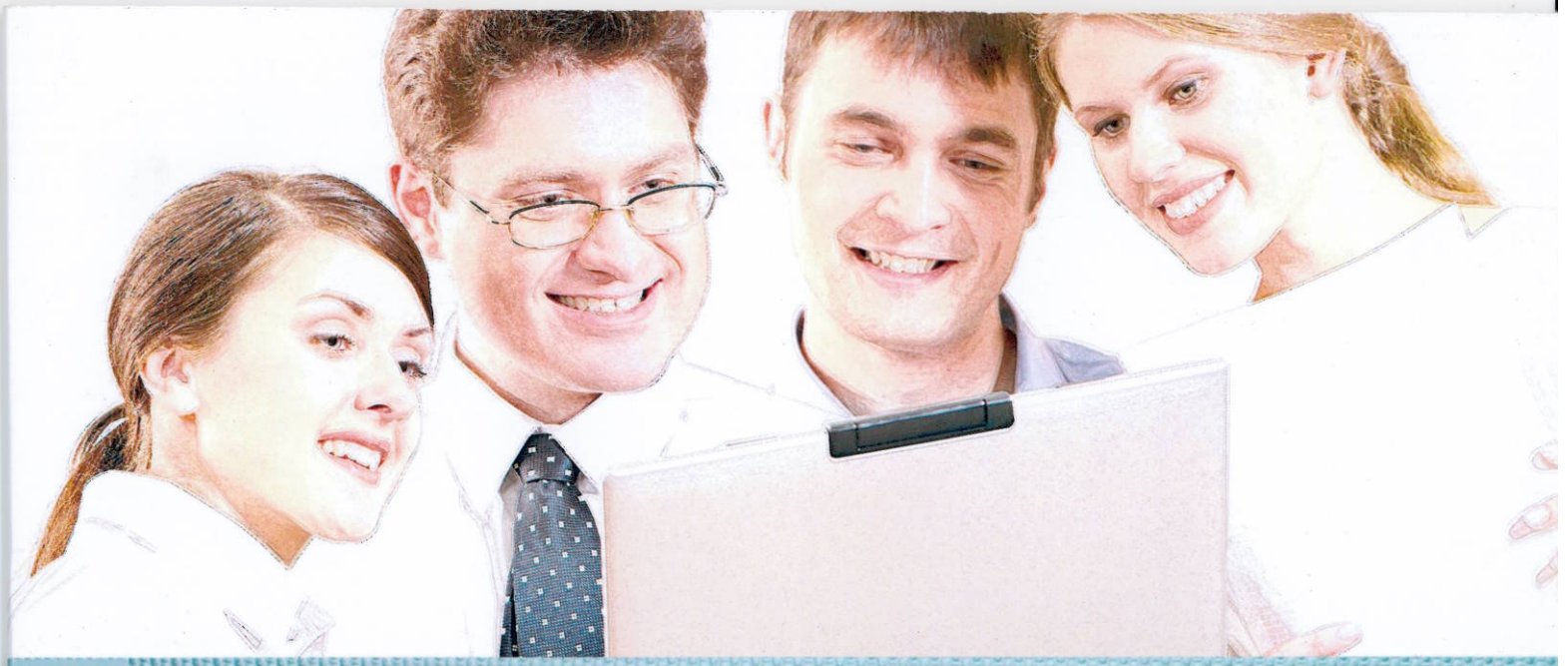

1st Workshop on Managing the Influence of People and Team Factors in Software Engineering

Silvia T. Acuña
Marta N. Gómez
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Proceedings

First Workshop on Managing the Influence of People and Team Factors in Software Engineering

INTEAMSE 2012

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Table of Contents

INTEAMSE 2012

General Chair's Message iii
Organizing Committee iv
Program Committee iv
Research Articles v

General Chair's Message

Welcome to the First Workshop on Managing the Influence of People and Team Factors in Software Engeineering (INTEAMSE) at the PROFES 2012 conference!

The overall goal of INTEAMSE is to further the discussion of human and social aspects that have an impact on software development. Our position is that human and team factors are a single research field applicable across the board. At this workshop, we intend people from one field to learn about methods and results from others in order to apply the approaches, leading to productive feedback.

Software engineering (SE) studies software development principles, processes, methods and tools. SE is based not on well-grounded scientific principles but on a compendium of disciplines that are refined and evolved through application into a body of knowledge. Nowadays, key software development issues are primarily concerned not with techniques but with sociological aspects and human nature. More importantly, people play a major role as sources of information, activity performers and product users.

Human aspects have been studied in different fields of SE. Analysed topics tend to overlap (e.g., quite a lot of research has addressed the expert/novice or introverted/extroverted dichotomy or teams in agile/heavy processes). However, results have not been disseminated outside their respective area.

Understanding what influence human and social issues have on the performance of a set of activities related to software development can improve the quality of the software process and product. It can also be beneficial for the team of professionals building the software, increasing their satisfaction with teamwork. Learning more about these issues can be helpful for selecting people to form work teams. This will improve the formation and maintenance of more effective teams.

We would like this first workshop to serve to set up a forum to debate the influence of human and social factors on software development. To date, human factors research has been compartmentalized by development type. We think that findings are potentially applicable irrespective of development type. Our proposal is to assemble researchers to exchange opinions and improve research. Although modest, our goals may have a major impact by instituting a standing forum, an information community.

This first INTEAMSE workshop includes four papers that have been accepted for presentation. The papers cover a range of issues. The first is a qualitative analysis on job satisfaction and motivation of software engineering practitioners, along with the factors that improve productivity. The second reports a controlled experiment to determine the relationship between team membership taking into account the personality factor of extraversion with respect to the quality of the product built by the team and team satisfaction. The third is a correlational study that shows that the software project development environment is a decisive factor for the importance and influence of personality factors on team performance. The fourth describes a quasi-experiment to identify the analysts' characteristics that influence on the elicitation effectiveness. Each paper describes a helpful piece of an interesting puzzle, useful for stimulating a wide discussion during the workshop.

We would like to thank all researchers and practitioners who helped us make this workshop possible. In particular, we are indebted to all the Program Committee members for their valuable suggestions concerning the workshop. We also thank the Workshop Program Chair at PROFES 2012, Burak Turhan, and the PROFES conference organizers. Last but not least, we acknowledge the continual support of Oscar Dieste whose prompt responses made a difference to the workshop planning and publicity.

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Research Articles

Job Satisfaction and Motivation of Software Engineering Practitioners 1
Adrián Hernández-López and Ricardo Colomo-Palacios

The Effect of the Extraversion of Software Development Teams on Software Quality and Team Satisfaction: A Controlled Experiment..... 9
Marta N. Gómez, Silvia T. Acuña, Marcela Genero and José A. Cruz-Lemus

The Relationship between Team Personality Factors and the Group's Performance is Depended on the Social Environment?..... 17
Kostadin Koroutchev, Silvia T. Acuña and Marta N. Gómez

In Search of Requirements Analyst Characteristics that Influence Requirements Elicitation Effectiveness: A Quasi-experiment..... 23
Alejandrina Aranda, Oscar Dieste and Natalia Juristo

First Workshop on Managing the Influence of People and Team Factors in Software Engineering

The Effect of the Extraversion of Software Development Teams on Software Quality and Team Satisfaction: A Controlled Experiment

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***Abstract*—The development of projects in teams during the course of a subject is a project-based learning practice which is widely recommended in the new academic degrees that have been adapted to the European Higher Education Area (EHEA). The formation of teams is generally based on the students' preferences. However, we believe that, as is found in literature, this formation could be based on factors related to the personalities of the members of the development team, and that these factors might affect both the quality of the software product developed and the satisfaction perceived by the development team. In this work we present a controlled experiment, which was carried out during an academic course on Data Bases. The intention of this experiment was to evaluate whether the work team's level of extraversion influenced, on the one hand, the final quality of the software products obtained and, on the other, the satisfaction perceived while this work was being carried out. The results obtained indicate that when forming work teams, the person teaching the subject should carry out a personality test beforehand in order to balance the amount of extraverted team members with those who are not extraverted. This would permit the students to feel satisfied with the work carried out by the team without reducing the quality of the software products developed.**

Keywords-Personality Factors; Extraversion; Satisfaction; Quality; Controlled Experiment; Team Building

I. INTRODUCTION

THE development of projects in teams during the course of a subject is a common practice in project-based learning, which is widely recommended in the new degrees that have been adapted to the European Higher Education Area (EHEA). Work teams in different subjects are normally formed without professors, thus fulfilling criteria such as affinity between students, positive experiences in previous work, or simply compatibility with timetables. However, these factors appear to be insufficient if high quality in the results obtained and the satisfaction perceived during the development of work is to be ensured.

Studies carried out in the academic setting [25, 26] show the influence that certain personality factors, such as conscientiousness or openness to experience have on the performance of software developers who carry out programming in pairs. Reviews of the empirical studies carried out [27] show that the students' level of skill is one of the factors that influences development efficiency when pair programming takes place.

Various researchers have examined the effect that team members, the characteristics of the team structure and the means of communication have on the team's productivity in the field of information systems development [4, 9, 23, 34]. The development of software demands that software engineers work in a team, despite carrying out interdependent tasks with complex relations. Teams must therefore plan their project, follow its progress and coordinate their work, but they must also reach an agreement as to their objectives, have a common work method, communicate freely and frequently, and create a working climate that is appropriate to the realization of their activities.

A correlational quasi-experiment was designed by following the research line of personality factors [2]. This empirical study obtained positive and direct relationships between the average extraversion personality factor of teams and the quality of the software obtained. It showed that the teams that are most satisfied with their work are precisely those whose members have the highest measures for the personality factors agreeableness and conscientiousness. There is also a direct positive relationship between the personality factors, extraversion and agreeableness. The outcomes showed that teams with high satisfaction levels are teams with members whose combined personality had mean levels of team extraversion. On the other hand, extraverted, social and participative teams developed better quality software products.

The aforementioned work and its conclusions have led us to carry out an experimental design within the framework of two disciplines: building teams in software development and in empirical software engineering.

In this research we have carried out a controlled experiment in the subject of Data Bases with the third year students on Computer Engineering and Technical Engineering in Systems and Management Computing degrees from the Computer Science department (ESI) at the University of Castilla-La Mancha (UCLM) in Ciudad Real, Spain during the 2010-2011 course. The controlled experiment consisted of forming teams composed of different factors as regards a specific type of personality – extraversion (see Table I) – and analyzing and comparing the relationships that existed between this personality factor and the quality of the complete development of a data base, and the satisfaction perceived by the members of the team during the development of this work.

TABLE I. TYPES OF TEAMS ACCORDING TO THE EXTRAVERSION OF THEIR MEMBERS

Degree of extraversion	Composition
Extraverted (EXT)	4 extraverted subjects
Mixed (MIX)	2 extraverted subjects and 2 non-extraverted subjects
Non-extraverted (NO-EXT)	4 non-extraverted subjects

The work presented herein is structured as follows: Section 2 describes the experiment design; Section 3 shows the analysis of the data obtained, Section 4 provides a discussion of these results and Section 5 shows the possible threats to the validity of the experiment. Related work is presented in Section 6 and finally, Section 7 shows our conclusions and future work.

II. DESIGN AND REALIZATION OF EXPERIMENT

The goals, variables, hypothesis, participants and tasks related to the experiment carried out are described in the following subsections. On the one hand, we have followed the guidelines for the communication of empirical research in Software Engineering [15]. On the other, the experimental design has been carried out by bearing in mind the proposals made in [16].

A. Goals, Hypotheses, Variables, Subjects and Tasks

This experiment used the Goal-Question-Metric [3] template for the definition of goals with the intention of: analyzing the work teams' level of extraversion; with regard to its influence on the quality of the end-product and the individual satisfaction perceived; from the point of view of the subject's professors; in the context of a set of Computer Engineering and Technical Engineering in Systems and Management Computing students From the ESI at the UCLM, Ciudad Real.

According to this description, the independent variable has been established as 'degree of extraversion' of the work team, which can take three different values as is shown in Table I.

The dependent variables are the following:

- Quality of the deliverables. The students had to provide different deliverables throughout the development of the project, the quality of each of which was measured by dividing the number of defects found by the size of the system, expressed as the number of the system's entities.
- Team Satisfaction. This variable was measured through the use of a questionnaire [13] which the students had to submit along with each deliverable. The questions in the questionnaire are shown in Appendix B.

The following experimental hypotheses were formulated based on the evidence previously found [2]:

- H_{10}: There is no difference in the quality of the deliverables of work teams with different degrees of extraversion.
- H_{20}: There is no difference in the satisfaction of work teams with different degrees of extraversion.

An inter-subject design was chosen, which is to say that each participant received a single treatment, with one factor (degree of extraversion) and three treatments (EXT, MIX and NO-EXT).

The participants in the experiment were 76 students from the courses described previously. Although these students' qualifications are not aligned with the EHEA, the subject of Data Bases began to be taught (along with one other subject) from the 2008-09 course onwards, following the guidelines of the EHEA, as a pilot in order to anticipate the advent of the new Computer Science Degree, which began to be taught in the 2010-2011 course.

All of the tasks that had to be carried out as part of this experiment formed part of this subject and were part of its evaluation.

The work teams were formed by providing the students with a questionnaire on personality [8] via the subject's virtual campus. This questionnaire is shown in Appendix A at the end of this paper, and was use to classify each student as extraverted or non-extraverted according to the responses given we calculate the median (30 points) of the responses of each subject. The students with values equal to or greater than the median are classified as extraverted and the others as non-extraverted, with 38 students in each category.

Once the students had been categorized, and after bearing in mind various criteria that would favor their compatibility (being on the same degree course, compatibility of timetables, etc.) 19 work teams were formed, each of which contained 4 students. These teams were distributed as follows: 6 EXT teams, 7 MIX teams and 6 NO-EXT teams (see Table I).

The composition of the teams and the different tasks that they had to carry out throughout the course were also published on the subject's virtual campus. These tasks and the various deliverables to be generated in each of them were:

- Deliverable 1: A specification, in natural language, of the requirements of a data base system which could be freely chosen by the students.
- Deliverable 2: The conceptual design of the data base using the Entity-Interrelation Model (EER diagram).
- Deliverable 3: A logic design of the data base by transforming the EER diagram into the Relational Model.
- Deliverable 4: the creation, population of tables and their consultation using the SQL language.

In order to ensure that all the teams carried out work consisting of a similar amount of effort, they were asked to provide an EER diagram containing between 15 and 20 entities.

B. *Experimental Procedure*

The tasks to be carried out by the participants took place on different dates throughout the course. It was established that the students could freely attend tutorials in order to consult the state of their work or any doubts that had arisen during the development of that work. Moreover, after the submission and correction of each deliverable, the professor responsible met each team to contrast this correction, since this affected the adequate development of the project as a whole.

On the set dates, the students were asked to use the virtual campus to send the corresponding deliverable of the team, along with the personal satisfaction test associated with it (Appendix B).

Once the corresponding deliverable had been received, the professor responsible for the team began to correct it to obtain its quality. As has already been mentioned, the quality of the deliverable (Cent) was calculated using the following formula:

$$CEnt = \frac{\#\ defects}{\#\ system} \frac{delivered}{entities} \quad (1)$$

The students' responses to the personal satisfaction questionnaire associated with each deliverable were later evaluated. These responses were in the form of a five-point Likert scale, and varied between 1 – Totally disagree and 5 – Totally agree.

The complete detailed analysis of this data and its contrast with the various experimental hypotheses is shown in the following section of this paper.

III. Analysis of the Data

This section shows the analysis of the data obtained and the results derived from it. The work related to each experimental hypothesis is dealt with in individual subsections in order to facilitate understanding.

A. *Relation between Extraversion and Quality of Deliverables*

Tables II, III, IV, and V show the data obtained for the students who participated in the experiment after studying the degree of extraversion of the team to which they belonged and its relationship with the quality of the work carried out, and was measured by using the different deliverables developed. The intention of this relationship is to corroborate working hypothesis H_{10}, shown previously.

Each table shows the degree of extraversion of the work team studied, the number of teams belonging to that type and the arithmetic mean and deviation obtained for each one of them with each deliverable.

It should be noted that the value obtained is calculated as the quotient of the number of mistakes made in the deliverable divided by the number of system entities (1). Thus, the lower the number obtained, the higher the quality of the deliverable in question.

TABLE II. Descriptive Statistics Of CEnt Variable For Deliverable 1

Extraversion	N	Mean	Typ. Dev.
EXT	6	1.4103	0.604
MIX	7	1.0252	0.600
NO-EXT	6	1.2461	1.022

TABLE III. Descriptive Statistics Of CEnt Variable For Deliverable 2

Extraversion	N	Mean	Typ. Dev.
EXT	6	2.0349	1.237
MIX	7	1.1006	0.591
NO-EXT	6	1.0247	0.495

In the case of the first deliverable (Table II) it will be observed that the group which obtained the best results is the MIX group, with differences in results of 21.54% with regard to the NO-EXT group and of 37.56% with regard to the EXT group.

The group that obtained the best results with the second deliverable (Table III) was the NO-EXT group, which was only 7.41% better than the MIX group, but was considerably better than the EXT group (98.58%).

The results obtained for the third deliverable (Table IV) are very similar for the EXT and NO-EXT groups, with a minimum difference of 0.45% in favor of that composed

purely of extraverted. However, on this occasion the MIX group obtained significantly inferior results, which were worse than those of the EXT group by 123.81%.

TABLE IV. DESCRIPTIVE STATISTICS OF CENT VARIABLE FOR DELIVERABLE 3

Extraversion	N	Mean	Typ. Dev.
EXT	6	0.5515	0.393
MIX	7	1.2343	0.726
NO-EXT	6	0.5540	0.471

TABLE V. DESCRIPTIVE STATISTICS OF CENT VARIABLE FOR DELIVERABLE 4

Extraversion	N	Mean	Typ. Dev
EXT	6	0.8189	0.629
MIX	7	0.4552	0.508
NO-EXT	6	0.4082	0.223

Finally, the results for deliverable 4 were similar for the MIX and the NO-EXT teams, with a difference of 11.51% in favor of the former. However, there was a great difference with regard to the EXT group (100.61%).

The working hypothesis related to these data (H_{10}) stated that: These is no difference in the quality of the deliverables of work teams with different degrees of extraversion. Bearing in mind that the data have a normal distribution, they were contrasted by using an ANOVA which produced the results shown in Table VI.

None of the values obtained had a statistical significance of 95%, and it is not therefore possible to reject the null hypothesis in any of the cases. However it should be stressed that both the second and the third deliverable had a significance of 90%, although the power observed was barely above 50%, and it would not therefore be appropriate to make any categorical statements with regard to the working hypothesis.

TABLE VI. ANOVA RELATED TO THE CENT VARIABLE

Deliverable	F	sig.	Power
1	0.423	0.662	10.7%
2	2.827	0.089	47.6%
3	3.253	0.065	53.5%
4	1.196	0.330	22.2%

A detailed commentary on the data shown above will be provided in the following section of the paper.

B. Relationship between Extraversion and Perceived Satisfaction

The relationship between the degree of extraversion of the team to which each student belonged and the personal satisfaction obtained after being part of that team was studied by generating three tables for each deliverable – one for each statement in the satisfaction questionnaire (Appendix B) which the participant had to respond to and submit after completing each deliverable. The possible evaluations that could be given (on a scale of 5 possibilities between 1 – Totally disagree and 5 – Totally agree) were calculated in each table, and the relative percentage that this data supposed and the accumulated percentage of responses were calculated for the number of responses to each possibility obtained by each of the teams.

This subsection shows an example of one of the tables corresponding to statement P3 of deliverable 1 (Table VII) in which the response that exceeds 50% of the accumulated responses is highlighted in grey.

TABLE VII. PERCEIVED SATISFACTION FOR THE P3 OF DELIVERABLE 1

	EXT (n=21)			MIX (n=25)			NO-EXT (n=16)		
Evaluation	Freq	%	Accum	Freq	%	Accum	Freq	%	Accum
Totally agree	5	23.8	23.8	9	36.0	36.0	3	18.8	18.8
Agree	12	57.1	80.9	15	60.0	96.0	8	50.0	68.8
Neither agree nor disagree	0	0	80.9	1	4.0	100	2	12.5	81.3
Disagree	3	14.3	95.2	0	0	100	3	18.8	100
Totally disagree	1	4.8	100	0	0	100	0	0	100

In this case, the null hypothesis being studied (H_{20}) indicated that: there is no difference in the satisfaction of work teams with different degrees of extraversion. Since the data are not normally distributed, this hypothesis was contrasted by carrying out a Kruskal-Wallis test. In spite of it not being a completely orthodox test, this was done by treating the values of the responses as continuous values, and by calculating the corresponding arithmetic means. The results obtained for each statement in the satisfaction questionnaire (Appendix B) concerning each deliverable are therefore shown in Table VIII. The values marked with a single asterisk (*) have a significance of 90%, whilst those marked with a double asterisk (**) have a significance of 95%.

As was indicated in the previous subsection, the details of the results obtained in this data analysis will be provided in the following section.

TABLE VIII. KRUSKAL-WALLIS TEST TO VERIFY HYPOTHESIS H_{20}

Deliverable	Statement	sig.
1	P1	0.093*
	P2	0.336
	P3	0.100
2	P1	0.132
	P2	0.026**
	P3	0.275
3	P1	0.125
	P2	0.059*
	P3	0.435
4	P1	0.373
	P2	0.024**
	P3	0.361

IV. RESULTS OBTAINED

With regard to the relationship between the extraversion of the members of a work team and the quality of the work developed, as the data from subsection 3.1 show, there is no tendency towards one particular team obtaining results that are clearly better according to the degree of extraversion of its members. Although, it might appear that the NO-EXT teams obtained better global results, there are various examples of the other two types of teams (once each) obtaining better values for a specific deliverable. However, the ANOVAs carried out indicate that the results do not have a statistical significance of 95%.

In summary, and as a conclusion for hypothesis H_{10}, the degree of extraversion of the members of which a work team is formed does not appear to have any significant effect on the results that that work team will obtain when carrying out a project.

However, with regard to the satisfaction perceived by the members of a work team there does appear to be a clear tendency which will allow significant conclusions to be obtained. If the responses given are grouped as totally agree and agree, i.e., if those responses of a non-neutral and favorable nature are considered, it will be noted that in all the questions concerning all the deliverables the group with the maximum accumulated frequency is always MIX.

Having found a clear tendency which is repeated in 100% of cases, it would appear to be appropriate to suggest that MIX teams seem to work in a better environment.

These findings are intensified upon finding various cases in which the relationship between the team members' satisfaction and their degree of extraversion is, moreover, statistically significant.

Therefore, and as a conclusion to hypothesis H_{20}, it is interesting to highlight that in those teams in which extraverted and non-extraverted members were mixed, the work environment perceived by them and their opinion of work in a team is the most positive of all.

This fact could be used with educative ends. When establishing work teams, tests could be carried out beforehand to allow the person teaching the subject in question to form balanced teams of extraverted and non-extraverted members. In the light of the findings of this work, the work teams' members would therefore perceive a greater satisfaction without the quality of their work being significantly reduced.

V. THREATS TO EXPERIMENTAL VALIDITY

The factors that may have threatened the validity of the experiment and how we have attempted to mitigate their effects are detailed as follows in accordance with the recommendations made for the reporting of empirical studies [9].

The internal validity of the experiment may have been affected by the non-homogeneity of the domains in which the teams were working. However, all the teams worked in domains that that had chosen themselves, and which we can therefore assume were well-understood. What is more, they were asked to work with similar sizes (between 15 and 20 entities), and we therefore assume that the complexity of the work can be considered comparable for all the teams.

The external validity may have been threatened by the fact that the students did not have a great deal of previous experience in modeling data bases, and that their experience was acquired during the development of their projects. This may have affected the results. Once again, we believe that since it was a complete academic course and the development of the tasks associated with the experiment supposed an important part of the students' evaluation, it is possible that this threat may have been mitigated by the participants' relatively homogeneous motivation and implication.

The validity of the conclusion should not have been affected, since commonly accepted evaluation tests for this statistical design were used [19, 36]. In some cases, and particularly that concerning hypothesis H_{10}, the power observed is low, which makes it difficult to establish definitive conclusions.

Finally, we believe that the construct validity was not threatened since material proposed in the literature related to the theme was used to build the teams, to obtain the students' perceived satisfaction and to calculate the defects in the deliverables [7].

VI. RELATED WORK

Software is developed by people, used by people and helps people to work. This indicates the importance of the human component in software development [12]. Several research works which consider this aspect and incorporate people in the software process have been carried out [1, 18, 20, 22, 32, 37]. These works analyze people individually and establish their relationships with the activities that they carry out in the project.

However, software engineering is essentially a team activity. The members of a software development team play different roles in the project in order to carry out the various activities of which it is composed. The software developed will therefore respond to its requirements according to what do the team members or do not during the software development. Moreover, the activities of which this process is made up are interrelated and demand that the people involved coordinate themselves and communicate with each other in an appropriate manner so that the project will be successful. Software engineers not only have to have technical knowledge, but must also be capable of working in a team if the software developed is to be of optimum quality. The configuration of the team is therefore important, and its members' personalities are an important aspect that must be considered. This idea has led to the appearance of several Software Engineering research that attempt to determine the influence of personality on software development.

Some researchers, such as White [34], Borovits et al. [4] or Rasch and Tosi [23], have studied how team member personality, team structure characteristics and communication styles influence information systems development team member productivity.

Research in the field of software development has focused on team levels and on the organization of people who work together on large scale programs in a software development organization [10]. This research has paid attention to the role of the team and the organizational factors in software development [11, 30]. Some studies use a standard test such as the Myers-Briggs Type Indicator (MBTI) [5, 6, 14, 17, 24, 31] to determine guidelines with which to attempt to ensure the team's success according to the security engineers' personality types and to identify a series of features and characteristics that may assist in building effective teams. The study by White and Leifer [35] determines the connection between the team's skills, personality features and performance. This study was carried out with highly consolidated teams of professionals, and the key factor examined was whether or not the tasks to be carried out were routine.

Zuser and Grechenig [38] propose the use of a questionnaire based on skills and personality features in order to provide the team with information about finalized projects during development, with the objective of improving their performance. This work concerns a descriptive experimental study in which the relationship between the team members' personalities and capabilities, and the team's efficiency are analyzed. The study shows that the use of this questionnaire assists teams to improve their efficiency more rapidly, and to resolve conflicts within the team. The tool improves knowledge of the team members' capacities and personality features, including their strengths and weaknesses, which is useful in critical situations in which the team may find itself.

The research carried out by Peslak [21] presents a descriptive correlational experimental study in which the impact of personality in relation to the success of the project is analyzed. The types of personality are determined by using the MBTI test. The work shows that the team members' personalities have a significant impact on the success of the project, while the same does not occur with the diverse personalities within the team.

The research developed by Sfetsos et al. [28] was a descriptive correlational controlled experiment in which the relationship between personality and the team's efficiency (pair programming), development quality and team satisfaction was analyzed. A comparison was made between heterogeneous and homogeneous pairs as regards the pairs' efficiency. The results show that there are important differences between heterogeneous and homogeneous teams. Pairs with heterogeneous temperaments and personalities have better communication, effectiveness and viability in collaboration. Walle and Hannay [33] carried out an empirical study which researched the nature and the effects of personality on collaboration in pair programming. It concerned an experimental study using a decision tree analysis, which is an iterative process in which the initial observations of the dependent variable (pair programming task) are successively divided into two halves, thus creating the binary structure of the tree. One of the conclusions reached was that the heterogeneity of personality increases the amount of communication and the intensity of collaboration.

Some correlational experimental studies have been carried out in academic settings [25, 26] to analyze the influence of certain personality factors, such as conscientiousness or neuroticism, on the performance of software developers who program in pairs. In the first study, the results indicated that the conscientiousness did not have a significant effect on performance, which may have been owing to the short duration of the tasks carried out during the experiment. However, the results revealed that another personality factor – openness to experience – had a direct correlation with performance. The second study did not find any relationship between neuroticism and performance.

The work of Cruz et al. [29] presents a systematic literature review of personality in software engineering in which some of the aforementioned research is considered. The results indicate that the majority of the studies analyzed are empirical research into the influence of personality, as regards both pair programming and team efficiency. It also points out that it is necessary to carry out replications of empirical studies and to test the models proposed in theoretical studies with empirical studies. One of the conclusions reached is the need to carry out replications of empirical studies to attain consolidation of the knowledge obtained, which could be used in new research, and the influence on the practice of software engineering.

To continue with the type of research that attempts to determine the influence of personality factors on software development, Acuña et al. [2] designed a correlational quasi-experiment with which they analyzed the relationships among team processes, characteristics of the task, software quality and the development team's satisfaction. The teams applied an adaptation of the agile methodology (eXtremeProgramming, XP) to the development of a

software product. They discovered that the most satisfied teams were those whose members had the highest marks for the personality factors agreeableness and conscientiousness. The levels of satisfaction were also higher when the team members could decide how to organize and develop their work. However, the higher the number of conflicts in the team, the more level of satisfaction and cohesion diminished. Finally, the teams showed a direct positive correlation between the average extraversion personality factor and the quality of the software product. As was mentioned previously, this was a quasi-experiment which allowed the authors to study correlations but not causal probabilities. This empirical study inspired the controlled experiment that is presented in this paper, and which was carried out to study the causality of the statistically significant correlations between the team's extraversion-satisfaction and the team's extraversion-software quality.

VII. Conclusions And Future Work

The main aim of this work has been to research whether a team's extraversion influences the quality of the work carried out by that team, and the satisfaction perceived by the team members after having worked in it.

This objective was attained by carrying out a controlled experiment with 19 teams, each consisting of 4 third year students from three computing degrees, in the subject of Data Bases at the ESI in Ciudad Real (UCLM) during the 2010-2011 course. The work teams were formed by controlling the level of extraversion in each team participating in the experiment.

The results obtained and commented on indicate a clear repercussion at an educative level. Upon forming the work teams, the person in charge of the subject was able to carry out a personality test beforehand which allowed him or her to form teams in which the number of members with an extraverted or non-extraverted character was balanced. In the light of the findings of the work presented herein, it should be possible to obtain higher team member satisfaction without significantly reducing the quality of the work produced.

The results obtained will also have repercussions in the students' professional lives since, as occurred in this experiment, during the performance of their profession they will have to become integrated into teams dedicated to software development, and will not be able to choose their team-mates on the basis of personal preferences.

As with all experiments, it would be advisable to repeat it in order to obtain a greater robustness of the conclusions obtained. We are therefore currently carrying out a replica with the students from same subjects on the 2011-2012 course. If the results of the replica confirm the findings of the original experiment, we shall consider the use of building teams method presented in this work in the entire degree course.

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APPENDIX A PERSONALITY QUESTIONNAIRE (EXTRAVERSION)

	Totally disagree	Disagree	Neither agree nor disagree	Agree	Totally agree
	A	B	C	D	E
1.	I am a cheerful, high-spirited person				A B C D E
2.	I really enjoy talking to people				A B C D E
3.	I enjoy parties where there is a crowd				A B C D E
4.	I don't consider myself especially light-hearted				A B C D E
5.	I like to have a lot of people around me				A B C D E
6.	I'm not as lively and high-spirited as other people				A B C D E
7.	I am a very active person				A B C D E
8.	I generally prefer to let others to do the talking at meetings				A B C D E
9.	I usually prefer to do things alone				A B C D E
10.	I laugh easily				A B C D E
11.	I like to be where the action is				A B C D E
12.	I don't much like chatting to people				A B C D E

APPENDIX B SATISAFACTION QUESTIONNAIRE

A - Totally disagree	B – Disagree	C – Neutral	D – Agree	E - Totally agree
P1 – I am very happy about having worked in this team				A B C D E
P2 – I am pleased about how my teammates and I work together				A B C D E
P3 – I am satisfied with my current team mates				A B C D E