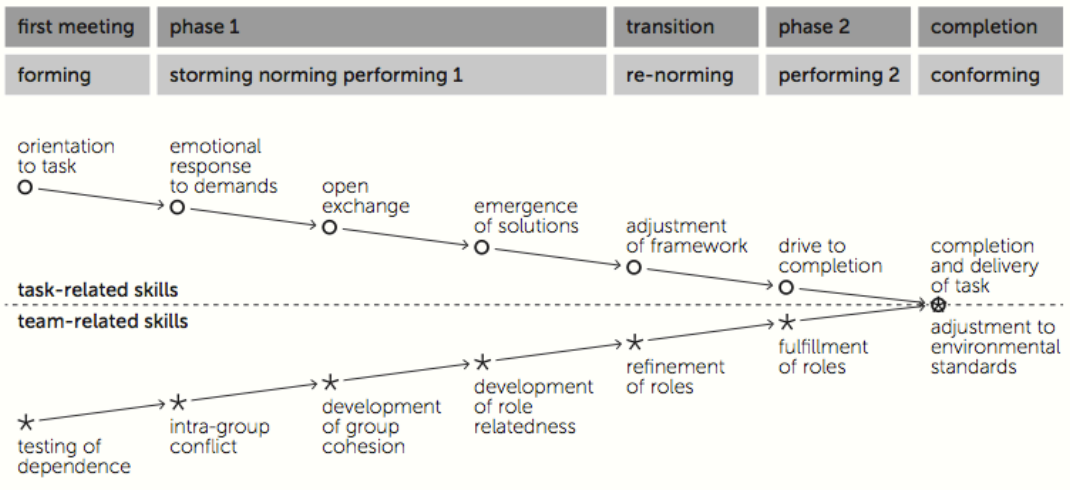

Figure 1. TEAM model (retrieved from Fransen, 2012)

Morgan et al.'s model also indicates two other possibilities for groups as they develop. One of them is the ability of the group to recycle through various phases, this means that the group can return to issues that have been resolved previously, and correct or make adjustments based on new knowledge acquired. The other possibility is, as the group members become more competent both in task-related and team-related issues, the two sets of skills may become more overlapped and even merge.

1.5.2. The Big Five in Teamwork.

The best-known framework for teamwork – The Big Five in Teamwork – is based on a meta-analysis of investigation on team effectiveness in organisational settings (Salas et al., 2005). Salas et al. (2005) established five key factors mediating team performance and effectiveness and three coordinating and supporting mechanisms, which are to some extent applicable to learning teams in educational settings. The coordinating and supporting mechanisms are mutual trust, shared mental models, and closed loop communication, and the factors are team orientation, team leadership, mutual performance monitoring, back-up behaviour, and adaptability. The coordinating mechanisms are

distinguished from the factors (i.e. behavioural components), the first being conditional for updating the last (Fransen, 2012).

Mutual trust implies the joint perception that individuals in the team will perform the actions that are significant to its members and will preserve the rights and concerns of all team members (Salas et al., 2005). Without adequate mutual trust, team members spend too much time and energy protecting their interests, checking and inspecting each other's behaviours and not enough time constructively collaborating (Peterson & Behfar, 2003). Investigation proves that virtual teams can also develop the same degree of confidence as face-to-face teams, but that they take more time to build this confidence (Jarvenpaa & Leidner, 1998). Virtual teams, however, seem to develop cognition-based trust faster than face-to-face teams (Wilson, Strauss, & McEvily, 2006), and the presence of sudden trust (for instance, based on background and recommendations of team members) in an early stage is a predictor of great performance (Kanawattanachai & Yoo, 2002).

Developing a shared understanding in a team (Derry, DuRussel, & O'Donnell, 1998) is essential to setting team goals, deciding on strategies, allocating subtasks, monitoring team processes adequately and communicating effectively (Klimoski & Mohammed, 1994; Van den Bossche, 2006). Team members develop these harmonious mental models in a process of negotiating and interrelating the diverse views of each member (Akkerman et al., 2007). Each team member's mental model should be adequately similar to the others to allow for easier management and achievement of team goals. But these mental models should not be too similar otherwise they will lack the input from different perspectives, which is the quality that improves team decision-making quality and performance (Kellermanns et al., 2008). Different researchers use different titles with respect to shared understanding, thus a distinction has to be made between mental models that are team-related, focusing on awareness of team functioning and expected behaviours of the team and of its individual members, and those that are task-

related, requiring information about the materials and strategies needed to successfully carry out tasks (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000).

Learning teams, as well as work teams, need to start by developing team-related and task-related mental models in early stages of collaboration to become more productive and deliver results. Even though they are seen to act pragmatically, learning teams tend to focus on task-related mental models and being efficient as *ad-hoc* short-term teams, as well as the need for completing assignments on time (Hsu, Chen, Chiu, & Ju, 2007). Student learning teams differ from work teams with respect to the ability to develop an elaborate mental model of the final outcomes, this is due to the fact that students are not experts in the field and have similar mental models, as a study conducted by Chiocchio and Essiembre (2009) about team ability, team heterogeneity, and team performance showed.

Communication enables teams to share their mental models and engage in activities regarding task execution, monitoring the process, and adapting to varying conditions (Salas et al., 2005). Closed-loop communication entails the ability of a team to exchange information, acknowledge its receipt, and give feedback (Kirschner, Beers, Boshuizen, & Gijselaers, 2008). Often we can find open-loop communication where information, reception and correct understanding of this information cannot be confirmed (Gillard & Johansen, 2004). Centralised communication is enough when the task is simple, but when the task is complex, teams benefit from all team members participating in decentralised communication (Leavitt, 1951; Shaw, 1954).

Team orientation implies both a preference for working with others as well as a tendency to enhance individual achievement through coordination of individual actions with other team members while performing group tasks (Salas et al., 2005). Team orientation facilitates decision-making and cooperation/coordination amidst team members, which results in augmented team performance (Eby & Dobbins, 1997), but it is

attitudinal and a result of team members' personal beliefs towards teamwork and, therefore, depends on a team's composition (Fransen, 2012). Learning teams contrast with work teams in the sense that members are supposed to learn together, but assessment is frequently individual, which may inhibit learning (Underwood, 2003) and students tend to do whatever the teacher asks, moreover in educational contexts, professors frequently decide on team formation, choice of assignments and reward system, thereby influencing team orientation (Fransen, 2012). Team formation based on learner attributes, such as learning strategies, have been shown ineffective, while forming heterogeneous ability groups appears to affect team orientation, as low and high-ability individuals perform equally well (Webb & Palincsar, 1996).

Some authors mention a resistance in students to work in teams due to multiple negative experiences in past collaborative learning experiences, but the professor can positively influence orientation by giving a clear purpose of the work, matching team size to the pedagogical objectives, maximising team longevity, giving students a say in team assignments, highlighting the value of each members' contributions, implementing specific forms of peer-assessment such as peer-rating, and actively supporting team evolution and the process of teamwork (Bacon, Stewart, & Silver, 1999; Felder & Brent, 2001).

Effects of team leadership on team effectiveness have been extensively studied in different settings and contexts (Cummings & Cross, 2003; Ferrante, Green, & Forster, 2006; Hackman, 1990; Nembhard & Edmondson, 2006). The effect of team leadership depends on the type of team and task at hand, as Hannah, Uhl-Bien, Avolio, and Cavarretta (2009) say that directive leadership will benefit the long-term teams composed of members with particular expertise to execute subtasks within the overall task. On the other hand, Alimo-Metcalfe and Alban-Metcalfe (2001) say that short-term units dealing with problems that require new creative solutions will profit most from transformational

leadership. A meta-analysis on the relationship between team member satisfaction and leadership style revealed that teams prefer democratic leadership instead of autocratic leadership (Foels, Driskell, Mullen, & Salas, 2000). Yet the effect on member satisfaction is moderated by team dimension and team composition (Foels et al., 2000). Learning teams tend to profit from shared leadership for effective learning (Johnson et al., 2002), given that inequality in participation levels does not get locked-in as a result of dominant members' proposals/contributions (Kapur, Voiklis, & Kinzer, 2008). Teams that depend too much on directive leadership usually learn less due to limited discussion (Durham et al., 1997). Learning teams regularly have a brief lifecycle and are frequently supposed to promote equal participation, which implies that team leadership may be less prominent for a learning team's effectiveness, except when crucial moments arise (Johnson et al., 2002). Hogg, Abrams, Otten, and Hinkle (2004), for example, found that in a stressful situation, a team assesses its performance at that point in time and adapts its strategies to deliver a timely result. This adaptation may include redistribution of subtasks and roles, regularly resulting in the emergence of a type of centralised leadership (Hogg et al., 2004).

Mutual performance monitoring implies tracking the work of one's fellow team members at the same time as carrying out one's own work (Salas et al., 2005). The more complex a task (Kirschner, 2002), the more critical mutual performance monitoring is and, in crucial moments it may condition the team's achievement (Porter, Gogus, & Chien-Feng Yu, 2010). Although studies on role assignment in a team (i.e. by a professor or the team itself) are still limited, investigation on assigned or acquired roles has been shown to affect perceived team efficiency by improving awareness of group interaction and collaboration (Weinberger, 2011). Consequently, role assignment within learning teams may promote and support effective mutual performance monitoring (Kollar, Fischer, & Hesse, 2006; Schellens, Van Keer, De Wever, & Valcke, 2007; Strijbos, Martens,

Jochems, & Broers, 2007). Also, with regard to role distribution, balanced teams show more efficient and effective interaction than non-balanced teams (Roberts & Nason, 2004).

Back-up behaviour is the ability to anticipate other team members' needs through solid knowledge of their duties and to shift the workload among members to achieve steadiness during periods of high workload or pressure (Salas et al., 2005). Back up behaviour is distinguishable from 'helping' in the sense that back-up behaviour is a response to the assessment of a genuine need for assistance (Porter et al., 2010; Porter, Hollenbeck, Ilgen, Ellis, West, & Moon, 2003). Adaptability is the capacity of a person or a group to adapt strategies through back up behaviour and a reallocation of intra-team resources, or by changing a course of action in response to switching internal and external conditions (Salas et al., 2005). Adapting to new situations requires both the presence of mutual performance monitoring and shared mental models, in particular an extensive mental model of the final outcomes (Chiocchio & Essiembre, 2009). Awareness tools may enable learners to analyse their interactions and thus promote, self-regulate, and adapt their behaviour. The Big Five is important only if the collective task requires the commitment and participation of all team members, which means that team members must be deeply interdependent (Wageman, 1995). In a truly collaborative task, interdependence is inevitable, as the task can only be successfully completed if team members depend on each other.

1.5.3. Team Collaboration Evaluator (TCE).

The conceptual framework for the Team Collaboration Evaluator (TCE) was developed by Fransen to establish which variables mediate learning team effectiveness and in what way. As a dependent variable in the framework, team effectiveness includes the quality of the team's performance and the perceived satisfaction of individual team members' needs (Fransen, 2012). In the complete conceptual framework, the variables

interfering in team effectiveness are presented within the perspective of team development and the phases of teamwork, which was derived from the TEAM model of group development (Morgan et al., 1993) as these variables differ according to the phase of teamwork (Fransen, 2012). According to Fransen, the research with the TCE needs to be replicated in various learning practices in the context of higher education to confirm the findings and also to further explore and explain the relationship between these variables and the development of learning teams towards effectiveness.

Despite the popularity of the Big Five model, the importance of these variables facilitating team effectiveness for educational contexts seems not to yet have been systematically investigated. Team orientation of the members of effective learning teams seems to be strong, probably as a result of team members regularly meeting informally to socialise (Fransen, 2012). This may result in swiftly developing initial trust that is likely to be conditional for developing shared mental models, and it may especially support the development of a team-related shared mental model (Fransen, 2012). Therefore, socialising during the informal team meetings may compensate for more than being predominantly task-oriented during formal team meetings (Fransen, 2012). Results have proved the importance of shared mental models and, to some degree, mutual performance monitoring, for a learning team to become effective (Fransen, 2012). As Fransen (2012) stated, team leadership will influence team effectiveness, and the personality of team members is also an influential factor to consider when looking at team performance.

1.5.4. Influence of leadership on team collaboration.

The role of leadership in learning teams or problem-solving teams is still unclear, as some investigators have found negative effects of leadership on team performance if the goal is learning and/or problem solving (Cummings & Cross, 2003; Durham et al., 1997; Johnson et al., 2002; Kayes, 2004), yet others describe positive effects on team efficiency

in teams which have a coordinator or planner (Henry & Stevens, 1999; Sivasubramaniam et al., 2002; Strijbos et al., 2004). Nevertheless, leadership seem to play a central part in understanding group behaviour, for it is the leader who regularly provides the direction toward goal attainment (Robbins et. al., 2010). Effective learning teams usually do not need team leadership, they only require some coordination, nevertheless the distribution of roles and inequality of participation, are frequently relevant issues in collaborative learning practices, which could be approached by assigning roles (Fransen, 2012).

Role division and subtask allocation should be based on skill distribution within the team. Leadership is usually reserved for the most skilled and committed team player, accepted by all members in the team (Fransen, 2012). This type of leadership is comparable to emergent leadership (Heckman, Crowston, & Misiolek, 2007), which grows based upon the need for the reinforcement, creation and on-going evolution of team structures that guide the efforts of team members. In teams without adequate initial trust, shared mental models, and skills-based role distribution, leadership is not likely to emerge, but presumably is needed given inferior team performance, loss of team orientation and motivation of team members (Fransen, 2012). Such a team will opt for leadership that is less democratic/more centralised to deal with the demanding situation (Hogg et al., 2004), while this leadership also needs the leader to be a mediator to effectively solve team conflicts (Rupprecht, Strasser, Gruber, & Harteis, 2010). Emergent leaders can be successful if mutual trust is assured and shared mental models are well developed. These individuals will democratically lead the team through a transition phase and a second performance stage by reinforcing team cohesion and transforming task accomplishment to speed up team performance and meet a pre-set deadline (Fransen, 2012). The assignment of functional roles to team participants tends to enhance effectiveness of learning teams (Strijbos et al., 2004), for selected teams, randomly formed groups, and student-led teams (Wang & Lin, 2007).

Burbach et al. studied the influence of having trained faculty to supervise teamwork and concluded that when professors employ research-supported classroom-based pedagogies of teamwork, the team effectiveness increases. So, students and ultimately employers will profit from taking on professors who are known to practice research-supported pedagogies of teamwork (Burbach et al., 2010).

Tabernero et al. (2009) discovered that task-oriented leaders caused higher group efficacy and positivism amongst members of the group, while in contrast relationship-oriented leaders cause greater cohesion between the members of the group. Research has shown that fairness perceptions play an important mediating role in the relationship between trust and consideration for the leader (Korsgaard, Schweiger, & Sapienza, 1995). Tremblay (2010) said that transformational leaders could influence commitment and turnover by positively enhancing the perceptions of justice and trust in the subordinates, but there may be other processes that could further explain this relationship, such as subordinate characteristics (Lien-Tung, 2005) and organisational culture variables.

1.5.5. Influence of personality on team collaboration.

Team effectiveness can be somewhat foretold by the team members' social skills and personality attributes (Baldwin et al., 1997; Ellis et al., 2003; Halfhill et al., 2005; Morgeson et al., 2005) and groups could be more effective if team members show dedication toward the team (i.e. the process) and the task (i.e. the product; Hirokawa et al., 2003). Myers et al. (2009) developed a study to examine whether college students' perceptions of the positive and negative proprieties of teamwork were associated with their tolerance level for ambiguity, for disagreement, conversational sensitivity, and cognitive flexibility. They concluded that students' observations of the positive traits of group work were correlated positively with tolerance for ambiguity, tolerance for disagreement, conversational sensitivity and cognitive flexibility (Myers et al., 2009),

however, students' attitudes towards the negative attributes of group correlated positively with conversational sensitivity (Myers et al., 2009).

Prewett et al. (2009) during the meta-analysis of the relationship between team members' personality and performance revealed that personality appears more closely associated with team process and behaviour than with team outcomes. Halfhill et al. (2005) looked for a connection between the personality of the group members and their performance and discovered that group performance was inversely related to group levels of variation for agreeableness, but not for variance of conscientiousness, as groups rated highly in both conscientiousness and agreeableness received better performance ratings than groups with all other compositions, suggesting a possible synergy of group personality composition with complementary traits.

1.6. Teamwork at the University of Madeira, a new approach

Some authors report a reluctance in students to work in teams due to negative experiences in past collaborative team experiences (Bacon et al., 1999; Felder & Brent, 2001). However, there is a growing need for teamwork in the workplace (McCorkle et al., 1999; McKinney & Graham-Buxton, 1993) and employers are considering graduate students ill- prepared to fulfil company needs, especially in the abilities related to the personal proficiency competence cluster (Pavlin et al., 2009). Yet, researchers argue that professors at higher educational institutions can positively influence orientation in teamwork by giving a clear outline of the work, matching team size to the pedagogical objectives, maximising team longevity, giving students a say in team assignments, highlighting the value of each team member's contributions, implementing specific forms of peer-assessment, such as peer-rating, and actively supporting team evolution and the process of teamwork (Bacon et al., 1999; Felder & Brent, 2001).

Vast problems can be found in individuals working in teams (Hackman, 1990), but HEIs and employers both agree that universities play an important role in improving the personal proficiency competence cluster of their students (Pavlin et al., 2009). Team Collaboration Evaluator (TCE), developed by Fransen, is a recent instrument to assess perceived team collaboration levels developed in learning teams. However, it still needs to go through more applications to gauge its accuracy. Some researchers report positive effects of having a leader or coordinator in the team (Henry & Stevens, 1999; Sivasubramaniam et al., 2002; Strijbos et al., 2004).

It seems that the model of having a facilitator/time-organiser in the learning teams works for some students, as was learnt by empirical observation and student feedback by the researcher. In todays job market the tasks are organised by projects in interdisciplinary teams (Nunes & Costa, 2005), thus students should have in the HEI experiences of working in teams, with individuals from different background. Therefore, it is relevant to study how different scientific areas perceive team collaboration. Some researchers argue that teamwork is influenced by the social skills and personality characteristics of the team members (Baldwin et al., 1997; Ellis et al., 2003; Halfhill et al., 2005; Morgeson, Reider, & Campion, 2005; Myers et al., 2009), but there is no consensus about its effects (Durham, Knight, & Locke, 1997; Johnson et al., 2002; Kayes, 2004; Henry & Stevens, 1999; Sivasubramaniam et al., 2002; Strijbos et al., 2004).

As a result of this problematic, the main research question for this work was defined as: Do the Computer Science and Psychology bachelor students, from the University of Madeira, perceived learning team collaboration differently? Are these perceptions associated with their sociodemographic and/or team characteristics?

The majors of Computer Science and Psychology were chosen in order to include in the experiment one class of students from the exact sciences/engineering field and

another from the humanities scientific field. The students are from the University of Madeira.

The main research question was developed into nine hypotheses:

H1. The perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) can be positively associated with the scientific field that students are from.

H2. The perception of team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) can be higher at the end of the semester.

H3. The perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) can be positively associated with the personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the time-organisers.

H4. The perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) can be significantly correlated with the personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the non-time-organisers.

H5. Time-organisers perceive team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) more positively than non-time-organisers.

H6. The time-organiser selection method may foresee the perceived teamwork effectiveness (perceived team effectiveness, final project grade), at the end of the semester.

H7. Older students have higher perceived team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) than younger students.

H8. Male students have higher perceived team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) than female students.

H9. The perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) is significantly correlated with the size of the team.

This work will test an alternative hypothesis when compared to the investigation done by Fransen (2012), as one of its goals is to explore how leadership and personality traits might affect the perceived teamwork result in two different scientific fields. Furthermore, Fransen studied the team collaboration with students in Netherlands, while this study will be done with students from the University of Madeira.

2. Method

2. Method

This chapter describes the method employed to collect data to test the hypothesis previously mentioned and presents the research plan. The goal of this research is to explore how teamwork done at HEIs can help students improve their personal proficiency competency cluster, specifically the research aims to empirically explore the perception of teamwork from two classes of students, in a pre- and post-test assessment, and explore connections between teamwork and personality traits.

A study was designed to assess teamwork collaboration of the students at the University of Madeira, specifically the connection with personality and team characteristics, based on Fransen's work under his doctoral dissertation (Fransen, 2012). Surveys are essentially cross-sectional and may be used to identify the characteristics of individuals and groups at different points in time, using longitudinal methods. We used a self-reported paper-and-pencil-based questionnaire to collect data, to ensure that all subjects were asked the same question in the same way, at the same time, and to give some protection against the bias that an interviewer could inadvertently introduce.

A convenience sample was chosen, comprised of one class of third year Computer Science bachelor students and a second year class of Psychology bachelor students. In order to have the subjects as close as possible to their natural context, the experiment was done as part of a class project in a mandatory course. Bearing in mind that the goal of the study is to evaluate team collaboration between students at the University of Madeira, the selected instruments were the Team Collaboration Evaluator (TCE, Fransen, 2012) to weigh team collaboration and the Big Five Inventory (BFI-10, Rammstedt & John, 2007)

to self-assess personality, one of the independent variables. Some qualitative questions were included in the survey so as to understand the team characteristics and to collect sociodemographic information.

2.1. Participants

This study involved 112 students, 59 students enrolled in the Artificial Intelligence Course, in the Computer Science (CS) major, and 53 enrolled in Cognitive Psychology Course, in the Psychology (Psy) major. Only 49 students from Computer Science and 50 students from Psychology replied to the questionnaire. The remaining students (n = 10 in Computer Science and n = 4 in Psychology) dropped out of the course for reasons not connected to the experiment. Students were informed previously about the goals of this experiment and had agreed to take part.

Of the 99 effective participants, 46 (46.5%) were female and 53 (53.5%) were male. Computer Science had 7 (14.3%) female students and 42 (85.7%) males. Psychology had 39 (78%) females and 11 (22%) male students (see Table 2).

Table 2

Gender distribution of the sample

	Computer Science		Psychology		Total
Gender	*n*	%	*n*	%	*N*
Male	42	85.7	11	22.0	53
Female	7	14.3	39	78.0	46
Total	49	100.0	50	100.0	99

When replying to the survey, students were asked to respond to a question related to their age classifying it in one of the available classes (20 years old or less; 21 to 25

years old; 26 to 30 years old; 31 to 35 years old; 36 to 40 years old; 41 to 45 years old; 46 to 50 years old; 51 to 55 years old; 56 to 60 years old; or over 60 years old). In this sample 82 (82.8%) students were 25 years old or younger (49.5% were 20 years old or younger, 33.3% were 21 to 25 years old). Computer Science students tended to be older (42.9% of the students were 21 to 25 years old *versus* 62% of the students who were 20 years old or younger in Psychology), but the oldest student, age 46-50, is a Psychology student (see Table 3).

To explore the age associations, a *Pearson's chi-square* test was made, revealing that there is a statistically significant possibility that Computer Science students are older than Psychology students (X^2 (2) = 6.423, p = .05). However, it has to be taken into consideration that Computer Science students are in the third year and Psychology students are in the second year.

Table 3

Age distribution on the sample

	CS		Psy		Total
Age	*n*	%	*n*	%	*N*
20 years old or less	18	36.7	31	62.0	49
21 to 25 years old	21	42.9	12	24.0	33
26 to 30 years old	8	16.3	2	4.0	10
31 to 35 years old	1	2.0	1	2.0	2
36 to 40 years old			1	2.0	1
41 to 45 years old	1	2.0	2	4.0	3
46 to 50 years old			1	2.0	1
Total	49	100.0	50	100.0	99

To explore the differences between younger and older students, the age ranges were combined into three groups. The younger group contained students of 20 years old or younger (n = 49), the middle group consisted of students from 21 to 25 years old (n = 33)

and the older group was made up of students who were older than 25 years (n = 17, see Table 4).

Table 4

Age distribution by groups

Age	*N*	%
Up to 20 years old	49	49.5
From 21 to 25 years old	33	33.3
More than 25 years old	17	17.2
Total	99	100.0

Professors asked the students to freely form the teams, specifying that there must be a minimum of 4 and a maximum of 8 members in each team. In consequence, individuals were split into a total of 17 groups, with 4-8 elements each (M = 5.79, SD = .89). Psychology students were shown to have bigger teams (M = 6.46, SD = .80, see Table 5).

Table 5

Breakdown of teams

		Elements in each team		
Major	Number of teams	*M*	*SD*	*Min-Max*
CS	9	5.1	0.37	4-6
Psy	8	6.46	0.8	5-8
Total	17	5.79	0.89	4-8

To explore the perceived influence of having a facilitator in the team, individuals were asked to formally appoint a time-organiser among them, using the selection method

that they agreed on as a team. Before the selection of the time-organiser, the professor explained the responsibilities of the time-organiser, which comprised of: being in charge of the coordination of the team and the teamwork; organising the tasks to be executed by the team members; controlling deadlines for the tasks; supervising the teammates; controlling the quality of the outcomes; dealing with the problems that may arise within the group; and acting as representative of the team before the professor. The words leader and chief were deliberately avoided, so the team could create their own dynamics around the time-organiser without the influence of pre-conceived ideas. Professors reported that during the semester some students had questions about the time-organiser duties, which the professors clarified during class, either in whole class discussions or smaller group discussions.

A total of 17 time-organisers were appointed, comprising six females (35.3%) and 11 males (64.7%). Female students are in the majority in Psychology major, but only five of them were selected to be time-organisers, indicating a low percentage of female time-organisers (63%) compared to the percentage of females in the class (78%). Women are a minority in Computer Science and just one of them was selected to be time-organiser, showing again a low percentage of female time-organisers (11%), when comparing to the total of females in the class (14%).

The age of the time-organisers varied from 20 years old or younger (n = 7), up to 41 to 45 years old (n = 1, see table 6). There were a total of six females who assumed the role of time-organiser and 5 (83.3%) of them were 20 years old or younger. The Psychology time-organisers were either 20 years old or younger (n = 6, 75%) or more than 35 years old (n = 2, 25%), whereas the Computer Science time-organisers were all under 30 years old (see Table 6).

Table 6

Age characterisation of the time-organisers

				Age				
Major	Gender	*N*	%	20 years old or less	21 to 25 years old	26 to 30 years old	36 to 40 years old	41 to 45 years old
Computer Science		9	52.9	1	5	3		
	M	8	88.9	1	4	3		
	F	1	11.1		1			
Psychology		8	47.1	6			1	1
	M	3	37.5	1			1	1
	F	5	62.5	5				
Total		17	100.0	7	5	3	1	1
	F	6	35.3	5	1			
	M	11	64.7	2	4	3	1	1

Only 85 (86%) students replied to both Pre-test and Post-test questionnaires. Moreover, four Psychology students and ten Computer Science students replied to only one of the questionnaires so it was not possible to match their Pre-test and Post-test questionnaires.

2.2. Instruments

Considering the research question and the population a survey was designed including questions for: characterisation of the students; characterisation of the team; self-perceived personality; assessment of the perceived personality of the time-organiser (to be filled in by the non-time-organiser only); and evaluation of the team collaboration. As we were conducting a longitudinal study, with two evaluation moments, two versions of the questionnaire were developed, a Pre-test version to be deployed at the beginning of teamwork collaboration ("*Questionário de recolha de informação sobre comportamentos*

de trabalho em equipa – Pre-Test", see Appendix A) and a Post-test version to be filled in near the end of the team collaboration ("*Questionário de recolha de informação sobre comportamentos de trabalho em equipa – Post-Test*", see Appendix B). The survey included questions for sociodemographic (gender, age, major, course), characterisation of the team (team number, size of the team), role in the team (dichotomous question "are you the time-organiser?" – "Yes", "No"), questionnaire BFI-10 for self-perceived personality assessment (10 questions), questionnaire BFI-10 for perceived personality of the time-organiser assessment (10 questions, to be filled in by the non-time-organisers only), questionnaire for measuring learning-team effectiveness and mediating variables (20 questions, that was excluded from the study later on), and a Team Collaboration Evaluator questionnaire (13 questions).

The Post-test survey included all the previous questions plus two more, namely: perception of the differences originating from having a time-organiser in the team (a dichotomous question "is there a perceived difference in having a time-organiser in the team?" – "Yes", "No") and time-organisers' selection method ("how was the time-organiser selected" – "Offered him/herself", "Agreed by the majority of the team members", "Unanimously agreed", "Secret voting", "Random Choice", "Other", and an open question to specify the selection method if "Other" was the chosen option). The instrument used in this study – the Big Five Inventory (BFI-10) and the Team Collaboration Evaluator (TCE) – are presented in the following sections.

Besides the survey completed by the students, the feedback given by the professor was also considered in the study, as well as the final project grade given by the professor assessed on a 20-point scale (1 = *students did not comply with any of the stipulated objectives* to 20 = *students totally achieved all the established goals*).

In this study the subscales of the Team Collaboration Evaluator (Shared Mental Models, Mutual Trust, Mutual Performance Monitoring, and Perceived Team

Effectiveness) and the final project grade may appear grouped as the Perceived Teamwork Result.

2.2.1. The Big Five Inventory (BFI-10).

To assess personality an instrument was included in the questionnaire (see Part II and Part III on the Appendix A and B), the Big Five Inventory (BFI-10), created by Rammstedt and John and published in 2007 (Rammstedt & John, 2007). The Big Five Inventory (BFI) was constructed as an extremely short instrument in the late 1980s (John, Donahue, & Kentle, 1991), despite the fact that, at that time, it "seemed radically short, it now seems tediously long as researchers are faced with limited assessment time" (Rammstedt & John, 2007, p. 204). Rammstedt and John (2007, p. 204) continue to argue "there has been an accelerating trend towards shorter and shorter personality instruments", where the demand for super-short assessments is growing, and even the investigators using the BFI ask for a shorter version. Typically, "BFI-10 scales captured 70% of the full BFI variance and retained 85% of retest reliability", as discriminant and structural validity of the instrument has remained substantially the same (Rammstedt & John, 2007, p. 210). Overall, research findings show that "BFI-10 retains a substantial portion of the reliability and validity of the original BFI-44 and thus support for the construct validity of the BFI-10" (Rammstedt & John, 2007, p. 210). Gosling et al. (2003b) agree that, when participants' time is actually limited, BFI-10 is an adequate assessment of personality. The students replied to the survey during the scheduled classes, hence the time constrains that led us to choose the BFI-10 to assess self-perceived personality and the perceived personality of the leader.

To create the BFI-10 two items (one positively-keyed and one negatively-keyed) were taken from each of the original scales of the 44-item BFI (John, Donahue, & Kentle, 1991), which form a total of 10 items rated on a 5-point Lickert scale (1 = *disagree*

strongly to 5 = *agree strongly*). Scores for the Personality assessment were calculated by aggregating the five subscales Agreeableness (2 items,), Extraversion (2 items), Conscientiousness (2 items), Neuroticism (2 items) and Openness (2 items), reverse keying Neuroticism to reflect Emotional Stability, and dividing by the total number of items in each subscale to obtain a mean score. All items consist of short phrases (e.g. is reserved; is generally trusting; tends to be lazy, etc., see Appendix A and B), which are based on prototypical trait adjectives related to each construct (John & Srivastava, 1999).

Benet-Martínez and John (1998, p. 729) refer to "little evidence for substantial cultural differences in personality structures at the broad level of abstraction represented by the Big Five dimensions", suggesting that it may be used in other cultures. A Portuguese validated version of the BFI-10 is not yet available and so this version was translated to be used in the scope of this research. A draft of the Portuguese BFI-10, called BFI-10-PT, created by Bártolo-Ribeiro & Aguiar (2008) was used as a reference as well as, another Portuguese version of the BFI-10 that has been used by researchers at M-iti (Madeira Interactive Technologies Institute), a research unit associated with LARSyS (Laboratory of Robotics and Engineering Systems). The translation from English to Portuguese was done by a Portuguese native speaker, using the already existing version in Portuguese, and was then reviewed by an English native speaker with excellent Portuguese knowledge. Both researchers have considerable knowledge in survey design. Furthermore, articles using this translated instrument have already been presented at the 10th Conference of the European Academy of Occupational Health Psychology (Pacheco & Soares, 2012a) and at the "II Congresso RESAPES" (Pacheco & Soares, 2012b), thus it has not been published.

BFI-10 was shown to have acceptable internal consistency (Cronbach $\alpha = .71$ for the non-time-organisers self-perceived evaluation, Cronbach $\alpha = .80$ for the time-organisers self-perceived evaluation, both based on the BFI-10 items and reversing the

negatively keyed items and reversing neuroticism to get the emotional stability subscale), as an overall instrument, and in its subscales for the time-organisers' self-perceived evaluation (Extraversion 2 items, Cronbach α = .76, Agreeableness 2 items, Cronbach α = .80, Conscientiousness 2 items, Cronbach α = .77, Emotional Stability 2 items, Cronbach α = .77 and Openness 2 items, Cronbach α = .79), and for the non-time-organisers self-perceived evaluation (Extraversion 2 items, Cronbach α = .65, Agreeableness 2 items, Cronbach α = .72, Conscientiousness 2 items, Cronbach α = .70, Emotional Stability 2 items, Cronbach α = .66, and Openness 2 items, Cronbach α = .68).

Low internal consistency was found in the assessment of the personality of the time-organiser by the non-time-organiser (Cronbach α = .45 for the perception of the time-organiser's personality evaluated by the non-time-organisers, both based on the BFI-10 items reversing negatively keyed items and reversing neuroticism to get the emotional stability subscale), as it did not met the expected level of .70 or above (Nunnally, 1978), likewise Erdle and Rushton (2011) findings using this same instrument. In spite of the Rammstedt and John (2007, p. 203) discussion that the BFI-10 scales retain significant levels of reliability and validity and, even though "reducing the items of the BFI-44 to less than a fourth, yielded effect sizes that were lower than those for the full BFI-44", it is still appropriate for studies with limited time constraints (Rammstedt & John, 2007). However, as this instrument revealed, when used for hetero-evaluations, low internal consistency, in addition to the fact that it has not yet been validated for the Portuguese population, the analyses using the perceived personality of the time-organisers by the non-time-organisers will be merely exploratory as conclusive inferences cannot be taken.

2.2.2. The Team Collaboration Evaluator (TCE).

The Team Collaboration Evaluator (TCE), developed by Fransen (2012) as part of his doctoral thesis published in 2012 (see Part V of the Appendix A and B), was the

selected instrument to evaluate the self-perceived team collaboration, as it allows for measurement of the perceived quality of team collaboration at various stages (Fransen, 2012).

As a derivation of the improved Team Effectiveness Questionnaire, it has 13 questions, specifically 9 items on three key variables mediating learning team effectiveness (shared mental models, mutual trust, and mutual performance monitoring), 3 items on the perceived team effectiveness, and 1 open question (Fransen, 2012). These first 12 items covering the main aspects of team collaboration are highly correlated (Fransen, 2012, findings of the TCE were confirmed by the results of other qualitative and quantitative measurements) and conclusions reflected learning team development (Fransen, 2012). The TCE has the potential to be a team tester to predict the emergence of learning team effectiveness during early stages of teamwork (Fransen, 2012).

TCE was a recent instrument when it was applied, therefore there was no validated Portuguese version and so it was translated for the scope of this research. To remove ambiguities that could prompt respondents to reinterpret what was being asked, the questionnaire was applied initially in a pilot test before it was used for full-scale data collection. The translation from English to Portuguese was done by a Portuguese native speaker and then reviewed by an English native speaker with excellent Portuguese knowledge. Both are researchers with good knowledge in survey design. The pair of questionnaires, the original English version and the Portuguese version, was sent to pilot test subjects ($N = 7$), from a sample conveniently selected for pilot data collection. Participants were asked to reply first to the survey in English and then to the Portuguese version. The subjects replied to all questions and the results in both versions were quite similar, indicating that the instrument measured the same factors. Though participants in the pilot test reported that it seemed to be more difficult to understand the questions in English (as, according to their feedback, they had to reread it 2 or 3 times), they revealed

that it was quite easy to answer it in Portuguese, and reported that it was an excellent exercise to reflect on teamwork.

Scores in the factors shared mental models (SMM, 3 items, Cronbach α = .89), mutual trust (MT, 3 items, Cronbach α = .88), mutual performance monitoring (MPM, 3 items, Cronbach α = .88) and perceived team effectiveness (PTE, 3 items, Cronbach α = .89) were rated using a 1 to 10 scale (1 = *Low/Almost Never True* to 10 = *High/Almost Always True*), based on the self-perception of the quality of team collaboration at that moment, then collapsed into 4 subscales and divided by the total number of items in each one of them to obtain a mean score. All items consisted of statements covering aspects of team collaboration and an open question was added at the end of the Pre-test Questionnaire for the participant to report on one incident that they had perceived as being essential for improving team collaboration up to that point. Internal consistency of this instrument was high (Cronbach α = .90).

2.3. Procedures

The experiment took place from September 2013 to January 2014, during the fall semester, with a sample of Computer Science and Psychology students from the University of Madeira. Five professors were interviewed in order to locate courses with an 8/10-week long teamwork project already planned as part of the coursework as the research needed to be integrated in the regular class activities. The professors of Artificial Intelligence and Programming in the Computer Science major replied affirmatively. But, as they were teaching the same students, only one of these courses was included in the study, and we opted for Artificial Intelligence, a course taught to the 3rd year students. The Psychology course Cognitive Psychology, taught to the 2nd year students, was chosen by convenience.

In the first or second week of classes (depending on the class syllabus that had been previously defined), professors asked students to form groups to work together on a one-semester long project, where individuals could freely choose their teammates, but groups were required to have a minimum of 4 and a maximum of 8 participants. In the following class, the professor presented the assignment and informed the students that they had, as homework, to choose a time-organiser, using the time-organiser selection method to be decided among the team members. In this same class, each professor explained the time-organiser responsibilities, namely being in charge of the coordination of the team and the teamwork, organising the tasks to be executed by the team members, controlling deadlines, supervising other teammates, controlling the quality of the outcomes, dealing with problems that may arise within the group, and acting as group representative before the professor. The words leader or chief were deliberately avoided, to allow team members to create their own team dynamics around the time-organiser without pre-conceived ideas. Before the start of the semester, the professors involved in the investigation received training about the research goals and were given instructions on how to administer the questionnaire to the students.

The team project for the Computer Science students was to assemble a robot, program it to execute a task decided among the team, and do a final report about their work. The assignment given to Psychology students was to do a presentation in class over a subject to be selected by the team from a list given by the professor and to prepare a final report about it. All teams worked in different topics.

Four weeks after getting the assignment, students received during class, paper copies of the Pre-test Questionnaire ("*Questionário de recolha de informação sobre comportamentos de trabalho em equipa – Pre-test*", see Appendix A) and were asked to complete it. They were informed that anonymity was assured, and their responses would

not influence their project grades, nor the final course grade. Students took between 12 and 20 minutes to complete the questionnaire.

The students worked in teams during the semester and, one week before the final delivery deadline, the professor asked the teams to fill in the Post-test Questionnaire ("*Questionário de recolha de informação sobre comportamentos de trabalho em equipa – Post-Test*", see Appendix B). The survey deployment time frame choice (one week before the final delivery deadline) was based on the assumption that all teams would have reached the final productive phase by that point, but that grading and/or a premature onset of team dismantling would not bias perceptions over team effectiveness, following the same procedure as Fransen (2012).

After collecting the data, statistical analyses were made using computer software (IBM SPSS Statistics, version 22 for MacOS X Yosemite 10.10.5).

3. Results

3. Results

The main goal of this study is to explore how teamwork done at HEIs can help students improve their personal proficiency competence cluster, namely empirically explore the perception of teamwork from two classes of students, in a pre and post-test assessment of their personality traits. In this chapter, having the literature reviewed and the methodology of the study described, preliminary results will be presented, where some exploratory analyses connected to self-perceived personality assessed with the BFI-10 will be shown. Finally, the hypotheses will be tested and the results explored.

This study used non-parametric tests (*Kruskal-Wallis* and *Wilcoxon Signed-Rank)* for the analyses where the violation of the assumption of normality was suggested and/or the sample was small. Parametric tests (*t*-test for Paired Samples, *t*-test for Independent Samples, *Pearson Product-Moment Correlation Coefficient*, Repeated-Measures Analysis of Variance, Two-Way between-Groups Analysis of Variance, Multi-way Analysis of Variance) were used when, after testing for normality, examining standardised skewness and the *Shapiro-Wilks test*, there was the suggestion of violation of the assumption of normality. Yet as the sample is large (30+), as argued by Gravetter and Wallnau (2000) and Stevens (1996) parametric analyses can be made, as this should not cause any major problems to the test results.

3.1. Preliminary results

After testing for normality, examining standardised skewness and the *Shapiro-Wilks test*, there was the suggestion of violation of the assumption of normality in the

instruments used in this study, namely the BFI-10 to assess the self-perceived personality of the students, the BFI-10 for the non-time-organisers to assess perceived personality of the time-organisers, and the TCE to assess self-perceived team collaboration. As such, analyses were made using both non-parametric and parametric tests.

Non-parametric tests (*Kruskal-Wallis* and *Wilcoxon Signed-Rank*) were conducted on the analyses where the violation of the assumption of normality was suggested and the sample was small (<30).

Parametric tests (*t*-test for Paired Samples, *t*-test for Independent Samples, *Pearson Product-Moment Correlation Coefficient*, Repeated-Measures Analysis of Variance, Two-Way between-Groups Analysis of Variance, Multi-way Analysis of Variance) were applied when there was the suggestion of violation of the assumption of normality. Yet as the sample is large (>30), as argued by Gravetter and Wallnau and Stevens, parametric analyses can be completed and this should not cause any major problems to the test results.

3.1.1. *Descriptive results.*

The highest self-perceived personality trait of the time-organisers was, in the Pre-test, conscientiousness ($M = 3.82$, $SD = 0.85$), and openness in the Post-test (Post-test: $M = 3.72$, $SD = 0.80$). Non-time-organisers had as the highest trait, in the Pre-test, openness (Pre-test $M = 3.76$, $SD = 0.73$; Post-test $M = 3.62$, $SD = 0.74$), and emotional stability as the lowest (Pre-test $M = 3.37$, $SD = 0.83$; Post-test $M = 3.34$, $SD = 0.76$, see Table 7).

When comparing the answers from the Pre-test to the Post-test, non-time-organiser students kept the same score on trait agreeableness (Pre-test $M = 3.51$, $SD = 0.53$; Post-test $M = 3.51$, $SD = 0.50$), slightly increased conscientiousness (Pre-test $M = 3.43$, $SD = 0.69$; Post-test $M = 3.45$, $SD = 0.61$), but decreased in all the subsisting traits. Time-organisers

increased only in trait openness (Pre-test $M = 3.65$, $SD = 0.70$; Post-test $M = 3.72$, $SD = 0.80$, see Table 7).

Table 7

Self-perceived personality of the time-organisers and non-time-organisers[1]

	Time-organisers				Non-time-organisers			
	Pre-test *n* = 17		Post-test *n* = 16		Pre-test *n* = 75		Post-test *n* = 75	
Personality traits	*M* (*SD*)	*Min-Max*	*M* (*SD*)	*Min-Max*	*M* (*SD*)	*Min-Max*	*M* (*SD*)	*Min-Max*
Extraversion	3.24 (0.71)	2-4.5	3.03 (0.69)	1.5-4.5	3.43 (0.74)	2-5	3.42 (0.80)[a]	2-5
Agreeableness	3.41 (0.54)	2.5-4.5	3.31 (0.57)	2-4	3.51 (0.53)	2-5	3.51 (0.50)	2-4.5
Conscientiousness	3.82 (0.85)	2-5	3.66 (0.77)	2-5	3.43 (0.69)	2-5	3.45 (0.61)	2-5
Emotional Stability	3.24 (0.90)	1.5-4.5	3.06 (0.95)	1.5-4.5	3.37 (0.83)	1.5-5	3.34 (0.76)[b]	2-5
Openness	3.65 (0.70)	2.5-5	3.72 (0.80)	2.5-5	3.76 (0.73)	2-5	3.62 (0.74)[b]	2-5

[a] *n* = 76
[b] *n* = 74

[1] We used letters (a, b, c, d, e…) formatted as superscript, to identify the notes included right below the table. The same technique will be used in the following tables.

The descriptive analyses of the instruments can be found in the Table 8 for the TCE, in the Pre-test and in the Post-test. The results increased in the Post-test for the shared mental models (SMM; Pre-test *M* = 7.91, *SD* = 1.20; Post-test *M* = 8.01, *SD* = 1.22), mutual performance monitoring (MPM; Pre-test *M* = 7.77, *SD* = 1.38; Post-test *M* = 7.88, *SD* = 1.37), and perceived team effectiveness (PTE; Pre-test *M* = 8.03, *SD* = 1.48; Post-test *M* = 8.12, *SD* = 1.28). Mutual trust (MT) decreased in the Post-test (Pre-test *M* = 8.30, *SD* = 1.16; Post-test *M* = 8.06, *SD* = 1.33).

Table 8

Perceived team collaboration, in the Pre-test and Post-test

	Pre-test *n* = 92		Post-test *n* = 91	
TCE items	*M* (*SD*)	*Min-Max*	*M* (*SD*)	*Min-Max*
SMM	7.91 (1.20)[a]	3.67-10	8.01 (1.22)	5.33-10
MT	8.30 (1.16)	4-10	8.06 (1.33)	3.33-10
MPM	7.77 (1.38)	2-10	7.88 (1.37)[b]	4-10
PTE	8.03 (1.48)	3-10	8.12 (1.28)[b]	4.33-10

[a] *n* = 79
[b] *n* = 92

An independent-samples *t*-test was conducted to explore if there were differences in the perceived team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) according to the moment it was assessed (Pre-test or Post-test).

There were statistically significant differences, in the Computer Science major, not only in the SMM subscale (Pre-test: *M* = 7.81, *SD* = 1.61; Post-test: *M* = 8.54, *SD* = 1.05; *t*(34) = -3.9, *p* = .00), but also in the MPM (Pre-test: *M* = 7.67, *SD* = 1.44; Post-test: *M* = 8.27, *SD* = 1.32; *t*(38) = -3.35, *p* = .00) and in the PTE (Pre-test: *M* = 8.13, *SD* = 1.41; Post-test: *M* = 8.68, *SD* = 1.06; *t*(38) = -2.73, *p* = .01, see Table 9). Additionally, there

were statistically significant differences in the Psychology major, not only in the SMM variable (Pre-test: $M = 8.11$, $SD = 1.04$; Post-test: $M = 7.60$, $SD = 1.23$; $t(35) = 2.79$, $p = .01$), but also in the MT (Pre-test: $M = 8.19$, $SD = 1.25$; Post-test: $M = 7.67$, $SD = 1.48$; $t(44) = 2.50$, $p = .02$) and in the MPM (Pre-test: $M = 8.09$, $SD = 1.17$; Post-test: $M = 7.49$, $SD = 1.39$; $t(45) = 3.37$, $p = .00$, see Table 9).

As an overall analysis, it is suggested that Computer Science students perceived themselves as more effective in the Post-test. On the contrary Psychology students' scores are lower in all the subscale items at the second point of evaluation (see Table 9).

Table 9

Perceived team collaboration in Pre-test and Post-test, by major

	Computer Science *n* = 39					*Psychology* *n* = 46				
	Pre-test	Post-test				Pre-test	Post-test			
TCE items	*M* (*SD*)	*M* (*SD*)	*t*	*df*	*p*	*M* (*SD*)	*M* (*SD*)	*t*	*df*	*p*
SMM	7,81 (1,61)[a]	8,54 (1,05)[a]	**-3.90**	34	.00	8.11 (1.04)[b]	7.60 (1.23)[b]	**2.79**	35	.01
MT	8,47 (1,05)	8,47 (1,06)	0.00	38	1.00	8.19 (1.25)[c]	7.67 (1.48)[c]	**2.50**	44	.02
MPM	7,67 (1,44)	8,27 (1,32)	**-3.35**	38	.00	8.09 (1.17)	7.49 (1.39)	**3.37**	45	.00
PTE	8,13 (1,41)	8,68 (1,06)	**-2.73**	38	.01	8.03 (1.44)	7.59 (1.24)	1.72	45	.09

[a] *n* = 35
[b] *n* = 36
[c] *n* = 45

The perceived teamwork result includes the results of the TCE scale and the final project grade given by the professor, presented on a 0-20 scale. Computer Science students got higher grade average (*M* = 17,33, *SD* = 1.52, *Min* = 12, *Max* = 20) than Psychology students (*M* = 16,86, *SD* = 0.93, *Min* = 15, *Max* = 18, see Table 10).

Table 10

Results of the teamwork effectiveness, by major

	Computer Science		Psychology	
Teams	PTE	Final project grade	PTE	Final project grade
Team 1	8.20	17	9.11	17
Team 2	7.00	12	6.92	18
Team 3	7.67	17	8.11	17
Team 4	9.33	17	7.93	17
Team 5	8.67	19	7.67	16
Team 6	9.67	20	8.06	17
Team 7	9.33	20	6.53	15
Team 8	8.87	16	6.47	18
Team 9	8.93	18	----	----

At the beginning of the teamwork, teams had to select the time-organiser. The method of selecting was freely decided by each of the teams. In the Computer Science major, the most popular selection method was “agreement by the majority of the members” (*n* = 19), closely followed by “agreed by all team members” (*n* = 16), furthermore there were four students that replied saying that the “time-organiser offered him/herself” (*n* = 4) and one student that stated that the time-organiser was chosen for being the first in an alphabetic order (*n* = 1). In the Psychology major the most popular selection method was “agreement by the majority of team members” (*n* = 23), followed by

"agreement between all team members" (*n* = 19). In the Psychology major some time-organisers were chosen "randomly" (*n* = 4), one student considered that the time-organiser in his team was selected because he/she offered to take the position (*n* = 1), and another student did not know how the time-organiser was selected, as it had happened already when he/she joined the team (*n* = 1).

In the Post-test survey two questions were added to collect student feedback on the influence of the time-organiser, thus one of the questions was "would the results be the same without a time-organiser?" where the respondents select "Yes" or "No". The large majority of students (64.4%) consider that the time-organiser had influenced the team, as they would not have achieved the same result without him/her. In spite of this, more than one third (35,6%) of the students considered the time-organiser dispensable.

Psychology non-time-organisers' were more conscientious over the influence of the time-organiser (73.2% considered that he/she was meaningful to the team outcomes). Only 66.6% of the non-time-organisers from Computer Science considered he/she was significant to the team outcomes (see Table 11). Time-organisers perceived their role as less important, as most of them consider that the result of the teamwork would be the same without having a time-organiser (Psy: *n* = 4, 57.1% of the Psychology time-organisers; CS: *n* = 6, 66.7% of the Computer Science time-organisers). Furthermore, more females than males classify the time-organiser as having made a difference (66.7% *versus* 62.2%, see Table 11).

Table 11

Perception of the influence of the time-organiser in the teamwork, by major and gender

Results would be the same without a time-organiser	Computer Science		Psychology		Male		Female	
	N	%	*N*	%	*N*	%	*N*	%
Yes	17	40.5	15	31.3	17	37.8	15	33.3
Time-organiser	6	35.3	4	26.7	6	35.3	4	26.7
Non-time-organiser	11	64.7	11	73.3	11	64.7	11	73.3
No	25	59.5	33	68.8	28	62.2	30	66.7
Time-organiser	3	12.0	3	9.1	5	17.9	2	6.7
Non-time-organiser	22	88.0	30	90.9	23	82.1	28	93.3
Total	42	100.0	48	100.0	45	100.0	45	100.0

Still considering the influence of having a time-organiser in the team, an analysis was made to explore the relation among respondents' age and their opinion about the importance of the time-organiser. Students over 25 years old were the ones that give more importance to the role of time-organiser (64.7%), followed by the younger subjects (59.2%, see Table 12).

Table 12

Perception of the influence of the time-organiser in the teamwork, by age

Results would be the same without a time-organiser	Up to 20 years old		From 21 to 25 years old		More than 25 years old	
	n	%	*n*	%	*n*	%
Yes	17	34.7	11	33.3	4	23.5
No	29	59.2	18	54.5	11	64.7
Total	46	93.9	29	87.9	15	88.2

3.2. Exploratory results

A paired-samples *t*-test was conducted to explore the differences in the non-time-organisers' self-perceived personality (extraversion, agreeableness, conscientiousness, emotional stability, openness) in the Pre-test and Post-test. There were no statistically significant differences (see Table 13).

Although not statistically significant, analyses showed that Computer Science non-time-organisers perceived themselves as more agreeable (Pre-test $M = 3.40$, $SD = 0.48$; Post-test $M = 3.52$, $SD = 0.50$,), slightly more conscientious (Pre-test $M = 3.36$, $SD = 0.67$; Post-test $M = 3.40$, $SD = 0.59$) and more emotionally stable (Pre-test $M = 3.18$, $SD = 0.90$; Post-test $M = 3.35$, $SD = 0.83$, see Table 13). Psychology non-time-organisers perceived themselves as slightly more extrovert (Pre-test $M = 3.53$, $SD = 0.69$; Post-test $M = 3.58$, $SD = 0.71$) and marginally more conscientious (Pre-test $M = 3.54$, $SD = 0.67$; Post-test $M = 3.56$, $SD = 0.58$, see Table 13).

Even though time-organisers form a small sample ($N = 17$), an exploratory paired-samples *t*-test was conducted to explore the differences in the self-perception of the time-organisers personality (extraversion, agreeableness, conscientiousness, emotional stability, openness), in the Pre-test and Post-test. The results revealed no statistically significant differences (see Table 13).

Yet not statistically significant, Computer Science time-organisers self-perceived, in the Post-test, as more open (Pre-test $M = 3.56$, $SD = 0.73$; Post-test $M = 3.78$, $SD = 0.79$), but decreased in all the other traits (extraversion: Pre-test $M = 3.33$, $SD = 0.91$; Post-test $M = 2.83$, $SD = 0.71$; agreeableness: Pre-test $M = 3.33$, $SD = 0.66$; Post-test $M = 3.11$, $SD = 0.60$; conscientiousness: Pre-test $M = 3.44$, $SD = 0.85$; Post-test $M = 3.28$, $SD = 0.67$; emotional stability: Pre-test $M = 3.06$, $SD = 0.92$; Post-test $M = 3.00$, $SD = 0.90$; see Table 13). Time-organisers in the Psychology major self-perceived as more extrovert (Pre-

test $M = 3.14$, $SD = 0.48$; Post-test $M = 3.29$, $SD = 0.64$) and slightly more agreeable (Pre-test $M = 3.50$, $SD = 0.41$; Post-test $M = 3.57$, $SD = 0.45$, see Table 13).

Table 13

Self-perceived personality in the Pre-test and Post-test, by major

	Computer Science $n = 30$					Psychology $n = 39$				
	Pre-test	Post-test				Pre-test	Post-test			
Personality traits	*M* (*SD*)	*M* (*SD*)	*t*	*df*	*p*	*M* (*SD*)	*M* (*SD*)	*t*	*df*	*p*
Time-organisers										
Extraversion	3.33 (0.91)[a]	2.83 (0.71)[a]	2.00	8	.08	3.14 (0.48)[b]	3.29 (0.64)[b]	-1.00	6	.36
Agreeableness	3.33 (0.66)[a]	3.11 (0.60)[a]	1.32	8	.23	3.50 (0.41)[b]	3.57 (0.45)[b]	-0.28	6	.79
Conscientiousness	3.44 (0.85)[a]	3.28 (0.67)[a]	0.71	8	.50	4.29 (0.70)[b]	4.14 (0.63)[b]	0.80	6	.46
Emotional Stability	3.06 (0.92)[a]	3.00 (0.90)[a]	0.81	8	.87	3.50 (0.96)[b]	3.14 (1.07)[b]	1.51	6	.18
Openness	3.56 (0.73)[a]	3.78 (0.79)[a]	0.17	8	.23	3.71 (0.76)[b]	3.64 (0.85)[b]	0.31	6	.77
Non-time-organisers										
Extraversion	3.35 (0.81)	3.25 (0.87)	0.77	29	.45	3.53 (0.69)	3.58 (0.71)	-0.43	38	.67
Agreeableness	3.40 (0.48)	3.52 (0.50)	-1.16	29	.26	3.64 (0.52)[d]	3.57 (0.45)[d]	1.29	37	.21
Conscientiousness	3.36 (0.67)[c]	3.40 (0.59)[c]	-0.37	28	.71	3.54 (0.67)	3.56 (0.58)	-0.26	38	.79
Emotional Stability	3.18 (0.90)	3.35 (0.83)	-1.67	29	.11	3.45 (0.78)[e]	3.31 (0.75)[e]	1.15	36	.26
Openness	3.43 (0.77)	3.33 (0.77)	1.10	29	.28	4.01 (0.55)[e]	3.86 (0.66)[e]	1.30	36	.20

[a] $n = 9$
[b] $n = 7$
[c] $n = 29$
[d] $n = 38$
[e] $n = 37$

Students assessed their time-organisers' perceived personality, both in Pre-test and Post-test through the BFI-10. These results were merely exploratory, since conclusive findings are not extractable as reliability did not meet the expected level of .70 or above (Nunnally, 1978), and have not been yet fully tested for personality hetero-evaluations. An exploratory paired-samples *t*-test was conducted to explore the difference between the perceived personality of the time-organiser (at Pre-test and Post-test) at both points of evaluation as evaluated by the non-time-organiser (extraversion, agreeableness, conscientiousness, emotional stability, openness). There is a statistically significant difference in the trait extraversion for the Psychology time-organiser [Pre-test *M*(*SD*) = 3.42 (0.70), Post-test *M*(*SD*) = 3,17 (0.63), *t*(35) = 2.49, *p* = .02, see Table 14].

As an overall breakdown, despite not being statistically significant, it is suggested that Computer Science time-organisers are perceived, in the Post-test, as more agreeable [Pre-test *M*(*SD*) = 3.41 (0.39), Post-test *M*(*SD*) = 3.50 (0.51), *t*(27) = -0.90, *p* = .38], more conscientious [Pre-test *M*(*SD*) = 3.78 (0.51), Post-test *M*(*SD*) = 3.91 (0.61), *t*(26) = -1.19, *p* = .26], more emotionally stable [Pre-test *M*(*SD*) = 3.56 (0.61), Post-test *M*(*SD*) = 3.68 (0.68), *t*(27) = -0.93, *p* = .36], and more open [Pre-test *M*(*SD*) = 3.43 (0.45), Post-test *M*(*SD*) = 3.54 (0.59), *t*(27) = 0.13, *p* = .36, see Table 14]. Psychology non-time-organisers evaluate their time-organisers, in the Post-test, as slightly more agreeable [Pre-test *M*(*SD*) = 3.54 (0.48), Post-test *M*(*SD*) = 3.57 (0.52), *t*(34) = -0.35, *p* = .73], more conscientious [Pre-test *M*(*SD*) = 4.36 (0.55), Post-test *M*(*SD*) = 4.47 (0.48), *t*(34) = -1.21, *p* = .23], and more open [Pre-test *M*(*SD*) = 3.60 (0.55), Post-test *M*(*SD*) = 3.72 (0.58), *t*(35) = -1.25, *p* = .22, see Table 14].

Table 14

Comparative of perceived personality of the time-organiser, by major

	Computer Science $n = 28$					Psychology $n = 36$				
	Pre-test	Post-test				Pre-test	Post-test			
Personality traits	*M* (*SD*)	*M* (*SD*)	*t*	*df*	*p*	*M* (*SD*)	*M* (*SD*)	*t*	*df*	*p*
Extraversion	3.43 (0.78)	3.27 (0.74)	1.51	27	.14	3.42 (0.7)	3.17 (0.63)	**2.49**	35	.02
Agreeableness	3.41 (0.39)	3.50 (0.51)	-0.9	27	.38	3.54 (0.48) [b]	3.57 (0.52) [b]	-0.35	34	.73
Conscientiousness	3.78 (0.51) [a]	3.91 (0.61) [a]	-1.19	26	.26	4.36 (0.55) [b]	4.47 (0.48) [b]	-1.21	34	.23
Emotional Stability	3.56 (0.61)	3.68 (0.68)	-0.93	27	.36	3.47 (0.83)	3.33 (0.75)	1.17	35	.25
Openness	3.43 (0.45)	3.54 (0.59)	0.13	27	.36	3.60 (0.55)	3.72 (0.58)	-1.25	35	.22

[a] $n = 27$

[b] $n = 35$

A *Kruskal-Wallis Test* was conducted to evaluate the difference in the self-perceived personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the Computer Science non-time-organisers within teams. Results suggested that within the majors there was a statistically significant difference in the self-evaluation of the personality trait extraversion, in the Computer Science major in the Pre-test, [$H(8) = 16.3$, $p = .04$], where Team 7 presents the highest score (Mean Rank = 24.7) and Team 4 the lowest (Mean Rank = 3.67, see Table 15 and Appendix C). In the Post-test, Computer Science students were shown to have statistically significant differences in the trait agreeableness [$H(8) = 17.34$, $p = .03$], having Team 8 with the highest results (Mean Rank = 30) and Team 4 with the lowest results (Mean Rank = 9.00, see Table 15 and Appendix D).

Table 15

Differences in the self-perceived personality of the Computer Science non-time-organisers

	Team 1		Team 2		Team 3		Team 4		Team 5		Team 6		Team 7		Team 8		Team 9			
Personality traits	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	X^2 (2)	*p*
Pre-test																				
Extraver-sion	4	20.38	3	5.33	4	15.63	3	3.67	4	17.50	4	22.00	5	24.70	4	19.00	4	25.38	**16.30 (8)**	.04
Agreeable-ness	4	20.25	3	17.67	4	15.25	3	21.50	4	20.88	4	16.13	5	17.20	4	20.88	4	13.25	2.76 (8)	.95
Conscien-tiousness	4	24.25	3	13.00	4	14.13	3	15.67	4	19.38	4	12.25	5	25.10	4	24.25	4	10.38	10.91 (8)	.21
Emotional Stability	4	22.13	3	16.67	4	22.13	3	8.50	4	24.88	4	19.75	5	16.70	4	11.38	4	17.50	7.83 (8)	.45
Openness	4	15.63	3	15.17	4	16.13	3	21.33	4	24.38	4	21.63	5	15.60	4	12.25	4	20.63	4.92 (8)	.77
Post-test																				
Extraver-sion	4	24.88	3	9.17	4	19.25	3	6.67	4	15.38	4	23.50	5	16.00	4	14.63	4	28.00	14.34 (8)	.07
Agreeable-ness	4	19.38	3	24.00	4	13.88	3	9.00	4	7.00	4	23.63	5	17.80	4	30.00	4	16.63	**17.34 (8)**	.03
Conscien-tiousness	4	25.00	3	6.50	4	16.75	3	15.33	4	24.25	4	12.50	5	21.50	4	22.00	4	10.38	13.51 (8)	.10
Emotional Stability	4	27.50	3	17.67	4	16.38	3	16.33	4	18.13	4	18.75	5	19.70	4	14.63	4	12.00	5.84 (8)	.67
Openness	4	16.75	3	12.50	4	19.50	3	16.17	4	21.75	4	20.13	5	15.80	4	14.50	4	23.63	3.92 (8)	.87

A *Kruskal-Wallis Test* was conducted to evaluate the difference in self-perceived personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the non-time-organisers, within the Psychology student teams. Results showed that, within the groups, there was no statistically significant difference in the students' self-evaluation, in any of the personality traits, either in the Pre-test [there were variations between $H(7) = 11.27$, $p = .13$ for agreeableness and $H(7) = 6.24$, $p = .51$ for openness], or in the Post-test [with variations between $H(7) = 8.70$, $p = .28$ for consciousness, and $H(7) = 1.66$, $p = .98$ for emotional stability, see Table 16, Appendix E and Appendix F].

Table 16

Differences in the self-perceived personality of the Psychology non-time-organisers

	Team 1		Team 2		Team 3		Team 4		Team 5		Team 6		Team 7		Team 8			
Personality traits	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	X^2 (2)	*p*
Pre-test																		
Extraversion	5	18.00	6	18.17	5	29.00	5	26.80	6	18.42	5	14.00	3	23.17	5	18.40	7.04 (7)	.42
Agreeableness	5	17.30	6	17.25	5	19.80	5	28.20	6	27.92	5	15.40	3	8.67	5	23.90	11.27 (7)	.13
Conscientious-ness	5	19.40	6	24.50	5	23.90	5	17.40	6	18.50	5	24.90	3	13.17	5	18.90	3.97 (7)	.78
Emotional Stability	5	26.10	6	22.25	5	22.90	5	22.00	6	17.00	5	15.90	3	14.83	5	21.10	3.76 (7)	.81
Openness	5	17.90	6	16.00	5	20.70	5	29.00	6	15.00	5	20.70	3	24.33	5	23.90	6.24 (7)	.51
Post-test																		
Extraversion	5	24.20	7	25.07	5	16.40	4	21.63	6	24.92	5	20.30	4	15.75	5	16.40	4.27 (7)	.75
Agreeableness	4	19.25	7	21.29	5	13.70	4	22.88	6	26.58	5	25.80	4	15.88	5	16.40	6.79 (7)	.45
Conscientious-ness	5	27.50	7	27.29	5	15.50	4	14.13	6	20.17	5	21.30	4	12.75	5	24.00	8.70 (7)	.28
Emotional Stability	4	18.25	7	22.50	5	19.40	4	24.88	6	18.50	5	17.70	4	18.25	4	20.13	1.66 (7)	.98
Openness	5	22.20	7	22.86	5	17.30	4	19.38	5	23.10	5	22.80	4	10.50	4	18.38	7.78 (7)	.69

To better understand the self-perceived personality of the students, some analyses were performed and were described as follows.

3.2.1. Is there a relationship between self-perceived personality traits scores of the non-time-organisers in the Pre-test and in the Post-test?

A *Pearson Product-Moment Correlation Coefficient* was conducted to investigate the relationship between the self-perceived personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the non-time-organisers in the Pre-test and in the Post-test. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996).

In the Pre-test, for the non-time-organisers, there were statistically significant medium positive relationships (Cohen, 1988) linking emotional stability with extraversion ($r = .33$, $p = .05$), and emotional stability with openness ($r = .35$, $p = .01$, see Table 17). Moreover, there was a statistically significant weak positive relationship (Cohen, 1988) linking openness with agreeableness ($r = .23$, $p = .05$, see Table 17).

In the Post-test, for the non-time-organisers, there were statistically significant weak positive relationships (Cohen, 1988) linking conscientiousness with extraversion ($r = .27$, $p = .05$), emotional stability with extraversion ($r = .29$, $p = .01$), and emotional stability with agreeableness ($r = .29$, $p = .01$, see Table 17). Additionally, there was a statistically significant medium positive relationship (Cohen, 1988) linking openness with extraversion ($r = .34$, $p = .01$, see Table 17).

The relationship between the self-perceived personality of the non-time-organisers in the Pre-test and the Post-test was explored. A statistically significant medium positive relationship (Cohen, 1988) was found linking emotional stability in the Pre-test with

extraversion in the Post-test ($r = .4$, $p = .01$) and a statistically significant weak positive relationship (Cohen, 1988) linking openness in the Pre-test with extraversion in the Post-test ($r = .25$, $p = .05$, see Table 17). Furthermore, a statistically significant medium positive relationship (Cohen, 1988) was found linking emotional stability in the Post-test with agreeableness in the Pre-test ($r = .31$, $p = .01$, see Table 17).

The correlations of the self-perceived personality trait scores, from Pre-test to Post-test, were tested and statistically significant strong positive relationships (Cohen, 1988) were found between each of the traits in the Pre-test and the results of the same trait, in the Post-test (extraversion: $r = .55$, $p = .001$; agreeableness: $r = .55$, $p = .001$; conscientiousness: $r = .61$, $p = .001$; emotional stability: $r = .67$, $p = .001$; openness: $r = .66$, $p = .001$, see Table 17).

Table 17

Correlation between self-perceived personality traits of the non-time-organisers, in the Pre-test and in the Post-test[1]

	Personality traits																	
	1		2		3		4		5		6		7		8		9	
Personality traits	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*
Pre-test																		
(1) Extraversion																		
(2) Agreeableness	75	.04									69	.23						
(3) Conscientiousness	75	-.01	75	.09							69	.03	68	-.04				
(4) Emotional Stability	75	**.33***	75	.20	75	-.10					69	**.40****	68	.22	68	.18		
(5) Openness	75	.15	75	**.23***	75	-.08	75	**.35****			69	**.25***	68	-.08	68	.05	67	.19
Post-test																		
(6) Extraversion	69	**.55*****																
(7) Agreeableness	68	-.02	68	**.55*****							75	.20						
(8) Conscientiousness	68	.04	68	-.07	68	**.61*****					75	**.27***	74	.01				
(9) Emotional Stability	67	.22	67	**.31****	67	.01	67	**.67*****			74	**.29****	73	**.29****	73	.13		
(10) Openness	67	-.01	67	.18	67	.10	67	.23	67	**.66*****	74	**.34****	73	-.08	73	.21	73	.09

*** $p < .001$, ** $p < .01$, * $p < .05$

Note: The numbers in the third row correspond to the items listed in the first column.

3.2.2. Do female students perceive themselves as more extroverted, agreeable, conscientious, neurotic and open than male students?

A two-way between-groups analysis of variance (ANOVA) was conducted to explore the influence of gender (female, male) and major (computer science, psychology) on the self-perceived personality traits (extraversion, agreeableness, conscientiousness, emotional stability and openness – BFI-10) of the non-time-organisers in the Post-test. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996).

There was a statistically significant main effect for the trait openness in the variable major [$F(1, 70) = 7.65$, $p = .01$, see Figure 2], with an effect size ($\eta 2 = .10$). There were neither main nor interaction effect for the variable gender.

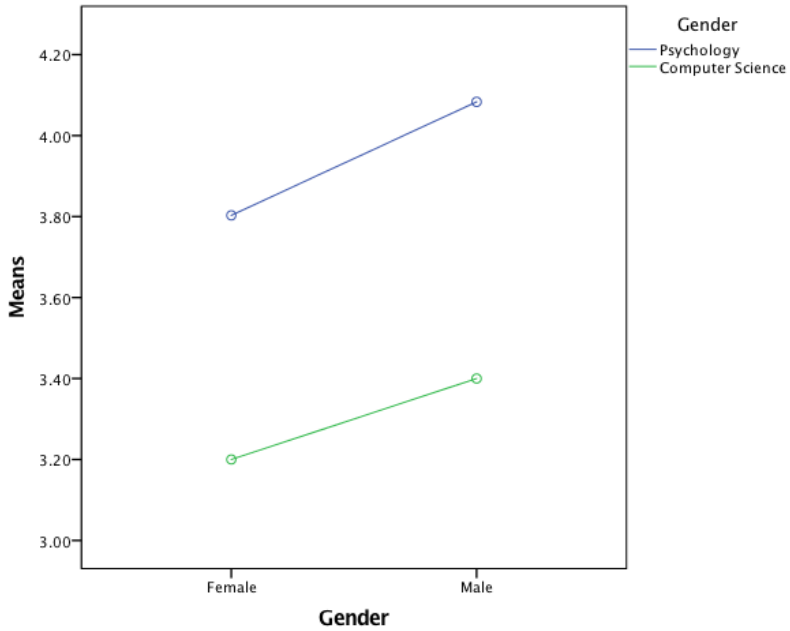

Figure 2. Perception of the influence of the gender and major variables in the self-perceived personality trait openness of the non-time-organisers, in the Post-test

3.3. Correlational analyses and variance analyses

In this section the hypotheses created to reply to the research question "Do the Computer Science and Psychology bachelor students, from the University of Madeira, perceived learning team collaboration differently? Are these perceptions associated with their sociodemographic and/or team characteristics?" will be tested and the results will be presented and explored.

3.3.1. H1. The perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) can be positively associated with the scientific field that students are from.

To examine if there were significant effects between the scientific field that students are from (Computer Science, Psychology) and the TCE scale a multivariate [majors (CS, Psy) x TCE scale (SMM, MT, MPM, PTE)] repeated-measures analysis of variance (ANOVA) was conducted. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the test results.

There was a significant interaction effect between the evaluation moment and the students' scientific field in all the TCE subscales, shown as follows. On the subscale SMM there was a statistically significant interaction effect connecting the point of evaluation to the major [F (1, 69) = 22.43, p = .01, η2 = .25, see Figure 3]. At the beginning of the semester Psychology students perceived themselves as having a higher level of shared

mental models than their counterparts from the Computer Science major (Psy: $n = 36$, $M = 8.11$, $SD = 1.04$; CS: $n = 35$, $M = 7.81$, $SD = 1.61$). Though, in the Post-test Computer Science students scored their SMM higher than they had in the Pre-test ($n = 35$, $M = 8.54$, $SD = 1.05$) whereas the Psychology students did the opposite ($n = 36$, $M = 7.60$, $SD = 1.23$) creating the interaction effect visible in Figure 3.

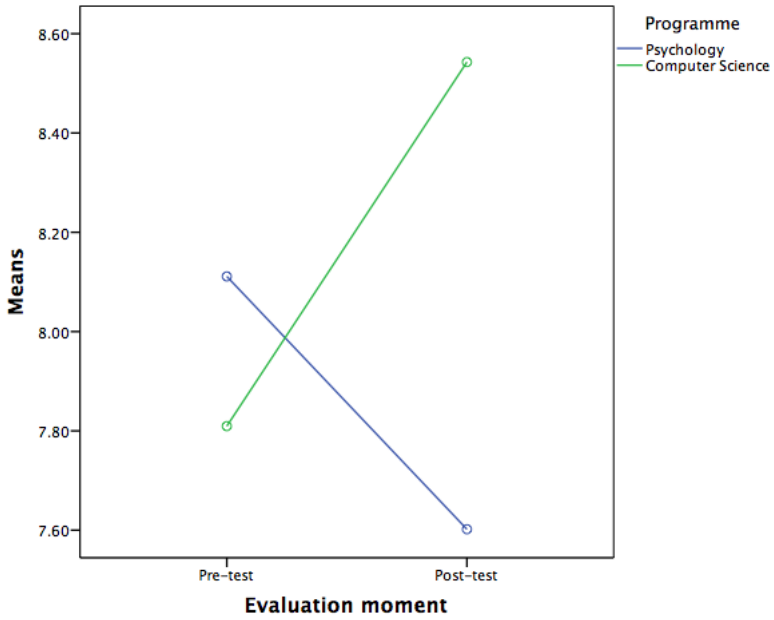

Figure 3. Difference in the perception of the item SMM, from the Pre-test to the Post-test, by major

A similar effect also existed for the subscale MT, where a statistically significant interaction effect was found, linking the point of evaluation to the major [F (1,82) = 4.09, $p = .05$, $\eta 2 = .05$, see Figure 4]. Computer Science students kept exactly the same level of perceived MT, in the Pre-test ($n = 39$, $M = 8.47$, $SD = 1.05$) and in the Post-test ($n = 39$, $M = 8.47$, $SD = 1.06$). Yet Psychology students evaluated their MT at a lower level in the Post-test ($n = 45$, $M = 7.67$, $SD = 1.48$), when compared with their scores in the Pre-test ($n = 45$, $M = 8.19$, $SD = 1.25$), creating an interaction effect (see Figure 4).

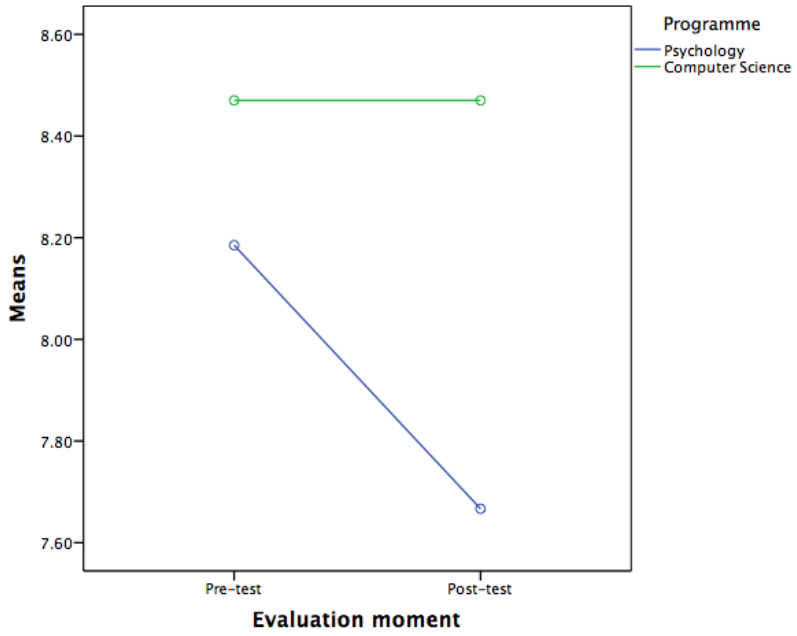

Figure 4. Difference in the perception of the item MT, from the Pre-test to the Post-test, by major

On the subscale MPM there was a statistically significant interaction effect relating the point of evaluation to the major [F (1,83) = 22.28, p = .01, η2 = .21, see Figure 5]. Computer Science students consider their MPM levels to be higher in the Post-test (n = 39, M = 8.27, SD = 1.32), when compared to the Pre-test (n = 39, M = 7.67, SD = 1.44), while Psychology students perceived the opposite (Pre-test: n = 46, M = 8.09, SD = 1.17; Post-test: n = 46, M = 7.49, SD = 1.39) creating an interaction effect (see Figure 5).

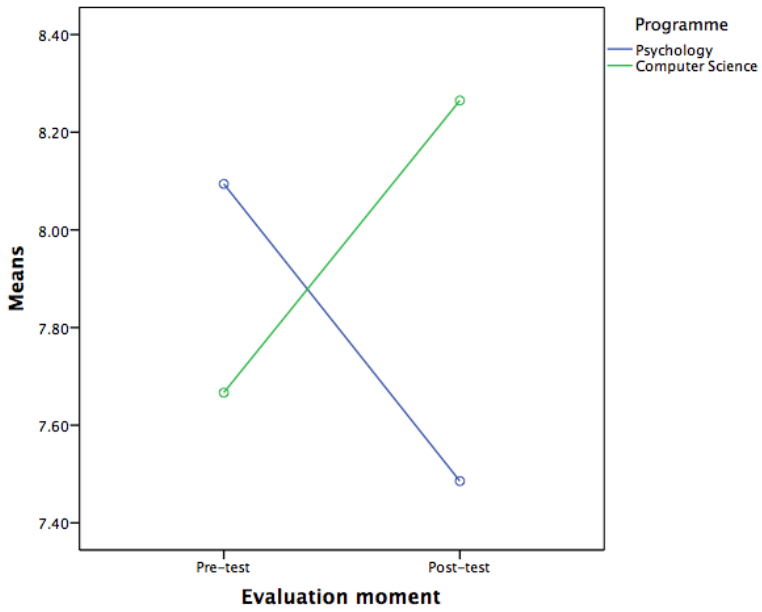

Figure 5. Difference in the perception of the item MPM, from the Pre-test to the Post-test, by major

Regarding the subscale PTE there was a statistically significant interaction effect connecting the evaluation moment and the major [F (1,83) = 8.79, p = .01, η2 = .10, see Figure 6]. Computer Science students perceived themselves as having a higher PTE than Psychology, from the beginning of the semester (CS: n = 39, M = 8.13, SD = 1.41; Psy n = 46, M = 8.03, SD = 1.44). Furthermore, Computer Science perceived that in the Post-test this level was even higher (n = 39, M = 8.68, SD = 1.06), meanwhile Psychology students gave lower scores to PTE (n = 46, M = 7.59, SD = 1.24). The interaction effect that was created is visible in Figure 6.

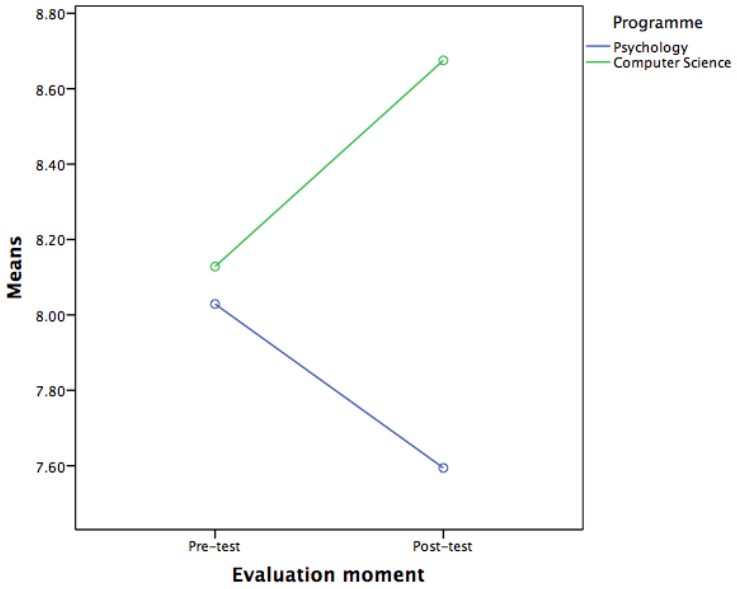

Figure 6. Difference in the perception of the item PTE, from the Pre-test to the Post-test, by major

When comparing the results from the Pre-test and the Post-test, we can observe that Computer Science students got higher results in the last survey, in SMM (Pre-test: n = 35, M = 7.81, SD = 1.61; Post-test: n = 35, M = 8.54, SD = 1.05), MPM (Pre-test: n = 39, M = 7.67, SD = 1.44; Post-test: n = 39, M = 8.27, SD = 1.32) and PTE items (Pre-test: n = 39, M = 8.13, SD = 1.41; Post-test: n = 39, M = 8.68, SD = 1.06, see Table 18). On the contrary, Psychology students got lower levels in the Post-test on every item of the scale, when compared to the Pre-test scores, namely in SMM (Pre-test: n = 36, M = 8.11, SD = 1.04; Post-test: n = 36, M = 7.60, SD = 1.23), MT (Pre-test: n = 45, M = 8.19, SD = 1.25; Post-test: n = 45, M = 7.67, SD = 1.48), MPM (Pre-test: n = 46, M = 8.09, SD = 1.44; Post-test: n = 46, M = 7.59, SD = 1.24) and PTE (Pre-test: n = 46, M = 8.03, SD = 1.44; Post-test: n = 46, M = 7.59, SD = 1.24, see Table 18). Briefly, Computer Science's TCE scale improved with the teamwork, yet the self-perceived TCE of Psychology students receded (see Table 18).

Computer Science students had, since the start, higher scores in the PTE item than Psychology students. This difference increases in the Post-test, as Computer Science

improved their results (Pre-test: $n = 39$, $M = 8.13$, $SD = 1.41$; Post-test: $n = 39$, $M = 8.68$, $SD = 1.06$, see Table 18) and Psychology decreased theirs (Pre-test: $n = 46$, $M = 8.03$, $SD = 1.44$; Post-test: $n = 46$, $M = 7.59$, $SD = 1.24$, see Table 18, Figure 7).

Table 18

Differences in the self-perceived team collaboration levels, by major

	Computer Science $n = 39$		Psychology $n = 46$					
	Pre-test	Post-test	Pre-test	*Post-test*				
TCE	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*	*df*	*p*	η^2
SMM	7.81[a] (1.61)	8.54[a] (1.05)	8.11[b] (1.04)	7.60[b] (1.23)	**22.43**	69	.00	.25
MT	8.47 (1.05)	8.47 (1.06)	8.19[c] (1.25)	7.67[c] (1.48)	**4.09**	82	.05	.05
MPM	7.67 (1.44)	8.27 (1.32)	8.09 (1.17)	7.49 (1.39)	**22.28**	83	.00	.21
PTE	8.13 (1.41)	8.68 (1.06)	8.03 (1.44)	7.59 (1.24)	**8.79**	83	.00	.10

[a] $n = 35$
[b] $n = 36$
[c] $n = 45$

A *Pearson Product-Moment Correlation Coefficient* was conducted to evaluate whether there was a relationship between the final project grade given by the instructor and the PTE, in both majors. The test for normality, examining standardised skewness and the *Shapiro-Wilks* test suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996). As an overall analysis, including data from both majors, a statistically significant moderate positive relationship (Cohen, 1988) was disclosed linking the final project grade given by the professor to the PTE level ($n = 92$, $r = .38$, $p = .001$).

Regarding the grades given by faculty to the teamwork project, Computer Science students also have a higher mean, when compared to the Psychology major ($M_{CS} = 17.3$;

M_{Psy} = 16.88). There was similarity between the evaluation made by the professor (final grade for the project) and the PTE of the Computer Science students (see Figure 7).

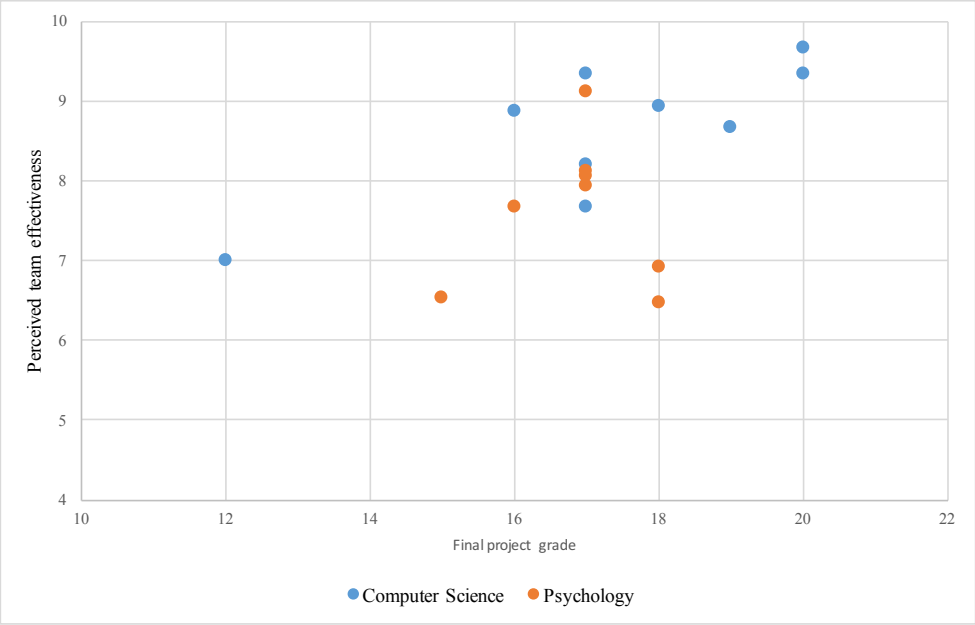

Figure 7. Relationship between project grade and PTE in the Post-test, by major

The relationship between the final project grade given by the instructor and the PTE level in the Computer Science major was explored using a *Pearson Product-Moment Correlation Coefficient*. The test for normality, examining standardised skewness and the *Shapiro-Wilks* test suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the test results. A statistically significant large positive relationship (Cohen, 1988) relating the final project grade given by the instructor to the PTE level of the Computer Science Students (n = 44, r = .56, p = .001) was found.

To evaluate whether there was a relationship between the final project grade given by the instructor and the PTE in the Psychology major a *Pearson Product-Moment Correlation Coefficient* was conducted. The test for normality, examining standardised

skewness and the *Shapiro-Wilks* test suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the analysis. In the Psychology a negative relationship was disclosed, but it was not statistically significant ($n = 48$, $r = -.02$, $p = .91$).

Hypothesis H1 is confirmed as the tests conducted suggest that the perception of the perceived teamwork result can be positively associated with the scientific field that students are from in all the items of the TCE scale, namely a statistically significant interaction effect in the shared mental models subscale (F (1, 69) = 22.43, $p = .01$, $\eta 2 = .25$, see Figure 3), a statistically significant interaction effect in the mutual trust subscale (F (1,82) = 4.09, $p = .05$, $\eta 2 = .05$, see Figure 4), a statistically significant interaction effect in the mutual performance monitoring (F (1,83) = 22.28, $p = .01$, $\eta 2 = .21$, see Figure 5) and a statistically significant interaction effect in the perceived team effectiveness (F (1,83) = 8.79, $p = .01$, $\eta 2 = .10$, see Figure 6). This conclusion is also supported by the grades given by the professors, as Computer Science students have a higher mean grade ($M_{CS} = 17.3$; $M_{Psy} = 16.88$) at the end of the semester.

3.3.2. H2. The self-evaluation of the team collaboration (shared mental models, mutual trust, mutual performance monitoring and perceived team effectiveness) is higher at the end of the semester.

A paired-samples *t*-test was conducted to explore the difference in the students' perception of their team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) according to the moment (Pre-test, Post-test) it was assessed. The test for normality, examining standardised skewness and the *Shapiro-Wilks* test suggested violation of the assumption of normality however, taking

into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the test results.

The evaluation of the influence of the intervention on students' scores in the TCE subscale revealed a statistically significant reduction in the MT, from the Pre-test (M = 8.32, SD = 1.16) to the Post-test [M = 8.04, SD = 1.35, $t(83) = 2.13$, p = .04, see Table 19], with an effect size ($\eta 2$ = .05).

Table 19

Comparison of students' TCE scores

	Pre-test n = 85	Post-test n = 85			
TCE items	M (SD)	M (SD)	t	df	p
SMM	7.96 (1.10)[a]	8.07 (1.23)[a]	-.69[a]	70	.49
MT	8.32 (1.16)[b]	8.04 (1.35)[b]	**2.13[b]**	83	.04
MPM	7.90 (1.31)	7.84 (1.40)	.39	84	.70
PTE	8.07 (1.42)	8.09 (1.28)	-.09	84	.93

[a] n = 71
[b] n = 84

A detailed analysis, by major, was done to explore these differences using the paired-samples t-test. The test for normality, examining standardised skewness and the *Shapiro-Wilks* test suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the analysis.

For the Computer Science major were found statistically significant increases from the Pre-test to the Post-test in the subscales SMM [Pre-test: M = 7.81, SD = 1.16, Post-test: M = 8.54, SD = 1.05, $t(34) = -3.89$, p = .00, $\eta 2$ = .31], MPM [Pre-test: M = 7.67, SD = 1.44, Post-test: M = 8.27, SD = 1.32, $t(38) = -3.35$, p = .00, $\eta 2$ = .23], and PTE [Pre-test:

M = 8.13, *SD* = 1.41, Post-test: *M* = 8.68, *SD* = 1.06, *t*(38) = -2.73, *p* = .01, η2 = .16, see Table 20].

Table 20

Comparison of the Computer Science students' TCE scores

	Pre-test *n* = 39	Post-test *n* = 39				
TCE items	*M* (*SD*)	*M* (*SD*)	*t*	*df*	*P*	η2
SMM	7.81 (1.16)[a]	8.54 (1.05)[a]	**-3.89**	34	.00	.31
MT	8.47 (1.05)	8.47 (1.06)	0.00	38	1.00	---
MPM	7.67 (1.44)	8.27 (1.32)	**-3.35**	38	.00	.23
PTE	8.13 (1.41)	8.68 (1.06)	**-2.73**	38	.01	.16

[a] *n* = 35

For the Psychology major statistically significant decreases from the Pre-test to the Post-test were found in the subscales SMM [Pre-test: *M* = 8.11, *SD* = 1.04, Post-test: *M* = 7.60, *SD* = 1.23, *t*(35) = 2.79, *p* = .01, η2 = .18] and MPM [Pre-test: *M* = 8.09, *SD* = 1.17, Post-test: *M* = 7.49, *SD* = 1.39, *t*(45) = 3.37, *p* = .00, η2 = .20]. Additionally there was a statistically significant reduction in the subscale MT [Pre-test: *M* = 8.19, *SD* = 1.25, Post-test: *M* = 7.67, *SD* = 1.48, *t*(45) = 2.50, *p* = .02, η2 = .12, see Table 21].

Table 21

Comparative of the Psychology students' TCE scores

	Pre-test $n = 46$	Post-test $n = 46$				
TCE items	*M* (*SD*)	*M* (*SD*)	*t*	*df*	*p*	η2
SMM	8.11 (1.04)[a]	7.60 (1.23)[a]	**2.79**	35	.01	.18
MT	8.19 (1.25)[b]	7.67 (1.48)[b]	**2.50**	44	.02	.12
MPM	8.09 (1.17)	7.49 (1.39)	**3.37**	45	.00	.20
PTE	8.03 (1.44)	7.59 (1.24)	1.72	45	.09	---

[a] $n = 36$
[b] $n = 45$

Hypothesis H2 has been partially confirmed as not all items of the TCE were shown to be higher at the end of the semester, hence only the subscales shared mental models [Pre-test: $M = 7.81$, $SD = 1.16$, Post-test: $M = 8.54$, $SD = 1.05$, $t(34) = -3.89$, $p = .00$, $\eta 2 = .31$], mutual performance monitoring [Pre-test: $M = 7.67$, $SD = 1.44$, Post-test: $M = 8.27$, $SD = 1.32$, $t(38) = -3.35$, $p = .00$, $\eta 2 = .23$], and perceived team effectiveness [Pre-test: $M = 8.13$, $SD = 1.41$, Post-test: $M = 8.68$, $SD = 1.06$, $t(38) = -2.73$, $p = .01$, $\eta 2 = .16$, see Table 21], in the Computer Science program, actually increased.

3.3.3. H3. The perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) can be positively associated with the personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the time-organisers.

A *Pearson Product-Moment Correlation Coefficient* was applied to evaluate the relationship between the perceived teamwork result (SMM, MT, MPM, PTE, final project grade) and the personality traits (extraversion, agreeableness, conscientiousness, emotional

stability, openness) of the time-organiser. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the test results.

As an overall analysis including data from both majors, statistically significant small positive relationships were uncovered (Cohen, 1988) not only between the time-organisers personality traits of emotional stability and extraversion ($r = .23$, $p = .05$), emotional stability and conscientiousness ($r = .26$, $p = .05$), but also linking the subscale MPM with the personality trait emotional stability ($r = .23$, $p = .05$), and connecting the final project grade with the personality traits extraversion ($r = .28$, $p = .01$) and openness ($r = .27$, $p = .05$, see Table 22). There were also medium positive relationships (Cohen, 1988) between the time-organisers' personality trait conscientiousness and agreeableness ($r = .33$, $p = .01$), and relating the final project grade with the subscales SMM ($r = .32$, $p = .01$), MT ($r = .38$, $p = .001$), MPM ($r = .48$, $p = .001$), and PTE ($r = .38$, $p = .001$, see Table 22). Exploring it further we may say that conscientiousness explains 11% of the variance in the agreeableness trait and that the final project grade predicts the variance of 10% in the SMM, 14% in the MT, 23% in the MPM and 14% in the PTE. Moreover, strong positive correlations (Cohen, 1988) were found within the subscales of the TCE, namely connecting MT to SMM ($r = .76$, $p = .001$), MPM to SMM ($r = .7$, $p = .001$), MPM to MT ($r = .81$, $p = .001$), PTE to SMM ($r = .65$, $p = .001$), PTE to MT ($r = .78$, $p = .001$) and PTE to MPM ($r = .77$, $p = .001$, see Table 22).

Even though they were not statistically significant, some negative relationships were found linking the time-organisers' personality trait agreeableness with openness ($n = 86$, r = -.16), with SMM ($n = 86$, $r = -.04$), with MT ($n = 86$, $r = -.05$), with MPM ($n = 86$, $r = -.05$), and with final project grade ($n = 86$, $r = -.09$, see Table 22).

Table 22

Correlation between the perceived teamwork result and the personality traits of the time-organisers

	Personality traits										Perceived teamwork result							
	1		2		3		4		5		6		7		8		9	
Items	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*
Personality traits																		
(1) Extraversion																		
(2) Agreeableness	86	.05																
(3) Conscientiousness	86	.07	86	**.33****														
(4) Emotional stability	87	**.23***	86	.18	86	**.26***												
(5) Openness	87	.19	86	-.16	86	.05	87	.02										
Perceived teamwork result																		
(6) SMM	87	-.04	86	-.04	86	.11	87	.09	87	.10								
(7) MT	87	.02	86	-.05	86	.20	87	.13	87	.21	91	**.76*****						
(8) MPM	87	.07	86	-.05	86	.16	87	**.23***	87	.2	91	**.70*****	91	**.81*****				
(9) PTE	87	.00	86	.02	86	.08	87	.17	87	.07	91	**.65*****	91	**.78*****	92	**.77*****		
(10) Final project grade	87	**.28****	86	-.09	86	.05	87	.16	87	**.27***	91	**.32****	91	**.38*****	92	**.48*****	92	**.38*****

*** $p < .001$, ** $p < .01$, * $p < .05$

Note: The numbers in the third row correspond to the items listed in the first column.

The relationship between the perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) and the personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the time-organisers in the Computer Science major was explored using a *Pearson Product-Moment Correlation Coefficient*. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the analysis.

There were statistically significant moderate positive relationships (Cohen, 1988) linking the Computer Science time-organisers' personality trait of conscientiousness with agreeableness ($r = .4$, $p = .01$), emotional stability with extraversion ($r = .32$, $p = .05$), and relating the final project grade with the time-organisers' personality trait of extraversion ($r = .40$, $p = .01$) and with the subscale SMM ($r = .48$, $p = .001$, see Table 23). A statistically significant strong positive relationships (Cohen, 1988) was found connecting not only the personality trait emotional stability with agreeableness ($r = .54$, $p = .001$) and with conscientiousness ($r = .54$, $p = .001$, see Table 23), but also within the subscales of the TCE, namely connecting MT with SMM ($r = .82$, $p = .001$), MPM with SMM ($r = .58$, $p = .001$), MPM with MT ($r = .69$, $p = .001$), PTE with SMM ($r = .71$, $p = .001$), PTE with o MT ($r = .79$, $p = .001$) and PTE with MPM ($r = .81$, $p = .001$, see Table 23). Exploring it further it seems that conscientiousness predicts 16% of the variance in the agreeableness, emotional stability explains the variance of 10% in the extraversion, 29% in the agreeableness trait, and another 29% in the conscientiousness trait. Moreover, the final project grade predicts 23% of variance in the SMM.

Table 23

Correlation between the perceived teamwork result and the personality traits of the time-organisers, in the Computer Science major

	Personality traits										Perceived teamwork result							
	1		2		3		4		5		6		7		8		9	
	n	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*
Personality traits																		
(1) Extraversion																		
(2) Agreeableness	42	.06																
(3) Conscientiousness	42	.16	42	**.4****														
(4) Emotional stability	42	**.32***	42	**.54*****	42	**.54*****												
(5) Openness	42	.10	42	-.24	42	-.18	42	.04										
Perceived teamwork result																		
(6) SMM	42	-.02	42	.00	42	.17	42	-.07	42	.07								
(7) MT	42	.22	42	.03	42	.24	42	.09	42	.10	44	**.82*****						
(8) MPM	42	.24	42	.11	42	.25	42	.16	42	.19	44	**.58*****	44	**.69*****				
(9) PTE	42	.21	42	.24	42	.23	42	.16	42	.09	44	**.71*****	44	**.79*****	44	**.81*****		
(10) Final project grade	42	**.40****	42	-.09	42	.18	42	.08	42	.30	44	**.48*****	44	**.55*****	44	**.65*****	44	**.56*****

*** $p < .001$, ** $p < .01$, * $p < .05$

Note: The numbers in the third row correspond to the items listed in the first column.

A *Pearson Product-Moment Correlation Coefficient* was conducted to test the relationship between the perceived teamwork result (SMM, MT, MPM, PTE, final project grade) and the personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the time-organisers in the Psychology major. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the test results.

Statistically significant moderate positive relationships (Cohen, 1988) were found not only linking the Psychology time-organisers' personality trait openness with MT (r = .38, p = .05), openness with MPM (r = .3, p = .05), conscientiousness with MPM (r = .49, p = .001), but also connecting the final project grade with emotional stability (r = .34, p = .05) and with openness (r = .36, p = .05, see Table 24). There were strong positive relationships connecting conscientiousness with SMM (r = .51, p = .001), with MT (r = .62, p = .001), and with PTE (r = .52, p = .001), as well as within the subscales of the TCE connecting MT with SMM (r = .69, p = .001), MPM with SMM (r = .74, p = .001), MPM with MT (r = .86, p = .001), PTE with SMM (r = .51, p = .001), PTE with MT (r = .74, p = .001) and PTE with MPM (r = .70, p = .001, see Table 24). Exploring it further it seems that the time-organisers' personality trait of openness explains the variance of 14% in the MT, 9% in the MPM, and 13% in the final project grade, meanwhile his/her conscientiousness trait predicts the variance of 26% in the SMM, 38% in the MT, 24% in the MPM, and 27% in the PTE. Moreover, the time-organiser' emotional stability seems to explain the variance of 12% in the final project grade.

Table 24

Correlation between the perceived teamwork result and the personality traits of the time-organisers, in the Psychology major

	Personality traits										Perceived teamwork result									
	1		2		3		4		5		6		7		8		9			
	n	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*		
Personality traits																				
(1) Extraversion																				
(2) Agreeableness	44	.05																		
(3) Conscientiousness	44	-.06	44	.11																
(4) Emotional stability	45	.14	44	-.17	44	.11														
(5) Openness	45	.29	44	-.13	44	.25	45	.02												
Perceived teamwork result																				
(6) SMM	45	-.06	44	.04	44	**.51*****	45	.17	45	.22										
(7) MT	45	-.13	44	-.02	44	**.62*****	45	.12	45	**.38***	47	**.69*****								
(8) MPM	45	-.08	44	-.09	44	**.49*****	45	.26	45	**.3***	47	**.74*****	47	**.86*****						
(9) PTE	45	-.2	44	-.01	44	**.52*****	45	.11	45	.17	47	**.51*****	47	**.74*****	48	**.7*****				
(10) Final project grade	45	.01	44	.01	44	.08	45	**.34***	45	**.36***	47	-.02	47	.19	48	.2	48	-.02		

*** $p < .001$, ** $p < .01$, * $p < .05$

Note: The numbers in the third row correspond to the items listed in the first column.

Hypothesis H3 has been partially confirmed, as not all items of the personality traits of the time-organisers are positively associated with the perceived teamwork result. The main factors that seem to influence the perceived teamwork result in the Computer Science major are extraversion which seems to explain 16% of the variance of the final project grade ($r = .40$, $p = .01$, see Table 23), and SMM, which tends to predict 23% of the variance of the final project grade ($r = .48$, $p = .001$, see Table 23). Yet, in the Psychology major, the personality trait conscientiousness seems to be the strongest influencer, accounting for 26% of the variance in the SMM ($r = .51$, $p = .001$), 38% in the MT ($r = .62$, $p = .001$), 24% in the MPM ($r = .49$, $p = .001$), and 27% in the PTE ($r = .52$, $p = .001$, see Table 24).

3.3.4. H4. The perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) is significantly correlated with the personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the non-time-organisers.

A *Pearson Product-Moment Correlation Coefficient* was conducted to evaluate whether there was a relationship between the perceived teamwork result (SMM, MT, MPM, PTE, final project grade) and the personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the non-time-organisers. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the test results.

As an overall analysis including the personality self-perception of the non-time-organisers from both majors, a statistically significant small positive relationship was

uncovered (Cohen, 1988) not only linking the time-organisers' personality traits of emotional stability with extraversion (r = .29, p = .05), and with agreeableness (r = .29, p = .05, see Table 25), but also a statistically significant moderate positive relationship (Cohen, 1988) between openness and extraversion (r = .34, p = .01, see Table 25). A statistically significant small negative correlation connecting the personality trait of agreeableness with the final project grade (r = -.23, p = .05, see Table 25) was also found. Nevertheless, the personality traits of the non-time-organisers seem to not be statistically significant related with the subscales of the TCE (SMM, MT, MPM nor PTE, see Table 25).

Table 25

Correlation between the perceived teamwork result and the personality traits of the non-time-organisers

	Personality traits									
	1		2		3		4		5	
Items	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*
Personality traits										
(1) Extraversion										
(2) Agreeableness	75	.2								
(3) Conscientiousness	75	**.27***	74	.00						
(4) Emotional stability	74	**.29***	73	**.29***	73	.13				
(5) Openness	74	**.34****	73	-.08	73	.21	73	.09		
Perceived teamwork result										
(6) SMM	75	.07	74	-.1	74	-.08	74	.11	74	-.11
(7) MT	75	.14	74	-.05	74	-.08	74	.08	74	-.08
(8) MPM	76	.1	75	-.07	75	.01	74	.13	74	-.05
(9) PTE	76	.1	75	.1	75	-.03	74	.08	74	-.05
(10) Final project grade	76	.13	75	**-.23***	75	.17	74	.03	74	.1

** $p < .01$, * $p < .05$

Note: The numbers in the third row correspond to the items listed in the first column.

A *Pearson Product-Moment Correlation Coefficient* was used to explore the relationship between the perceived teamwork result (SMM, MT, MPM, PTE, final project grade) and the personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the non-time-organisers in the Computer Science major. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the analysis. No statistically significant relationships were found linking the Computer Science non-time-organisers' personality traits with the subscales of the TCE (SMM, MT, MPM, PTE), nor with the final project grade (see Table 26).

Table 26

Correlation between the perceived teamwork result and the personality traits of the non-time-organisers, in the Computer Science major

	Personality traits									
	1		2		3		4		5	
Items	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*
Personality traits										
(1) Extraversion										
(2) Agreeableness	35	.14								
(3) Conscientiousness	34	.11	34	.06						
(4) Emotional stability	35	.23	35	.29	34	.20				
(5) Openness	35	.29	35	-.05	34	.07	35	.23		
Perceived teamwork result										
(6) SMM	35	.16	35	-.05	34	-.02	35	.11	35	.11
(7) MT	35	.30	35	-.02	34	.13	35	.18	35	.11
(8) MPM	35	.24	35	.06	34	-.01	35	.10	35	.14
(9) PTE	35	.19	35	.2	34	.17	35	.12	35	.20
(10) Final project grade	35	.25	35	-.27	34	.21	35	.00	35	.18

Note: The numbers in the third row correspond to the items listed in the first column.

The relationship between the perceived teamwork result (SMM, MT, MPM, PTE, final project grade) and the personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the non-time-organisers in the Psychology major was explored using a *Pearson Product-Moment Correlation Coefficient*. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the analysis.

There were statistically significant moderate positive relationships (Cohen, 1988) linking the Psychology non-time-organisers' personality trait extraversion with conscientiousness ($r = .36$, $p = .05$) and with emotional stability ($r = .38$, $p = .05$, see Table 27). However, no statistically significant relationships were found linking the Psychology non-time-organisers' personality traits with the subscales of the TCE (SMM, MT, MPM nor PTE), nor with the final project grade (see Table 27).

Table 27

Correlation between the perceived teamwork result and the personality traits of the non-time-organisers, in the Psychology major

	Personality traits									
	1		2		3		4		5	
Items	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*	*n*	*r*
Personality traits										
(1) Extraversion										
(2) Agreeableness	40	.22								
(3) Conscientiousness	41	**.36***	40	-.12						
(4) Emotional stability	39	**.38***	38	.31	39	.09				
(5) Openness	39	.3	38	-.22	39	.26	38	-.01		
Perceived teamwork result										
(6) SMM	40	.17	39	-.06	40	.01	39	.11	39	-.08
(7) MT	40	.16	39	.00	40	-.12	39	-.02	39	-.05
(8) MPM	41	.16	40	-.11	41	.17	39	.14	39	-.01
(9) PTE	41	.27	40	.17	41	.00	39	.02	39	.00
(10) Final project grade	41	.04	40	-.08	41	.28	39	.09	39	.18

* $p < .05$

Note: The numbers in the third row correspond to the items listed in the first column.

Hypothesis H4 has been partially confirmed, as there are no statistically significant correlations between the personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the non-time-organisers and the perceived teamwork result (SMM, MT, MPM, PTE, final project grade). Only one statistically significant small negative correlation was found, connecting the personality trait of agreeableness with the final project grade ($r = -.23$, $p = .05$, see Table 25), when the test was applied to all students.

3.3.5. H5. Time-organisers perceive team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) more positively than non-time-organisers

To evaluate whether time-organisers perceive team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) more positively than non-time-organisers, a *Wilcoxon Test* and a paired samples *t*-test were made, the first to explore the relationship between TCE and the time-organisers, as the distribution is not normal and it is a small group ($n =< 17$), and the *t*-test to evaluate the relationship between TCE and the non-time-organisers that, even though not normally distributed, has a larger sample (30+), which according to Gravetter and Wallnau should not cause any major problems to the use of parametric tests.

Results indicate that there was no statistically significant difference of the perceived TCE (SMM, MT, MPM, PTE) for the time-organisers (To), nor for the non-time-organisers (N-To, see Table 28). Although not statistically significant, in the Post-test time-organisers achieved a higher level in the SMM subscale ($M_{To} = 8.31$, $SD_{To} = 0.09$, $M_{N\text{-}To} = 7.99$, $SD_{N\text{-}To} = 1.28$, see Table 28), but got lower levels for all the other items (MT: $M_{To} = 7.94$, $SD_{To} = 1.7$; $M_{N\text{-}To} = 8.06$, $SD_{N\text{-}To} = 1.27$; MPM: $M_{To} = 7.63$, $SD_{To} = 1.73$, $M_{N\text{-}To} = 7.89$, $SD_{N\text{-}To} = 1.33$; and PTE: $M_{To} = 7.96$, $SD_{To} = 1.4$, $M_{N\text{-}To} = 8.12$, $SD_{N\text{-}To} = 1.25$, see Table 28).

Table 28

TCE scores by role within the team

	Time-organiser *n* = 17				Non-time-organiser *n* = 69				
	Pre-test	Post-test			Pre-test	*Post-test*			
TCE items	*M* (*SD*)	*M* (*SD*)	*Z*	*p*	*M* (*SD*)	*M* (*SD*)	*t*	*df*	*p*
SMM	7.76 (1.04)[a]	8.31 (0.09)[b]	-1.65	.10	8.01 (1.11)[c]	7.99 (1.28)[c]	0.07	56	.94
MT	8.39 (1.06)	7.94 (1.7)[b]	-0.94	.35	8.30 (1.19)[d]	8.06 (1.27)[d]	1.71	67	.09
MPM	7.67 (1.73)	7.63 (1.73)[b]	-0.28	.78	7.95 (1.19)	7.89 (1.33)	0.33	68	.74
PTE	7.69 (1.69)	7.96 (1.4)[b]	-0.09	.93	8.15 (1.33)	8.12 (1.25)	0.17	68	.86

[a] *n* = 15
[b] *n* = 16
[c] n = 57
[d] *n* = 68

When comparing the evaluation of the perceived team collaboration by time-organisers and non-time-organisers some differences are detected. Yet those differences are not statistically significant indicating that Hypothesis H5 cannot be confirmed.

3.3.6. H6. The time-organiser selection method may foresee the perceived teamwork effectiveness (final project grade, perceived team effectiveness), at the end of the semester.

A two-way between-groups analysis of variance (ANOVA) was conducted to explore the influence of the major (Computer Science, Psychology) and the time-organisers' selection method on the final project grade and on the subscale PTE. The test for normality, examining standardised skewness and the *Shapiro-Wilks* test suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996).

Regarding the final project grade, there was a statistically significant interaction effect [$F(3, 79) = 6.1$, $p = .001$] with an effect size ($\eta^2 = .19$), visible in Figure 8. Additionally, there was also a statistically significant main effect for the time-organisers' selection method [$F(4, 79) = 4.01$, $p = .01$], with effect size ($\eta^2 = .17$], meaning that the time-organisers' selection method might have a connection to the final project grade. *Post-hoc comparisons* using the *Tukey HSD test* indicated that the mean score for the time-organisers' selection method "Agreed by all team members" ($M = 17.86$, $SD = 1.48$) was significantly superior (Mean difference = 1.19, $SD = .35$, $p = .01$) to the selection method "Nominate by most of the team members" ($M = 16.67$, $SD = 1.93$). However, none of the remaining selection methods were statistically significant, namely "Offered him/herself" ($M = 16.80$, $SD = 1.1$), "Random Choice" ($M = 17.25$, $SD = 0.50$) or "Other" ($M = 17.50$, $SD = 0.71$).

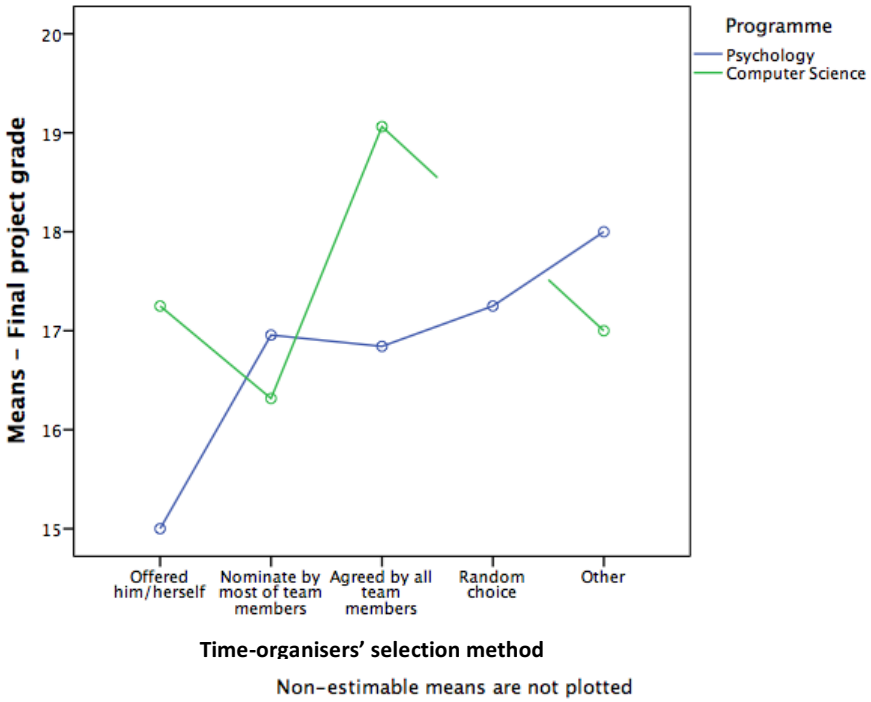

Figure 8. Relationship between the final project grade and the time-organisers' selection method, by major

With regard to the PTE, there was a statistically significant main effect for the time-organisers' selection method [$F(4, 79) = 6.17$, p = .001], with an effect size ($\eta 2 = .24$, see Figure 9). *Post-hoc comparisons* using the *Tukey HSD test* indicated once again that the mean score for the time-organisers' selection method "Agreed by all team members" ($M = 8.77$, $SD = 1.09$) was significantly superior (Mean difference = 1.04, $SD = .24$, $p = .001$) to the selection method "Nominate by most of the team members" ($M = 7.73$, $SD = 1.25$). However, none of the other selection methods were statistically significant, namely "Offered him/herself" ($M = 7.73$, $SD = 0.76$), "Random Choice" ($M = 7.42$, $SD = 1.75$) or "Other" ($M = 6.83$, $SD = 0.71$).

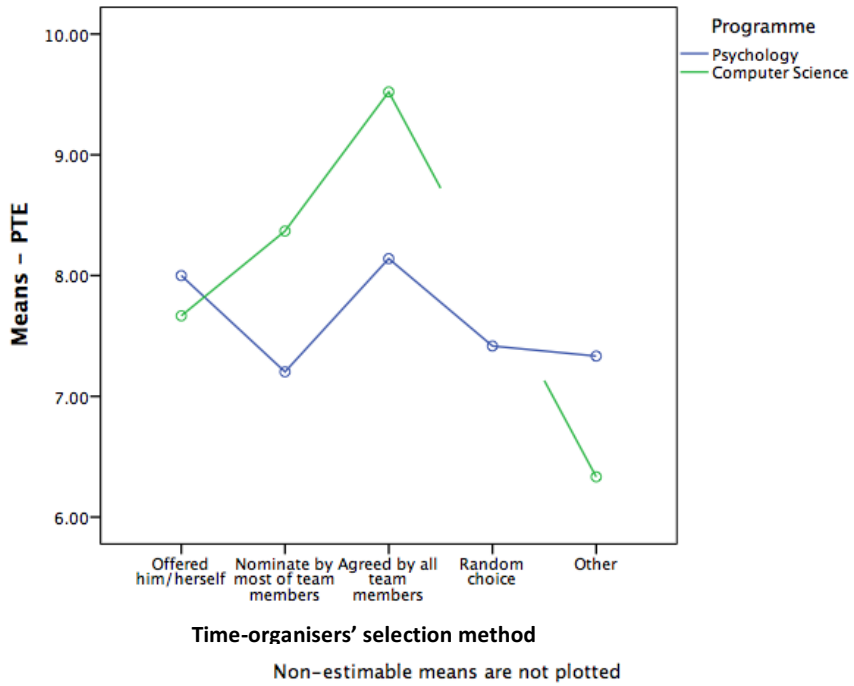

Figure 9. Relationship between the subscale PTE and the time-organisers' selection method, by major

A positive influence was found between the time-organisers' selection method "Agreed by all team members" versus the "Nominate by most of the team members", both for the final project grade and for the PTE, suggesting that the time-organisers' selection method might have foreseen the perceived teamwork effectiveness (final project grade, perceived team effectiveness). Hypothesis H6 has been confirmed.

3.3.7. H7. Older students have higher perceived team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) than younger students.

To evaluate whether TCE (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) was statistically significant related to students' age a *Kruskal-Wallis Test* was conducted (non-parametric measure). The ages were split into three age scales: up to 20 years old, from 21 to 25 years old and more than

25 years old. There was no statistically significant correlation between the age groups and TCE, for any of the subscales shared mental models, mutual trust, mutual performance monitoring nor for perceived team effectiveness, in the Pre-test or in the Post-test (see Table 29).

Table 29

Differences in the TCE, by age groups

TCE items	Up to 20 years old				From 21 to 25 years old				More than 25 years old				Pre-test		Post-test	
	Pre-test		Post-test		Pre-test		Post-test		Pre-test		Post-test					
	n	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	*n*	Mean Rank	X^2 (2)	*p*	X^2 (2)	*p*
SMM	37	42.82	47	44.61	27	39.44	29	48.14	15	34.03	15	46.23	1.60	.45	.33	.85
MT	46	49.12	47	42.98	30	41.72	29	50.74	16	47.94	15	46.3	1.47	.48	1.56	.46
MPM	46	49.53	47	43.85	30	44.62	30	49.85	16	41.31	15	48.1	1.36	.51	1	.61
PTE	46	46.55	47	41.2	30	49.63	30	51.12	16	40.47	15	53.87	1.24	.54	3.93	.14

There are no statistically significant differences between the group ages (up to 20 years old, from 21 to 25 years old, 25+ years old) and their evaluation of the TCE (shared mental models, mutual trust, mutual performance monitoring and perceived team effectiveness), consequently the Hypothesis H7 cannot be confirmed.

3.3.8. H8. Male students have higher perceived team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) than female students.

To evaluate whether perception of team collaboration (shared mental models, mutual trust, mutual performance monitoring and perceived team effectiveness) differs for gender (male , female) an independent-samples *t*-test was conducted. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the analysis.

There were statistically significant differences in the Post-test, not only in the SMM subscale (Females: $M = 7.69$, $SD = 1.2$; Males: $M = 8.32$, $SD = 1.17$; $t(89) = -2.53$, $p = .01$), with an effect size ($\eta^2 = .07$), but also in the MT (Females: $M = 7.78$, $SD = 1.43$; Males: $M = 8.33$, $SD = 1.18$; $t(89) = -1.99$, $p = .05$) with an effect size ($\eta^2 = .04$), and in the PTE (Females: $M = 7.79$, $SD = 1.28$; Males: $M = 8.43$, $SD = 1.21$; $t(90) = -2.44$, $p = .02$) with an effect size ($\eta^2 = .06$). However, there was no statistically significant difference in the Pre-test (see Table 30).

An overall look through the results suggests that females, in the Pre-test, consider themselves to have higher SMM and MPM than males (Females: $M_{SMM} = 7.97$, $SD_{SMM} = 1.28$, $M_{MPM} = 8.04$, $SD_{MPM} = 1.28$; Males: $M_{SMM} = 7.85$, $SD_{SMM} = 1.13$, $M_{MPM} = 7.52$, $SD_{MPM} = 1.44$), meanwhile males consider themselves to have higher MT and PTE than

females (Females: M_{MT} = 8.13, SD_{MT} = 1.34, M_{PTE} = 8.02, SD_{PTE} = 1.64; Males: M_{MT} = 8.47, SD_{MT} = 0.94, M_{PTE} = 8.05, SD_{PTE} = 1.33). By comparison, in the Post-test, females got lower TCE levels and males self-evaluated as having higher scores in all the TCE items (SMM: $M_{Pre\text{-}test}$ = 7.85, $SD_{Pre\text{-}test}$ = 1.13, $M_{Post\text{-}test}$ = 8.32, $SD_{Post\text{-}test}$ = 1.17; MPM: $M_{Pre\text{-}test}$ = 7.52, $SD_{Pre\text{-}test}$ = 1.44, $M_{Post\text{-}test}$ = 8.01, $SD_{Post\text{-}test}$ = 1.37; PTE: $M_{Pre\text{-}test}$ = 8.05, $SD_{Pre\text{-}test}$ = 1.33, $M_{Post\text{-}test}$ = 8.43, $SD_{Post\text{-}test}$ = 1.21), except for MT (MT: $M_{Pre\text{-}test}$ = 8.47, $SD_{Pre\text{-}test}$ = 0.94, $M_{Post\text{-}test}$ = 8.33, $SD_{Post\text{-}test}$ = 1.18, see Table 30), suggesting that females struggled more on teamwork than males.

Table 30

Perceived team collaboration, by gender

	Males n = 48		Females n = 44				
TCE items	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*
Pre-test							
SMM	7.85[b]	1.13	7.97[a]	1.28	0.47	77	.64
MT	8.47	0.94	8.13	1.34	-1.4	90	.17
MPM	7.52	1.44	8.04	1.28	1.81	90	.07
PTE	8.05	1.33	8.02	1.64	-0.11	90	.91
Post-test							
SMM	8.32	1.17	7.69	1.2	**-2.53**	89	.01
MT	8.33	1.18	7.78	1.43	**-1.99**	89	.05
MPM	8.01	1.37	7.73[c]	1.38	-0.98	90	.33
PTE	8.43	1.21	7.79[c]	1.28	**-2.44**	90	.02

[a] n = 38
[b] n = 41
[c] n = 45

After the teamwork was completed male students self-evaluated the TCE with higher levels than in the Pre-test, but female students were the other way around, lowering all scores, suggesting that, for female students, teamwork changed their SMM for the lower levels ($M_{Pre\text{-}test}$ = 7.97, $SD_{Pre\text{-}test}$ = 1.28, $M_{Post\text{-}test}$ = 7.69, $SD_{Post\text{-}test}$ = 1.2), MT ($M_{Pre\text{-}}$

$_{test}$ = 8.13, $SD_{Pre\text{-}test}$ = 1.34, $M_{Post\text{-}test}$ = 7.78, $SD_{Post\text{-}test}$ = 1.43), MPM ($M_{Pre\text{-}test}$ = 8.04, $SD_{Pre\text{-}test}$ = 1.28, $M_{Post\text{-}test}$ = 7.73, $SD_{Post\text{-}test}$ = 1.38) and PTE ($M_{Pre\text{-}test}$ = 8.02, $SD_{Pre\text{-}test}$ = 1.64, $M_{Post\text{-}test}$ = 7.79, $SD_{Post\text{-}test}$ = 1.28). Nonetheless, male students also scored in a lower level, in the Post-test, for mutual trust than in the Pre-test (MT: $M_{Pre\text{-}test}$ = 8.47, $SD_{Pre\text{-}test}$ = 0.94, $M_{Post\text{-}test}$ = 8.33, $SD_{Post\text{-}test}$ = 1.18, see Table 30).

Hypothesis H8 is confirmed as male students have higher perceived team collaboration than females students at the end of the semester, with this difference being statistically significant for the subscales shared mental models (Males: M = 8.32, SD = 1.17; Females: M = 7.69, SD = 1.2; $t(89) = -2.53$, p = .01), mutual trust (Males: M = 8.33, SD = 1.18; Females: M = 7.78, SD = 1.43; $t(89) = -1.99$, p = .05), and perceived team effectiveness (Males: M = 8.43, SD = 1.21; Females: M = 7.79, SD = 1.28; $t(90) = -2.44$, p = .02, see Table 30).

3.3.9. H9. The perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) is significantly correlated with the size of the team.

To evaluate whether there was a relationship between the perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) and the size of the team a *Pearson Product-Moment Correlation Coefficient* was conducted. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to the use of parametric tests.

As an overall analysis including data from both majors, statistically significant small negative relationships were disclosed (Cohen, 1988) linking the size of the team

with SMM (r = -.27, p = .01), and with MT (r = -.22, p = .05, see Table 31), seeming to explain 7% and 5% of its variance, respectively. There was a statistically significant medium size negative correlation between the size of the team and PTE (r = -.32, p = .01, see Table 31) that explains 10% of the variance.

The relationship between the perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) and the size of the team in the Computer Science major was explored using a *Pearson Product-Moment Correlation Coefficient*. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996). There was a statistically significant moderate positive relationship (Cohen, 1988) linking the size of the team with the final project grade (r = .4, p = .01, see Table 31), that is, the size of the team predicts 16% of the variance in the final grade in the Computer Science major.

A *Pearson Product-Moment Correlation Coefficient* was conducted to test the relationship between the perceived teamwork result (SMM, MT, MPM, PTE, final project grade) and the size of the team in the Psychology major. The test for normality, examining standardised skewness and the *Shapiro-Wilks test* suggested violation of the assumption of normality however, taking into consideration that the sample is large enough (30+), this disrespect should not cause any major problems (Gravetter & Wallnau, 2000; Stevens, 1996) to test results. A statistically significant strong positive relationship (Cohen, 1988) was found, having the size of the team explaining 37% of the variance in the final project grade (r = .61, p = .001, see Table 31).

Even though not being statistically significant, it seems that Computer Science students perceived a positive relationship between the size of the team and the TCE items,

suggesting that bigger groups have higher level of self-perceived team collaboration, while Psychology students had negative correlations, indicating that smaller teams were more appreciated.

Table 31

Correlation between the perceived teamwork result and the size of the team, by major

	Global results		CS		Psy	
	1		1		1	
Team characteristic	*n*	*r*	*n*	*r*	*n*	*r*
(1) Size of the team						
(2) SMM	91	**-.27****	44	.21	47	-.14
(3) MT	91	**-.22***	44	.17	47	-.04
(4) MPM	92	-.18	44	.23	48	.00
(5) PTE	92	**-.32****	44	.16	48	-.09
(6) Final project grade	99	.09	49	**.4****	50	**.61*****

*** $p < .001$, ** $p < .01$, * $p < .05$

Note: The numbers in the third row correspond to the items listed in the first column.

Hypothesis H9 is partially confirmed, as not all items of the TCE were associated with the size of the team. It seems that bigger teams lead to higher grades, both in the Computer Science major, where a moderate positive correlation (Cohen, 1988) was found ($r = .4$, $p = .01$, see Table 31) and in the Psychology major, where a strong positive correlation was disclosed ($r = .61$, $p = .001$, see Table 31). Nonetheless, in an overall analysis, these relationships cannot be detected, but new ones arise indicating a negative connection between the size of the teams and the self-perceived team collaboration score, namely small negative relationships (Cohen, 1988) not only linking the size of the team with SMM ($r = -.27$, $p = .01$), and with MT ($r = -.22$, $p = .05$), but also a medium size negative correlation among size of the team and PTE ($r = -.32$, $p = .01$, see Table 31).

4. Discussion

4. Discussion

In this chapter the results will be discussed, taking into consideration the aim of this study which is to explore how teamwork done at HEIs can help students improve their personal proficiency competence cluster, namely explore empirically the perception of teamwork and personality, with two classes of students, using a pre- and post-test. Firstly, some of the research constrains will be reported to frame the discussion that will follow and secondly each hypothesis will be discussed, presenting the results and linking them to previous investigations, as well as to other connected findings in this study.

We have focused specifically on understanding the differences that scientific background, personality, sociodemographic characteristics, and team attributes may place on the perception of team collaboration. It was discovered that teamwork seems to be influenced by the scientific background of the students, by some personality traits of the time-organiser, some personality traits of the non-time-organiser, by the selection method of the time-organiser, by gender, and by the size of the team.

There are several factors that might have influenced the team dynamics and biased these findings. Students came from the two diverse scientific backgrounds of exact sciences/engineering (Computer Science students from the School of Exact Sciences and Engineering) and humanities (Psychology students from the School of Arts and Humanities). Moreover, the data was collected from students on a course taught in the 3rd year (Artificial Intelligence) and another in the 2nd year (Cognitive Psychology). Furthermore, the sample involves participants with different age ranges and, consequently,

distinctive maturity levels and cognitive stages, that should be considered when discussing the results. Finally, the teamwork assignment was connected with their scientific field, thus the nature of the task was singular to each major. Computer Science students were asked to assemble a robot, program it to do a specific task, and write a report, while Psychology students were asked to research a specific subject related to cognitive psychology, prepare a presentation about it, and write a report.

Reliability analyses were applied to confirm the construct of the scales BFI-10 and TCE, as a result the BFI-10 showed low internal consistency in the evaluation of the perceived personality of the time-organisers by the non-time-organisers (Cronbach α = .45). The BFI-10 applied to the perceived-personality of the time-organiser (Cronbach α = .80), the BFI-10 applied to the perceived personality of the non-time-organiser (Cronbach α = .71) and the TCE (Cronbach α = .90) revealed good internal consistency. Moreover, in this study the non-time-organisers assessed the time-organisers' perceived personality using the BFI-10, although its reliability has not been proved for hetero-evaluations. Consequently, conclusive inferences cannot be taken with the perception of the personality of the time-organiser by the non-time-organisers, as is included in Hypothesis H4.

4.1. Analysis of the hypothesis

This section will go through each of the defined hypotheses discussing its results, and giving suggestions as to what might be done to improve teamwork results.

H1. The perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) can be positively associated with the scientific field that students are from.

Results uncovered a positive association of the perceived teamwork result with the scientific field that students are from, and it was found that Computer Science students seem to have a higher self-perception of their teamwork results and have higher grades than Psychology students. This seems to be not only because the score of Computer Science students on the subscale of perceived team effectiveness is closer to the final project grade given by the professors (see Figure 7 and Table 10), but also because their average grade at the end of the team project is higher. The final project grade given by the professors and the data from the repeated-measures analysis of variance (ANOVA) of students' perceived team collaboration both support this conclusion.

The fact that Computer Science students have a higher self-perception of their teamwork collaboration might be connected to the nature of the assignment, as it may be easier to assess whether the main goal of the project was achieved or not (Does the robot perform the task in the intended manner?). However, this may also be explained by the age and/or maturity of the students, as being older and probably more experienced may lead them to a better understanding of team collaboration. Other factors that might also underpin these findings are the personality of the team members or team leadership that might have positively influenced the team dynamics. Further research should be conducted to explore these relationships.

Psychology students had a very positive perception of their teamwork collaboration in the Pre-test, but their results decreased considerably in the Post-test, which might be related to their younger age, different maturity level, or the nature of the assignment. As suggested by Resick et el. (2010) teams with a higher shared perception of

the task demands adopt more efficient strategies, leading to faster decisions, which stresses the influence of the task in teamwork results. These might even be related with team leadership, as these time-organisers did not establish a statistically significant correlation between perceived teamwork result and the personality trait extraversion which is considered to be related with effective leadership (Judge et al., 2002). This will be explained in Hypothesis H3.

Gender may also provide an explanation, as most of the Psychology students are women and, as argued by Ro and Choi (2011), male students weigh the dynamics and performance of their team more positively than females. Therefore, the lower results of the Psychology students in the TCE may be related to the biased perception that females usually have towards their own performance (Gallos, 1995; Scheuneman, 1997).

The size of the team might provide an explanation to the fact that Computer Science students increased their TCE levels in the Post-test. As Rollinson et al. (1998) argued, large groups have a tendency to split into factions, which can lead to intra-group conflict, while smaller groups are often cohesive and more effective. Robbins et al. argues that group performance is connected with cohesiveness. Thus, Computer Science students belonged to smaller groups which might explain why they became a more cohesive and, consequently, more effective team. However, in Hypothesis H9 of this study, the relationship linking size of the team with results is explored and findings show that bigger teams have higher grades.

In a broad analysis, a correlation between perceived team effectiveness and final project grade was found, suggesting that students and professors have similar perceptions over the teamwork result. In a detailed analysis, it was also found that this correlation is positive and large for the Computer Science students, suggesting that the higher grades

given by the professor are to the students that have higher levels of perceived team effectiveness.

For the Psychology students, even though this correlation is not statistically significant, it is negative suggesting that the students who have higher grades are those that self-perceived as less effective. But this finding might be connected to the fact that the Psychology major has a high rate of females and, as argued by Scheuneman (1997), women tend to, in formal contexts, under-evaluate their performance and learning abilities. Moreover, Gallos work might also provide an explanation, as she suggests that women have stronger requirements for support, requesting faculty intervention to decrease fear, self-doubt, and loss of confidence. Therefore, I envisage that faculty, leaders and any other individuals dealing with women, should pay special attention to the females on their teams, giving them regular support to overcome their fears and lack of confidence, helping them to have a more realistic perception of their performance and competencies.

The nature of the task, the age, maturity level, personality of the team members or leadership might also influence this negative correlation between final project grade and perceived team effectiveness. Further studies should explore these factors. Results seem to suggest that Computer Science students performed higher when working in teams, and have a higher self-perception of their performance, which might enhance their personal proficiency competence cluster and, consequently, might improve their employability (Pavlin et al., 2009), accomplishing one of the goals of the Bologna process.

Hypothesis H1 is confirmed, as the findings show that students from the Computer Science scientific field have a more positive perception of their teamwork result. Further studies should be conducted to explore the differences in teamwork between scientific fields, considering on factors such as age, maturity level, gender and nature of the task.

H2. The perception of team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) can be higher at the end of the semester.

In this study, the perception of team collaboration was not higher at the end of the semester, as lower scores were registered in the subscales of mutual trust and mutual performance monitoring. In spite of this, when checking the results by major, statistically significant differences were found with large effects for the Computer Science students on the subscales of shared mental models, mutual performance monitoring and perceived team effectiveness. Conversely, Psychology students had a statistically significant decrease on the perceived team collaboration scale.

Mutual trust is one of the subscales of the TCE and the lack of it might be the main failure factor against team effectiveness (Lewicki & Bunker, 1996; Mach et al., 2010; Peterson & Behfar, 2003; Robbins et al., 2010). In this study, mutual trust was the only subscale where Computer Science students did not evolve (i.e. kept the same level in the Pre-test and Post-test), whereas Psychology students' perception decreased.

Fransen (2012) describes the development of mutual trust levels at an early stage of the collaboration as conditional for developing shared mental models that will help team collaboration. Psychology students had, at an early stage (Pre-test), high levels of mutual trust, nevertheless their self-perceived shared mental model levels decreased in the Post-test. This decrease might have damaged team collaboration, as groups with low mutual trust usually demonstrate task and relationship conflicts and these negatively affect performance (De Dreu & Weingart, 2003). The perceived levels of mutual trust for the Computer Science students were constant and this might explain the higher level of perception of team collaboration.

Hinsz (1995) and Rentsch et al., (1994) found that prior experiences may affect team development, especially in educational settings, where it is common for individuals to have met already and worked together on other assignments (Fransen, 2012). This might explain the fact that in the Pre-test, shared mental models of all students were already at a high level, suggesting that the team had gone through a rapid group development such as the TEAM model advocates (Morgan et al., 1993).

Computer Science students' perceptions revealed improvements in the shared mental models over time and this may have contributed to the improved results that were achieved at the end of the semester. This confirms previous findings that shared mental models facilitate the processes of setting goals, establishing strategies, monitoring team processes, and communicating effectively (Davies, 2009; Klimoski & Mohammed, 1994; Salas et al., 2005; Van den Bossche, 2006; Van den Bossche et al., 2006), leading to stronger team collaboration scores (Davies, 2009; Fransen, 2012; Klimoski & Mohammed, 1994; Salas et al., 2005; Van den Bossche et al., 2006).

The fact that Psychology students decreased their shared mental models may be related to the lower level of perceived mutual trust that might have spoiled the team dynamics. However other factors like age, maturity, or nature of the task might be in the genesis of this decline. The reasons for this decrease should be explored in further studies.

This study discovered that Computer Science students increased their perception of mutual performance monitoring and perceived team effectiveness over time. Researchers (Fransen, 2012; Porter et al., 2010; Salas et al., 2005) suggest that mutual performance monitoring is crucial to a team's achievements, which might explain the positive results claimed by the Computer Science students. Conversely, Psychology students also experienced a decrease in these items, which again might be connected with the lack of

mutual trust, age differences, gender, maturity levels, or nature of the task. Further work should be conducted to explore these factors.

Wegerif (1998) relates poor team performance with the lack of time to engage with peers and to create a sense of community, nevertheless this should not be an explanation in this study's results as all teams had similar time deadlines, but different results. Minnaert et al. (2011) argues that in learning teams the perceived satisfaction of individual needs is important, as it might severely impact the collaborative work, and explain some of the results in this study. In this research data related with the team members' needs was not collected, but this factor should be considered and explored in future studies.

A positive relationship linking the TCE subscales with the final project grades was found, advocating that teams with higher levels in the Team Collaboration Evaluator achieve higher grades, supporting Fransen's conclusions. Furthermore, findings seem to indicate that the final project grade can be predicted as 10% by shared mental models, 14% by the mutual trust, 23% by mutual performance monitoring, and 14% by perceived team effectiveness.

Hackman argues that learning teams' effectiveness is expressed by the quality of the group results hence, as in this study the grades given by the professors varied from 12 to 20 (out of 20), we might consider the teams as effective. However, the results could have been even better if the students had improved their team collaboration, as these two factors correlate. Therefore, professors should help the students in the development of shared mental models, mutual trust, mutual performance monitoring, and perceived team effectiveness, as it might be a predictor of the final project grade.

The fact that Psychology students decreased their self-perception in all the TCE subscales might be connected with team leadership, as will be explained in Hypothesis H3. Psychology time-organisers did establish a statistically significant relationship linking

perceived teamwork result with the personality traits connected with leadership (consciousness and openness, Robbins et al., 2010), but not with the one connected to effective leadership (Judge et al., 2002). This might have influenced the perceived teamwork result.

Hypothesis H2 is partially confirmed, as not all the TCE subscales improved at the end of the semester. However, this was true for the subscales of shared mental models, mutual performance monitoring, and perceived team effectiveness for the Computer Science students.

H3. The perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) can be positively associated with the personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the time-organisers.

As the result of a broad analysis, a positive correlation linking the time-organisers' personality trait emotional stability with the mutual performance monitoring subscale was found, suggesting that time-organisers who are more emotionally stable will positively influence the mutual performance monitoring perceptions of the team members. Furthermore, positive relationships were found linking the final project grade with extraversion and with openness, suggesting that time-organisers who were more extravert and more open might lead their teams to higher grades. These results support Matzler et al's. findings on the connection of extraversion and openness with the willingness to share knowledge, but also Judge et al's. (2002) work on the fact that extraversion is the most distinctive trait of effective leaders. Moreover, conscientiousness and openness are the personality traits that time-organisers self-perceived as being of a higher level, confirming the strong and consistent relationship that the personality traits conscientiousness and

openness have with leadership (Robbins et al., 2010). Professors should identify among their students those with higher levels of extraversion as they might be the best fit to lead effective teams. This same recommendation can be taken by anyone that needs to select a leader.

Despite the fact that in this study the time-organiser was never clearly identified as leader, his/her role was to influence the group and help them to do the assigned task, which might be connected to Robbins et al's. concept of leadership "to influence a group toward the achievement of a vision or set of goals". Moreover, the students also seem to have acknowledged this, as they frequently refer to the time-organiser as their leader.

Negative correlations were found linking the time-organiser personality trait agreeableness with shared mental models, mutual trust, mutual performance monitoring, and with final project grade. This suggests that the less agreeable the time-organiser, the higher results the team has, both on the TCE scale and in the final project grade. This might also explain the results of Hypothesis H2, as the Psychology time-organisers experienced an increment in the agreeableness trait over time.

After the teamwork, Computer Science time-organisers, considered themselves more open, but less extravert, less agreeable, less conscious and less emotionally stable, suggesting that teamwork changed the way they perceived their own personality. Psychology time-organisers also perceived themselves as less conscious and less emotionally stable, but more extravert, more agreeable and less open. These findings may be justified by the demands of the teamwork, as time-organisers are under great pressure to meet the deadline and facilitate their peers' performance. This might have created some stressful situations within the team (Hogg et al., 2004), thus the decrease in the traits of conscientiousness and emotional stability.

A positive correlation linking the final project grade with the extraversion trait of the Computer Science time-organisers was found suggesting that, for those students, the more extrovert the time-organiser, the higher the grades the team will achieve. This supports the findings of Judge et al. (2002) about the connection between extraversion and effective leadership.

Psychology time-organisers revealed a link between consciousness, openness and emotional stability on the TCE scale with the final project grade, indicating that the more conscious, open and emotionally stable the time-organiser is, the higher results the team might get. This confirms the reports of Robbins et al. that consciousness and openness are connected to leadership. However, effective leadership is connected with the personality trait extraversion (Judge et al., 2002), where it seems that the more extravert the leader is, the better the potential result achieved by the team. However, this relation was not found in the Psychology time-organisers, as they revealed a negative correlation between extraversion and perceived teamwork result, not supporting the research of Judge et al. (2002). This may also provide an explanation for Hypothesis H1 and Hypothesis H2, namely for the decrement in the perceived TCE scale for the Psychology students. Further studies should explore the connection between time-organiser extraversion trait and perceived teamwork result so as to confirm if Judge et al. (2002) findings apply to learning teams.

Professors should consider helping students to develop the personality traits extraversion, conscientiousness and openness, as it might improve the leadership skills of the student. This will also contribute to the fulfilment of the Bologna Process goals, namely the improvement of the personal proficiency competence cluster and consequently students' employability (Pavlin et al., 2009).

Non-time-organisers perceived differences in the time-organisers' personality over time, viewing them in the Post-test, as more agreeable, more conscious, more open, and less extravert. However, Computer Science students perceive their time-organisers over time as more emotionally stable, and Psychology students perceive the time-organisers as less emotionally stable. An explanation for these findings may be related to the fact that during teamwork the time-organiser is under strong scrutiny and, possibly as a result of the tension of solving team problems, becomes more reserved and less social. This would support the Hogg et al. findings that in a stressful situation, contingency strategies can be developed, regularly resulting in the emergence of a type of centralised leadership.

Most of the students recognised the importance of having a time-organiser in the team, with the Psychology non-time-organisers being more consensual with this finding. This confirms previous work about the positive effects of leadership on team efficiency (Henry & Stevens, 1999; Shimazoe & Aldrich, 2010; Sivasubramaniam et al., 2002; Strijbos et al., 2004), and seems to rejects some researcher projects that presented negative connections of leadership with learning/problem solving teams (Cummings & Cross, 2003; Durham et al., 1997; Johnson et al., 2002; Kayes, 2004).

The time-organiser was shown to be important in team cohesion, as according to non-time-organisers feedback, he/she played a crucial role in the teamwork organisation and development, but also in maintaining the relationships within the team. Time-organisers second the idea that they helped team cohesion, as they claimed to have had an important part in making the organisation/distribution of the tasks easier, less chaotic and, consequently, the outcomes were better. Moreover, the time-organiser was shown to have helped the team dynamics as, considering the non-time-organisers feedback, they dealt with problems and called students' attention to the deadlines, giving the opportunity for the non-time-organisers to truly focus on their tasks. Furthermore, the time-organiser made

the team members feel more pressured to meet the goals and deadlines, allowing them to surpass the initial expectations.

Time-organisers agreed that they played an important part in the team dynamics, as having a clearly identified time-organiser helped with the communication, but they also claim to have had a crucial role in peer motivation and happiness, thereby facilitating team collaboration. Thus, the time-organiser had tasks that went beyond the interventions required when conflict occurs, which seem to not confirm Fransen's (2012) findings that, in learning teams, the leader works as a coordinator, being required only when stressful situations arise. Rollinson et al. (1998) argues that leadership in learning teams is not critical for merging/synchronising personal contributions, and ensuring that members understand their interdependence, as all the individuals are expected to participate equally through discourse and negotiation. However, this is not confirmed by the student feedback, as they revealed that the time-organiser played an important role in the distribution of the tasks and ensuring that all team members met the deadlines.

Yet, more than one third of the students consider that they would have achieved the same result without a formally appointed time-organiser, suggesting that the time-organiser would be dispensable. Still, going through the student feedback to justify the answer, the most frequent explanation is that, if the time-organiser was not formally appointed, someone in the team will take that role. Some students replied to the survey acknowledging that the presence of the time-organiser was not significant. However, they seem to recognise its importance and it seems to be common for them to have a team member taking the role of time-organiser, even when it is not formally requested. This suggests that, based on their prior teamwork experience, these students agree on the relevance of the time-organiser's role, giving some support to Fransen's (2012) findings that under stressful conditions and with complex tasks, a leader may arise within the team.

In short, students acknowledge the importance of leadership in learning teams and it seems that they do insert this practice into their teamwork routines. This might help to improve the personal proficiency skills of the students, considered as the most important central competency cluster for graduates to function well in the workplace and in society in general (Pavlin et al., 2009). Moreover, it might contribute to fulfil one of the goals of the Bologna Process and for student employability. In short, appointing a time-organiser in learning teams seems to be positively recognised by the sample in this study, thus professors might consider applying it to their student teams in future.

Females and older students were shown to have a higher impression over the perceived influence of the time-organiser in team collaboration. This impression might be down to the fact that female students have stronger needs for support, confirmation, and interest to decrease fear, self-doubt and loss of confidence as reported by Gallos (1995). However, the presence of a time-organiser/ facilitator/ mentor/leader might give females the support that they need (Gallos, 1995) and might help team collaboration. On the other hand, older students, who might have had professional experience already, might be used to performing under the presence of a coordinator and thus, they seemed to consider the existence of a time-organiser a good model for a learning team.

Males were more frequently chosen as time-organisers than females, even though women were the majority in the team. This might be connected with the fact that women may prefer not to step up, or that men have a more positive attitude towards teamwork (Ro & Choi, 2011) and consequently are chosen to act as time-organisers. Professors should consider encouraging females and younger students to take the role of time-organiser, so the former can reinforce their self-confidence and the latter can experience the influence of the time-organiser.

This study was done with an exploratory concept of leadership. However, future studies should consider exploring further the concept of a time-organiser or even assessing leadership styles when assigning a formal leader. This data could be correlated to the perceived teamwork result. The time-organiser influence may have been clearer if a control group had been put in place, thus it should be considered in future studies. The time-organiser seemed to be significant to the perceived teamwork result and accepted by the peers, however it needs further exploration to confirm these findings.

Hypothesis H3 is partially confirmed, as some personality traits of the time-organisers are related with the TCE scales and final project grade, namely extraversion, emotional stability, and openness.

H4. The perceived teamwork result (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness, final project grade) can be significantly correlated with the personality traits (extraversion, agreeableness, conscientiousness, emotional stability, openness) of the non-time-organisers.

Related to the findings when analysing the time-organiser's personality traits in an analysis including all students, a negative correlation was detected connecting the personality trait agreeableness of the team members to the final project grade, explaining 5% of its variance. This gives some support to Halfhill et al's. (2005) findings of a negative correlation between the group members' agreeableness and its performance.

No statistically significant relationships were found linking the personality traits of the non-time-organisers with the perceived teamwork result. But this, once again, supports the findings of Bell (2007), Peters et al. (2007) and Driskell et al. (1987) about the weak correlation between personality traits and team performance, as they seem to influence

behavioural processes but not team outcomes. Bozionelos (2004) also reported that personality differences can affect the cohesiveness of the group and, consequently, its effectiveness if they are not handled sensitively. This result might be explained by the group attributes, as they were formed ad-hoc in the classroom and comprised large teams (3 to 7 elements, plus the time-organiser). Teams including individuals with diverse ages/maturity levels might have created heterogeneous groups, which might, in turn, affect team cohesion (Fransen, 2012). Moreover, according to the feedback from the professors, some team members joined in the days following the group constitution. This might have also influenced team cohesion.

Openness is the personality trait with the highest level, both in the Pre-test and Post-test, for the non-time-organisers. In the Post-test, non-time-organisers reported an increment on self-perceived conscientiousness and agreeableness. Both these results might have helped collaborative learning, as individuals who score highly in agreeableness, conscientiousness, and openness are more willing to share knowledge (Matzler et al., 2008). In the Post-test results, the Computer Science students self-perceived as more agreeable, more emotionally stable, and more conscientious. Meanwhile Psychology students self-perceived as more extrovert and more conscientious. All non-time-organisers improved their self-perception over conscientiousness, which stresses the importance of this personality trait on team collaboration.

Hypothesis H4 is partially confirmed as the only statistically significant correlation is a negative one, between the final project grade and the personality trait agreeableness of the non-time-organisers.

H5. Time-organisers perceive team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) more positively than non-time-organisers

In this study, there are no statistically significant differences in the team collaboration scores depending on the role of the responder and as a result it is not possible to confirm previous findings that the collaborative learning effectiveness depends on role assignment within a team (Fransen, 2012; Baldwin et al., 1997; Ellis et al., 2003; Halfhill et al., 2005; Morgeson et al., 2005; Robbins et al., 2010). Schellens et al. (2007), and Strijbos et al. (2007) found that role assignment in learning-teams promotes effective mutual performance monitoring, but this link was not confirmed in this research.

Even though not statistically significant, when comparing scores from both roles, time-organisers usually have lower self-perceptions on the subscales of the TCE. This provides some support to previous work on the influence of roles in perceived team efficiency (Weinberger, 2011), and effectiveness (Kollar et al., 2006; Schellens et al., 2005; Strijbos et al., 2004; Strijbos et al., 2007). From the Pre-test to the Post-test, time-organisers gave higher scores to shared mental models and perceived team effectiveness, but perceived their mutual trust and mutual performance monitoring levels as lower. The role that the time-organiser had in the team seemed to affect their trust in peers. The time-organiser also self-perceived their mutual performance monitoring at a lower level, suggesting that during the teamwork they might have felt some problems dealing with their peers. This link should be explored in future studies. Professors might consider paying attention to the mutual trust and mutual performance monitoring levels of time-organisers as it might predict some conflict within the team.

Non-time-organisers perceived their performance in the Post-test as inferior, having a lower self-perception on all subscales of the TCE. Further studies should be conducted to confirm this result and explore connections to other factors.

Hypothesis H5 cannot be confirmed, as the differences in the perception of the time-organiser and non-time-organiser over team collaboration are not statistically significant.

H6. The time-organiser selection method may foresee the perceived teamwork effectiveness (final project grade, perceived team effectiveness), at the end of the semester.

There is a main effect linking the selection method of the time-organiser with the final project grade, but also with the subscale PTE, indicating that the selection method "Agreed by all team members" might predict higher levels of collaboration at the end of the semester, namely higher grades and higher perceived team effectiveness. Thus, professors might consider encouraging students to select their time-organisers by unanimity, as it might predict higher grades and higher perceived team collaboration.

Fransen (2012) argues that leadership is usually reserved for the most skilled and committed team player, accepted by all team members, whereas this kind of leadership may be comparable to emergent leadership (Heckman et al., 2007). In this study outcomes highlight that the teams with higher result were the ones that chose their time-organiser upon unanimity, which seems to confirm Fransen's findings (2012). Fransen goes even further to say that teams democratically led, have their cohesion reinforced, which speeds up team performance (Fransen, 2012).

Hypothesis H6 is confirmed, as the time-organiser selection method seems to foresee the perceived teamwork effectiveness (perceived team effectiveness, final project grade).

H7. Older students have higher perceived team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) than younger students.

There were no statistically significant differences in the team collaboration scale based on the age of the participants, thus supporting neither Fransen's findings (2012) that team effectiveness depends on team members' characteristics, nor Burbach et al's. work (2010), where he showed that older students have higher scores.

Although not statistically significant, all age groups received higher scores in the Post-test on the subscale shared mental models, which might suggest a progressive developmental path in the team group. This might also confirm findings that linear progressive models entail an increase in maturity and performance over time (Mennecke et al., 1992). Computer Science students are older than Psychology students but this might be due to the fact that this experiment was run in a 3rd year class of Computer Science students and a 2nd year class from Psychology.

Younger students (up to 20 years old) decreased their self-perception of mutual trust, mutual performance monitoring and perceived team effectiveness. Nevertheless, this might also be related to the fact that the younger students were mainly women and, as presented previously, female students perceive their teams' dynamics and performance more negatively than males (Ro & Choi, 2011). Students over 20 years old (from 21 to 25 years old and 25+ years old) increased their self-perceived mutual performance monitoring and perceived team effectiveness. This result might also be due to their gender, as they are mainly men and tend to have a more positive perception of their performance (Ro & Choi,

2011). Professors should consider mixed age teams, as the older members may work as mentors to the younger members and, to the contrary, the younger members can transmit their creativity and higher expectations to the more mature team members.

Hypothesis H7 cannot be confirmed as there are no statistically significant differences in the self-perceived TCE scale, according to the age of the participants.

H8. Male students have higher perceived team collaboration (shared mental models, mutual trust, mutual performance monitoring, perceived team effectiveness) than female students.

Results show that males have higher perceived team collaboration, which confirms studies that report females as having a more pessimistic attitude towards collaborative learning (Scheuneman, 1997; Ro & Choi, 2011). Gallos (1995) explains these differences referring to female students needs of stronger support, confirmation, and interest by the professors, in order to reduce their fear, self-doubt, and low self-confidence. This study does not support Burbach et al. findings (2010) that females have significantly higher teamwork scores than their counterparts, which might be explained by the fact that these results also included students' self-perception on their effectiveness, where females have clearly a more negative attitude (Ro & Choi, 2011).

The role of females in teamwork should be addressed in further studies in order to explore these differences. The schools may play a relevant role in giving more teamwork practise to their students as some resistance towards teamwork is related to multiple negative experiences (Bacon et al., 1999; Felder & Brent, 2001).

According to Fenwick and Neal (2001), groups are more effective when females outnumber or equal men, however it has also been argued that women perform best when competing in same-sex teams against male teams (Ivanova-Stenzel & Kübler, 2005). Men

seem to have higher results when their groups include females (Ivanova-Stenzel & Kübler, 2005), which might be due to the balance of the attitudes between genders. Therefore, professors, employers and managers should encourage their teams to have an equal gender mix. However, this could not be easy to achieve in some expertise fields that are gender unbalanced, such as Computer Science and Psychology (see Table 2).

Hypothesis H8 is confirmed, as males perceived their team collaboration at a higher level than females perceived their own team collaboration.

H9. Perceived team collaboration (shared mental models, mutual trust, mutual performance monitoring and perceived team effectiveness) is significantly correlated with the size of the team.

In an overall analysis, including data from both programs, we can find a negative correlation combining the size of the team with some subscales of the TCE, suggesting that smaller teams have stronger shared mental models, mutual trust and perceived team effectiveness. Having a closer look by major, a new relationship arises positively linking, in both majors, the final project grade with the size of the team, indicating that bigger teams have higher grades. This confirms Shaw's (1971) research that large groups consistently get higher marks than the smaller ones. It also supports Robbins et al's. arguments (2010) that the size of the group is related to team effectiveness, and, moreover, that groups of approximately seven members tend to be more effective when taking action. However, it is not possible to confirm Rollinson et al's. (1998) findings, that neither have large groups a tendency to split into factions, nor that smaller groups lack the diversity of skills for creating effective problem solving. According to Foels et al. (2005), team dimension affects team member satisfaction and, consequently, may have had some influence on the self-perception of the TCE items.

Even though this is not statistically significant, we can observe that students' perceptions differ, as Computer Science students had a positive correlation between the size of the team and the self-perceived team collaboration. Conversely, bigger teams of Psychology students have lower self-perceived shared mental models, mutual trust and perceived team effectiveness. This suggests that Computer Science students perceive a more adequate work environment in bigger teams, whereas Psychology students' perception prefer smaller groups environment. These findings with Psychology students corroborate Seijts and Latham's (2000) work, where it was found that individuals perform at higher levels in smaller groups. However, it is not possible to confirm in this study that smaller groups are faster at completing tasks (work that should be addressed in the future). The findings with the Computer Science students might second Rollinson et al's. (1998) theory that bigger teams are better at creative problem solving because they comprise more skills. These results might be explained by the nature of the tasks involved in this study, as students might have had to find diverse methods of assessing collaboration in teamwork. But the results might also be explained by the gender factor, as Computer Science students are mainly male (this suggest that males might have higher results in bigger teams) and the majority of Psychology students are female (which suggest that females might have higher results in smaller teams).

Hypothesis H9 is partially confirmed, as in an overall analysis bigger teams have higher self-perceived team collaboration but, in a detailed analysis per major, Computer Science students were revealed to have higher collaboration levels in bigger teams and Psychology students in smaller teams.

Conclusions

Conclusions

One of the aims of this study was to explore how teamwork experienced at the higher education institutions can help students improve their personal proficiency competency cluster. This was transposed to empirically exploring the perception of teamwork and personality traits from two classes of students, in a Pre- and Post-test assessment. It intends to reflect on the somewhat ill-preparedness of graduate students to work in teams, in industrial contexts (Hughes, 2002; Casner-Lotto et al., 2006; Pavlin et al., 2009). Some suggestions will be presented that might contribute to a better understanding of learning teams and thus, hopefully, achieve more employability for the students. This chapter contains the main findings of this research, describes key conclusions and presents some final recommendations. It also includes a description of some of the limitations of the study, as well as ideas for further work.

The Bologna process seems to have brought some changes to the way in which individuals are taught in Portuguese academia. The paradigm changed from a school system centred on the instructor to one where the learner has an active role in search of knowledge. The professors seem to be no longer the main source of erudition, they are now facilitators (Adam, 2008). It has been shown that in correlation with traditional lectures or individualistic environments, learning teams result in greater accomplishments by the students, and also by the professors. Thus it would be pertinent to understand how students at the University of Madeira perceive collaborative learning, or teamwork and which factors are involved.

The phenomenon of teamwork, its effectiveness, and connected variables have been broadly studied (for instance, Borges et al., 2009; Frasen, 2012; Katzenbach & Smith, 1993b; Robbins et. al., 2010; Sundstrom et al., 2000). The influence of leadership and personality on teamwork have been explored in both industrial and academic contexts. The triple issue of teamwork, leadership, and personality within learning teams at the University of Madeira seems not to have been addressed as yet, and thus it was the inspiration for this study.

In an overall analysis, findings show that there are statistically significant differences in the perception of students about team collaboration based on their scientific field, gender, size of team they are in, moment of evaluation, personality of the time-organiser, selection method of the time-organiser, and personality of the team members. The learning teams in this study were formed ad-hoc, thus containing some students who have worked together in the past and some that have not. Therefore, team development most probably follows a progressive developmental path where team members tend to operate pragmatically, influenced by prior experience.

Students seem to view their time-organisers as an important asset to the team dynamic, although this is not that strongly acknowledged by the time-organisers themselves. Females and Psychology students have a higher positive perception of the influence of the time-organisers. Students were shown to have already implemented some coordination practises, as they said that they regularly select team members to take the time-organiser role in teams of which they are a part. Professors might consider having time-organisers in their teamwork projects, as this may help students to improve their performance. Females and younger students tend to assume the time-organiser role less often. Thus teachers could consider specific actions to encourage females and younger students to take the role of time-organiser.

Although the instrument used to assess the self-perceived personality (BFI-10) of the time-organiser and non-time-organiser is not validated for the Portuguese population, some introductory analyses will be presented that might help us reflect more on this subject. The personality traits extraversion and openness of the time-organiser were revealed as being positively correlated with the final project grade. That is to say that leaders might consider working on their personality traits extraversion and openness, as this might improve the results of the team. Moreover, a negative correlation was found associating agreeableness with final project grade, and with some of the TCE subscales. If professors are to choose the time-organisers, they should select individuals with higher extraversion and openness, but lower agreeableness levels. These subjects might also be the ones more willing to assume coordination roles and, additionally, these roles could contribute to their personal satisfaction. If the time-organiser is to be chosen by other subjects/groups, the professor could consider encouraging those to select the individual that is perceived as more extravert and more open, as he/she might be a better fit for the role.

Regarding the non-time-organisers' self-personality assessment, a negative correlation between agreeableness and the final project grade was discovered. However, previous studies have shown the weak correlation between personality traits and team performance, as they seem to influence behavioural processes but not the team outcomes. The results showed that, after doing the teamwork (Post-test) students decreased their mutual trust and mutual performance monitoring. Students tend to self-perceive their performance (perceived team effectiveness) as higher than their professors (final grade given by the teacher). Computer Science students have a higher positive correlation rate between self-perceived team collaboration and the final project grade, which might suggest higher self-assessment skills. The team collaboration results are positively

correlated with the final project grade. Thus, professors should encourage improvements in the shared mental models, mutual trust, mutual performance monitoring and perceived team effectiveness as this might help to improve the final project grade. Mutual performance monitoring seems to be the best predictor, as it explains 23% of the variation.

The time-organiser selection method seems to be correlated to the final project grade and to the team collaboration scale. Selecting the time-organiser through unanimity seems to be a predictor for higher final project grades and higher levels of team collaboration. Professors should encourage their students to agree on the member to act as time-organiser, as this might boost team performance.

The variables of age and the role assigned to students in the team (being time-organiser or non-time-organiser) do not appear to take a statistically significant part in team collaboration. Thus we cannot confirm previous work, which has suggested that collaborative learning depends either on the role assigned (Halfhill et al., 2005, Morgeson et al., 2005), or depends on the age (Burbach et al., 2010).

Male students seem to self-perceive their team collaboration at higher levels than females. Professors, leaders, and other team managers might consider teaming up gender-mixed groups to balance their self-perceptions of team effectiveness. Moreover, teams are more effective when females outnumber or equal males (Fenwick & Neal, 2001). Professors should also consider facilitating teams with mixed ages, as older students may act as mentors of the younger members. This might improve team dynamics in a positive way.

In a broad analysis, a negative correlation was detected involving the number of team members and the self-perceived team collaboration. However, there is a positive correlation between size of the team and final project grade. Thus smaller teams seem to have higher levels of self-perceived team collaboration and it has been suggested that

bigger teams get higher grades. Team dimension seems to affect team members' satisfaction and, consequently, may have had some impact on the self-perception of the TCE items (Foels et al., 2005).

This investigation aimed to empirically explore how Computer Science and Psychology students from the University of Madeira perceive learning team collaboration. It was done considering connected factors such as sociodemographic and team characteristics. The research question was developed into nine hypotheses, designed to cover its features. Hypotheses related to the differences between the scientific field (H1), time-organiser selection method (H6), and gender (H8) were confirmed. This means that Computer Science student teams that have selected the time-organiser unanimously, and contain male students are the ones that achieve higher perceived team collaboration level and higher grades, which might suggest that they are more prepared to work in learning teams under the same conditions. The hypotheses associated with the role in the team (time-organiser or non-time-organiser, H5) and age (H7) were not confirmed. Thus it seems that neither the age nor the role of the student in the team influence the perception of the team collaboration level, nor the final project grade in learning teams under the same conditions. The hypotheses linked with the level of the perceived evolution of team collaboration (H2), self-perceived personality of the time-organiser (H3), self-perceived personality of the non-time-organiser (H4), and size of the team (H9) were partially confirmed. That is to say that, in learning teams under the same conditions, and regarding the perceived evolution of team collaboration (H2) only Computer Science students seem to have a higher self-perception of team collaboration levels in the Post-test. Concerning the self-perceived personality of the time-organiser (H3), only the personality trait of extraversion for the Computer Science time-organisers, and conscientiousness for the Psychology time-organisers seem to influence the teamwork result. Considering the self-

perceived personality of the non-time-organiser (H4) just the personality trait agreeableness seems to influence negatively the final project grade. Finally, the size of the team (H9) seems to suggest that bigger teams achieve higher grades, for both the Computer Science and for the Psychology students.

With the implementation of the Bologna Process the role of the students in the learning process was highlighted. They now have an active role in the search for knowledge. The learning outcomes are top priorities, with increasing concentration on what a learner knows and is able to do at the end of a learning process. Actions to promote employability, like preparing students for lifelong learning, or the development of a broader range of skills, are now emphasised. The higher education institutions play a central role in these requests, they help develop field expertise competencies, but they also need to address personal proficiency skills. This seems of utter magnitude if we consider that some authors (Bacon et al., 1999; Felder & Brent, 2001) mention a resistance in students to work in teams due to multiple negative experiences, but the higher education institutions and the professors can positively influence students.

Limitations

The evaluation of personality and interpersonal interactions based only on self and peer-perception in an empirical study raises some questions about accuracy and the reliability of the findings. This study was done with 17 teams, from just two different majors, with a total of 99 cases, and without a control group. Therefore, the scope and generalisation of the findings are limited. Moreover, the data was collected from students

in a course taught in the 2nd year (Cognitive Psychology) and another in the 3rd year (Artificial Intelligence), who might vary in age, cognitive stages, and/or maturity diversity.

Neither instrument used in this study, BFI-10 and TCE, have been validated for use by the Portuguese population. The instrument used to evaluate team collaboration (TCE) was applied to the Portuguese student population for the first time. Despite this fact, it has revealed high validity, generating consistent findings throughout the study. The non-time-organisers assessed the time-organisers personality using the BFI-10, although it has not yet been proved in its reliability for hetero-evaluations. It has also shown low internal reliability in this evaluation.

Furthermore, in this research the concept of time-organiser was introduced, referring to the individual with the responsibility for coordinating the team. Some extrapolation was made from the concept of leadership to cross with the existing literature, as the concept of time-organiser had not yet materialised. Students also understood its similarities, as they referred to the time-organiser as leader.

One of the variables in the study was personality and some comparisons were made between the personality of the Computer Science and Psychology students. These students were chosen previously from two different scientific fields, one related with exact sciences/engineering and the other with humanities. Thus, the personality idiosyncrasies that were found in this study may be related to the professional training pupils have had at the university. Students are learning how to think and behave according to their future professions and this might have influenced their personality idiosyncrasies. Consequently, the differences found in the personality traits might be as a result of the training that students have in their majors, not exactly shaped by the teamwork context.

The teamwork assignment completed by students was different for every team and was connected with their scientific field. Computer Science students had a hands-on task, while the Psychology pupils had a more theoretical task, consequently this fact alone could explain part of the variation in the team collaboration levels among majors. Team sizes between the majors differed, which could have introduced some variance to the perceived teamwork result.

Further work

Our research is only a first step towards understanding the determinants of team collaboration. Additional research is necessary to increase our understanding of the nuanced mechanisms through which teams collaborate, and more specifically the mutual causation of team collaboration with team performance. Here, we outline a few future research recommendations.

Evaluation of personality and the interpersonal interactions based on self and peer-perceptions may be limitative, as it does not consider cognitive diversity. Having independent researchers observing some team interaction and doing interviews with students and professors, at both points of evaluation, should also be considered. Semi structural interviews can give more insights into the rationale behind some findings.

Considering the limitations of this work, replications should involve more students, from different scientific fields and from diverse geographical locations. Control groups should be introduced. Exploring contrasts in the team collaboration with students from distinctive scholar levels (Bachelors *versus* Masters, for instance), but also at different stages within each major (1st year, 2nd year, and 3rd year) might be pondered. Ideally the

sample should include one experimental group and one control group, in each of the main scientific areas (for instance, humanities, social sciences, exact sciences, engineering, life sciences and economics). The tasks to be developed during teamwork should be similar in all the teams, preferably using a hands-on assignment that might allow students to combine their skills and enhance their expertise. The sample has to be carefully selected, so it can be balanced in relation to gender and age. Exploring the differences between full-time students and part-time students that already have work experience is another factor that could be considered.

Before replication, the instruments to assess personality and team collaboration should be validated for use by the Portuguese population. It should be ensured that the instrument to assess personality is validated for evaluation within Portugal, or different instruments should be considered.

Student academic records may also be considered so correlations between past performances and teamwork result can be conducted. This could be done at an individual or at a group level.

Further studies might be dedicated to further explore the relationship between leadership and team effectiveness, within learning teams. The introduction of an instrument to evaluate leadership styles should also be considered, as it may unveil novel approaches over the leader-team relationship. Specific leadership training for the time-organisers may also be pondered. We might consider a follow-up stage to explore whether the students reproduce, of their own accord, the scheme of time-organiser in future learning-teams.

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Appendices

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Questionário de recolha de informação sobre comportamentos de trabalho em equipa (*BFI-10*, *TCE*)
(Rammstedt & John, 2007; Fransen, 2012; versão traduzida por Pacheco & Soares, 2013)

Este projeto, elaborado por Dulce Pacheco no âmbito do doutoramento em Psicologia na Universidade da Madeira sob a orientação da Prof.ª Doutora Luísa Soares, tem como principais objetivos conhecer como os alunos do 1.º ciclo trabalham em equipa.
A participação neste estudo implica a resposta a questões sócio-demográficas, sobre personalidade e trabalho em equipa. As respostas são anónimas e os dados resultantes deste estudo serão mantidos confidenciais, sendo divulgados publicamente apenas os resultados globais sem qualquer informação que leve à identificação dos participantes.
O preenchimento do questionário tem uma duração aproximada de 15 minutos. Por favor, responda a todas as questões.
Na I parte é solicitado que coloque os últimos 4 dígitos do seu documento de identificação fiscal (cartão de contribuinte). Este dado é apenas para que cada questionário tenha um número único, que permita cruzar as suas respostas de agora, com o 2º questionário que terá de responder no final do semestre. Este dado não será utilizado para obter informações pessoais ou para qualquer outro fim.

Consentimento
Ao continuar, declaro que fui informado e percebi os objetivos e procedimentos do estudo e concordo participar no projeto dando a minha autorização para que os dados sejam apresentados de forma completamente anónima e confidencial em apresentações públicas, congressos e publicações científicas.

I parte

1. Grupo nº ☐ **2. Nº elementos no grupo** ☐ **3. É o *time-organizer*?** ☐ Sim ☐ Não

4. Sexo ☐ Feminino ☐ Masculino **5. Últimos 4 dígitos do NIF** ☐

6. Curso ☐ **7. Unidade curricular** ☐

8. Idade

☐ 20 anos ou menos	☐ 21-25 anos	☐ 26-30 anos
☐ 31-35 anos	☐ 36-40 anos	☐ 41-45 anos
☐ 46-50 anos	☐ 51-55 anos	☐ 56-60 anos
☐ mais de 60 anos		

II parte

Indique de que forma as seguintes afirmações **o descrevem a si**:

BFI-10

	1 - Discordo totalmente	2 – Discordo	3 - Nem concordo nem discordo	4 – Concordo	5 - Concordo totalmente
1. Sou uma pessoa reservado(a)?					
2. Sou uma pessoa de confiança?					
3. Tenho tendência para ser preguiçoso(a)?					
4. Lido bem com o stress?					
5. Tenho poucos interesses artísticos?					

Appendix A: Pre-test Questionnaire

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BFI-10

	1 - Discordo totalmente	2 – Discordo	3 - Nem concordo nem discordo	4 – Concordo	5 - Concordo totalmente
6. Sou uma pessoa sociável e extrovertido(a)?					
7. Tenho tendência para ver as falhas nas outras pessoas?					
8. Faço normalmente um trabalho completo e rigoroso?					
9. Enervo-me com facilidade?					
10. Sou uma pessoa com uma imaginação ativa?					

III parte

Se é o *time-organizer* da sua equipa passe diretamente à IV parte. Se não, indique de que forma as seguintes afirmações **descrevem o *time-organizer* da sua equipa**:

BFI-10

	1 - Discordo totalmente	2 – Discordo	3 - Nem concordo nem discordo	4 – Concordo	5 - Concordo totalmente
1. É uma pessoa reservado(a)?					
2. É uma pessoa de confiança?					
3. Tem tendência para ser preguiçoso(a)?					
4. Lida bem com o stress?					
5. Tem poucos interesses artísticos?					
6. É uma pessoa sociável e extrovertido(a)?					
7. Tem tendência para ver as falhas nas outras pessoas?					
8. Faz normalmente um trabalho completo e rigoroso?					
9. Enerva-se com facilidade?					
10. É uma pessoa com uma imaginação ativa?					

IV parte

Indique de que forma as seguintes afirmações descrevem a **eficácia da aprendizagem em grupo** e as suas variáveis:

	1 - Discordo totalmente	2 - Discordo	3 – Discordo ligeiramente	4 - Nem concordo nem discordo	5 – Concordo ligeiramente	6 - Concordo	7 - Concordo totalmente
1. Estava claro desde o início o que a equipa pretendia alcançar.							
2. A equipa investiu algum tempo para ter a certeza que todos os membros entendiam os objetivos da equipa.							

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	1 - Discordo totalmente	2 - Discordo	3 – Discordo ligeiramente	4 - Nem concordo nem discordo	5 – Concordo ligeiramente	6 - Concordo	7 - Concordo totalmente
3. Os membros da equipa entendem o que é esperado deles nos seus diversos papéis.							
4. Pouco tempo após o início do projeto a equipa tinha um entendimento comum sobre o trabalho que tinha de ser realizado.							
5. Pouco tempo após o início do projeto a equipa tinha um entendimento comum sobre como lidar com esse trabalho.							
6. Na nossa equipa podemos contar uns com os outros para ter o trabalho feito.							
7. Os membros da equipa podem trazer para a discussão problemas e as situações difíceis.							
8. Os membros desta equipa por vezes rejeitam outros por serem diferentes.							
9. Ao trabalhar com os membros desta equipa o meu talento e competências são valorizados e utilizados.							
10. É difícil pedir ajuda aos outros elementos desta equipa.							
11. Os membros do grupo guardam apenas para si alguma informação que devia ser partilhada.							
12. Ninguém nesta equipa agiria propositadamente para destruir o meu trabalho.							
13. Nós regularmente tiramos algum tempo para perceber como podemos melhorar a nossa forma de trabalho em equipa.							
14. Nesta equipa há sempre alguém que nos faz refletir sobre a nossa forma de trabalhar em equipa.							
15. Os membros da equipa contam comigo para obter informações e opiniões.							
16. Eu conto com a informação e conselho dos membros da minha equipa.							
17. Quando os membros da minha equipa têm sucesso nas suas funções é bom para mim.							
18. Eu estou satisfeito com o desempenho da minha equipa.							
19. Nós realizamos as tarefas de uma forma com a qual todos concordamos.							
20. Eu gostaria de voltar a trabalhar com esta equipa.							

V parte

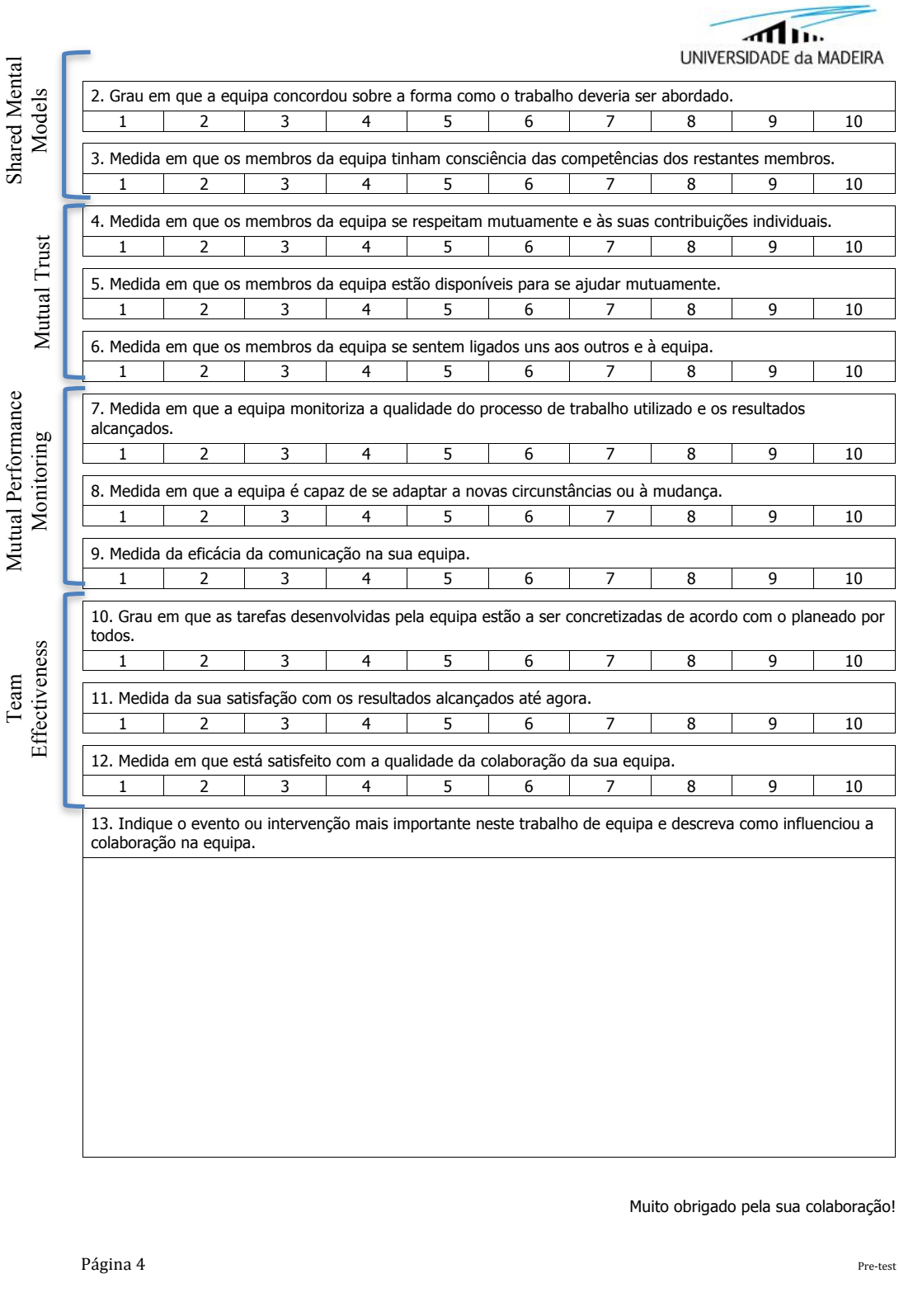
Abaixo encontra doze afirmações sobre alguns aspetos do trabalho em grupo. Por favor, avalie a sua equipa nestes aspetos, baseado na sua perceção da qualidade do trabalho em equipa até este momento. No final há uma pergunta aberta sobre a experiência mais marcante que teve com o seu grupo.
A escala varia entre 1 e 10. **1 Pouco/Nada** - **10 Muito/Totalmente**.

Shared Mental Models

1. Grau em que a equipa concordou sobre o objetivo do trabalho.									
1	2	3	4	5	6	7	8	9	10

Pre-test

Appendix A: Pre-test Questionnaire



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Shared Mental Models

2. Grau em que a equipa concordou sobre a forma como o trabalho deveria ser abordado.									
1	2	3	4	5	6	7	8	9	10

3. Medida em que os membros da equipa tinham consciência das competências dos restantes membros.									
1	2	3	4	5	6	7	8	9	10

Mutual Trust

4. Medida em que os membros da equipa se respeitam mutuamente e às suas contribuições individuais.									
1	2	3	4	5	6	7	8	9	10

5. Medida em que os membros da equipa estão disponíveis para se ajudar mutuamente.									
1	2	3	4	5	6	7	8	9	10

6. Medida em que os membros da equipa se sentem ligados uns aos outros e à equipa.									
1	2	3	4	5	6	7	8	9	10

Mutual Performance Monitoring

7. Medida em que a equipa monitoriza a qualidade do processo de trabalho utilizado e os resultados alcançados.									
1	2	3	4	5	6	7	8	9	10

8. Medida em que a equipa é capaz de se adaptar a novas circunstâncias ou à mudança.									
1	2	3	4	5	6	7	8	9	10

9. Medida da eficácia da comunicação na sua equipa.									
1	2	3	4	5	6	7	8	9	10

Team Effectiveness

10. Grau em que as tarefas desenvolvidas pela equipa estão a ser concretizadas de acordo com o planeado por todos.									
1	2	3	4	5	6	7	8	9	10

11. Medida da sua satisfação com os resultados alcançados até agora.									
1	2	3	4	5	6	7	8	9	10

12. Medida em que está satisfeito com a qualidade da colaboração da sua equipa.									
1	2	3	4	5	6	7	8	9	10

13. Indique o evento ou intervenção mais importante neste trabalho de equipa e descreva como influenciou a colaboração na equipa.

Muito obrigado pela sua colaboração!

Página 4

Pre-test

Appendix A: Pre-test Questionnaire

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(Rammstedt & John, 2007; Fransen, 2012; versão traduzida por Pacheco & Soares, 2013)

Este projeto, elaborado por Dulce Pacheco no âmbito do doutoramento em Psicologia na Universidade da Madeira sob a orientação da Prof.ª Doutora Luísa Soares, tem como principais objetivos conhecer como os alunos do 1.º ciclo trabalham em equipa.
A participação neste estudo implica a resposta a questões sócio-demográficas, sobre personalidade e trabalho em equipa. As respostas são anónimas e os dados resultantes deste estudo serão mantidos confidenciais, sendo divulgados publicamente apenas os resultados globais sem qualquer informação que leve à identificação dos participantes.
O preenchimento do questionário tem uma duração aproximada de 15 minutos. Por favor, responda a todas as questões.
Na I parte é solicitado que coloque os últimos 4 dígitos do seu documento de identificação fiscal (cartão de contribuinte). Este dado é apenas para fazer o cruzamento das respostas com o questionário que respondeu no início do semestre. Este dado não será utilizado para obter informações pessoais ou para qualquer outro fim.

Consentimento
Ao continuar, declaro que fui informado e percebi os objetivos e procedimentos do estudo e concordo participar no projeto dando a minha autorização para que os dados sejam apresentados de forma completamente anónima e confidencial em apresentações públicas, congressos e publicações científicas.

I parte

1. Grupo nº ☐ **2. Nº elementos no grupo** ☐ **3. É o *time-organizer*?** ☐ Sim ☐ Não

4. Sexo ☐ Feminino ☐ Masculino **5. Últimos 4 dígitos do NIF** ☐

6. Curso ☐ **7. Unidade curricular** ☐

8. Idade

☐ 20 anos ou menos	☐ 21-25 anos	☐ 26-30 anos
☐ 31-35 anos	☐ 36-40 anos	☐ 41-45 anos
☐ 46-50 anos	☐ 51-55 anos	☐ 56-60 anos
☐ mais de 60 anos		

II parte

Indique de que forma as seguintes afirmações **o descrevem a si**:

	1 - Discordo totalmente	2 – Discordo	3 - Nem concordo nem discordo	4 – Concordo	5 - Concordo totalmente
1. Sou uma pessoa reservado(a)?					
2. Sou uma pessoa de confiança?					
3. Tenho tendência para ser preguiçoso(a)?					
4. Lido bem com o stress?					
5. Tenho poucos interesses artísticos?					
6. Sou uma pessoa sociável e extrovertido(a)?					
7. Tenho tendência para ver as falhas nas outras pessoas?					
8. Faço normalmente um trabalho completo e rigoroso?					
9. Enervo-me com facilidade?					

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	1 - Discordo totalmente	2 – Discordo	3 - Nem concordo nem discordo	4 – Concordo	5 - Concordo totalmente
10. Sou uma pessoa com uma imaginação ativa?					

III parte

Se é o *time-organizer* da sua equipa passe diretamente à IV parte. Se não, indique de que forma as seguintes afirmações **descrevem o *time-organizer* da sua equipa**:

	1 - Discordo totalmente	2 – Discordo	3 - Nem concordo nem discordo	4 – Concordo	5 - Concordo totalmente
1. É uma pessoa reservado(a)?					
2. É uma pessoa de confiança?					
3. Tem tendência para ser preguiçoso(a)?					
4. Lida bem com o stress?					
5. Tem poucos interesses artísticos?					
6. É uma pessoa sociável e extrovertido(a)?					
7. Tem tendência para ver as falhas nas outras pessoas?					
8. Faz normalmente um trabalho completo e rigoroso?					
9. Enerva-se com facilidade?					
10. É uma pessoa com uma imaginação ativa?					

IV parte

Indique de que forma as seguintes afirmações descrevem a **eficácia da aprendizagem em grupo** e as suas variáveis:

	1 - Discordo totalmente	2 - Discordo	3 – Discordo ligeiramente	4 - Nem concordo nem discordo	5 – Concordo ligeiramente	6 - Concordo	7 - Concordo totalmente
1. Estava claro desde o início o que a equipa pretendia alcançar.							
2. A equipa investiu algum tempo para ter a certeza que todos os membros entendiam os objetivos da equipa.							
3. Os membros da equipa entendem o que é esperado deles nos seus diversos papéis.							
4. Pouco tempo após o início do projeto a equipa tinha um entendimento comum sobre o trabalho que tinha de ser realizado.							
5. Pouco tempo após o início do projeto a equipa tinha um entendimento comum sobre como lidar com esse trabalho.							
6. Na nossa equipa podemos contar uns com os outros para ter o trabalho feito.							
7. Os membros da equipa podem trazer para a discussão problemas e as situações difíceis.							

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	1 - Discordo totalmente	2 - Discordo	3 – Discordo ligeiramente	4 - Nem concordo nem discordo	5 – Concordo ligeiramente	6 - Concordo	7 - Concordo totalmente
8. Os membros desta equipa por vezes rejeitam outros por serem diferentes.							
9. Ao trabalhar com os membros desta equipa o meu talento e competências são valorizados e utilizados.							
10. É difícil pedir ajuda aos outros elementos desta equipa.							
11. Os membros do grupo guardam apenas para si alguma informação que devia ser partilhada.							
12. Ninguém nesta equipa agiria propositadamente para destruir o meu trabalho.							
13. Nós regularmente tiramos algum tempo para perceber como podemos melhorar a nossa forma de trabalho em equipa.							
14. Nesta equipa há sempre alguém que nos faz refletir sobre a nossa forma de trabalhar em equipa.							
15. Os membros da equipa contam comigo para obter informações e opiniões.							
16. Eu conto com a informação e conselho dos membros da minha equipa.							
17. Quando os membros da minha equipa têm sucesso nas suas funções é bom para mim.							
18. Eu estou satisfeito com o desempenho da minha equipa.							
19. Nós realizamos as tarefas de uma forma com a qual todos concordamos.							
20. Eu gostaria de voltar a trabalhar com esta equipa.							

V parte

Abaixo encontra doze afirmações sobre alguns aspetos do trabalho em grupo. Por favor, avalie a sua equipa nestes aspetos, baseado na sua perceção da qualidade do trabalho em equipa até este momento. No final há uma pergunta aberta sobre a experiência mais marcante que teve com o seu grupo.
A escala varia entre 1 e 10. **1 Pouco/Nada** - **10 Muito/Totalmente**.

1. Grau em que a equipa concordou sobre o objetivo do trabalho.									
1	2	3	4	5	6	7	8	9	10

2. Grau em que a equipa concordou sobre a forma como o trabalho deveria ser abordado.									
1	2	3	4	5	6	7	8	9	10

3. Medida em que os membros da equipa tinham consciência das competências dos restantes membros.									
1	2	3	4	5	6	7	8	9	10

4. Medida em que os membros da equipa se respeitam mutuamente e às suas contribuições individuais.									
1	2	3	4	5	6	7	8	9	10

5. Medida em que os membros da equipa estão disponíveis para se ajudar mutuamente.									
1	2	3	4	5	6	7	8	9	10

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6. Medida em que os membros da equipa se sentem ligados uns aos outros e à equipa.									
1	2	3	4	5	6	7	8	9	10

7. Medida em que a equipa monitoriza a qualidade do processo de trabalho utilizado e os resultados alcançados.									
1	2	3	4	5	6	7	8	9	10

8. Medida em que a equipa é capaz de se adaptar a novas circunstâncias ou à mudança.									
1	2	3	4	5	6	7	8	9	10

9. Medida da eficácia da comunicação na sua equipa.									
1	2	3	4	5	6	7	8	9	10

10. Grau em que as tarefas desenvolvidas pela equipa estão a ser concretizadas de acordo com o planeado por todos.									
1	2	3	4	5	6	7	8	9	10

11. Medida da sua satisfação com os resultados alcançados até agora.									
1	2	3	4	5	6	7	8	9	10

12. Medida em que está satisfeito com a qualidade da colaboração da sua equipa.									
1	2	3	4	5	6	7	8	9	10

13. Indique o evento ou intervenção mais importante neste trabalho de equipa e descreva como influenciou a colaboração na equipa.

VI parte

1. Imagine que este trabalho tinha decorrido sem a designação de um *time-organizer*. Teria o mesmo resultado?

☐ Sim ☐ Não

Em que medida teria sido diferente se não existisse um *time-organizer*? Comente, por favor:

2. Como foi feita a designação do *time-organizer*?

	Autoproposto
	Nomeação da maioria dos membros
	Nomeação por unanimidade dos membros
	Votação secreta

	De forma aleatória
	Outro, qual?

Muito obrigado pela sua colaboração!

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Table 32

Comparative of the self-perceived personality of the Computer Science non-time-organisers in the Pre-test, grouped by team

	Team 1 $n = 4$	Team 2 $n = 3$	Team 3 $n = 4$	Team 4 $n = 3$	Team 5 $n = 4$	Team 6 $n = 4$	Team 7 $n = 5$	Team 8 $n = 4$	Team 9 $n = 4$
Personality trait	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Extraversion	3.5 (.71)	2.33 (.29)	3.13 (.63)	2.17 (.29)	3.38 (1.11)	3.63 (.85)	3.8 (.27)	3.38 (.75)	3.88 (.48)
Agreeableness	3.5 (.58)	3.5 (.87)	3.25 (.29)	3.5 (.0)	3.5 (.41)	3.25 (.65)	3.3 (.57)	3.5 (.41)	3 (.71)
Conscientiousness	3.75 (.65)	3 (.0)	3 (.82)	3.17 (.76)	3.38 (.25)	2.88 (.85)	3.8 (.57)	3.75 (.65)	2.75 (.87)
Emotional Stability	3.62 (.85)	3.17 (1.76)	3.63 (.48)	2.5 (.5)	3.88 (.75)	3.38 (.95)	3.2 (.67)	2.75 (.65)	3.13 (1.18)
Openness	3.25 (.5)	3.33 (1.53)	3.38 (.85)	3.83 (1.04)	4.13 (1.03)	3.75 (.65)	3.3 (.67)	3.13 (.95)	3.63 (.48)

Table 33

*Comparative of the self-perceived personality of the Computer Science non-time-organisers in the **Post**-test, grouped by team*

	Team 1 *n* = 4	Team 2 *n* = 3	Team 3 *n* = 4	Team 4 *n* = 4	Team 5 *n* = 4	Team 6 *n* = 4	Team 7 *n* = 5	Team 8 *n* = 4	Team 9 *n* = 4
Personality trait	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Extraversion	3.75 (.65))	2.5 (.5)	3.25 (.65)	2.33 (.29)	3.13 (1.25)	3.63 (.63)	3 (.71)	3 (1.0)	4.13 (.75)
Agreeableness	3.5 (.41)	3.83 (.76)	3.25 (.5)	3 (.0)	2.75 (.5)	3.75 (.5)	3.4 (.22)	4.13 (.25)	3.38 (.48)
Conscientiousness	3.88 (.75)	2.67 (.29)	3.25 (.29)	3.17 (.76)	3.75 (.65)	3 (.71)	3.5 (.41)	3.5 (.0)	2.88 (.48)
Emotional Stability	4 (.0)	3.5 (1.32)	3.25 (.65)	3.17 (1.04)	3.5 (1.08)	3.38 (1.11)	3.5 (.35)	3.13 (.63)	2.88 (.85)
Openness	3.25 (.65)	3 (1.73)	3.5 (.71)	3.17 (.58)	3.75 (.98)	3.5 (.82)	3.2 (.57)	3.13 (.25)	3.75 (.65)

Table 34

Comparative of the self-perceived personality of the Psychology non-time-organisers in the Pre-test, grouped by team

	Team 1 *n* = 5	Team 2 *n* = 6	Team 3 *n* = 5	Team 4 *n* = 5	Team 5 *n* = 6	Team 6 *n* = 5	Team 7 *n* = 3	Team 8 *n* = 5
Personality trait	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Extraversion	3.4 (1.24)	3.42 (.49)	4 (.35)	3.9 (.42)	3.33 (.82)	3.2 (.45)	3.67 (.58)	3.4 (.65)
Agreeableness	3.5 (.35)	3.5 (.32)	3.6 (.22)	3.9 (.22)	4.08 (.74)	3.4 (.74)	3.17 (.29)	3.8 (.45)
Conscientiousness	3.6 (.89)	3.75 (.42)	3.7 (.76)	3.4 (.55)	3.33 (.93)	3.8 (.57)	3.17 (.58	3.5 (.71)
Emotional Stability	3.8 (.57)	3.67 (.68)	3.7 (.84)	3.5 (.94)	3.17 (.98)	3.1 (.82)	2 (1.0)	3.5 (.5)
Openness	3.9 (.65)	3.75 (.52)	4 (.35)	4.4 (.82)	3.67 (.68)	4 (.35)	4.17 (.29)	4.1 (.65)

Table 35

Comparative of the self-perceived personality of the Psychology non-time-organisers in the Post-test, grouped by team

	Team 1 *n* = 5	Team 2 *n* = 7	Team 3 *n* = 5	Team 4 *n* = 4	Team 5 *n* = 6	Team 6 *n* = 5	Team 7 *n* = 4	Team 8 *n* = 5
Personality trait	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Extraversion	3.9 (1.3)	3.79 (.7)	3.3 (.45)	3.63 (.75)	3.83 (.75)	3.5 (.71)	3.25 (.29)	3.3 (.45)
Agreeableness	3.5 (.41)[a]	3.57 (.35)	3.3 (.27)	3.63 (.25)	3.92 (.66)	3.8 (.57)	3.38 (.25)	3.4 (.42)
Conscientiousness	4 (.79)	3.86 (.48)	3.3 (.57)	3.25 (.5)	3.42 (.8)	3.6 (.42)	3.25 (.29)	3.7 (.45)
Emotional Stability	3.25 (.29)[a]	3.5 (.91)	3.3 (.84)	3.63 (.85)	3.17 (1.03)	3.2 (.57)	3.25 (.29)	3.25 (.98)[a]
Openness	4 (.79)	4 (.29)	3.7 (.45)	3.75 (1.19)	4.1 (.89)[b]	4 (.35)	3.25 (.65)	3.75 (.65)[a]

[a] $n = 4$

[b] $n = 5$