



Journal of Technology and Science Education

ISSN: 2014-5349

info@jotse.org

OmniaScience

España

Escartín Solanelles, Jordi; Ceja Barba, Lucia; Celdrán Castro, Montse; Martín Peña, Javier
Flow experiences in everyday classes of spanish college students: the fit between challenge and skill
Journal of Technology and Science Education, vol. 4, núm. 2, julio-diciembre, 2014, pp. 62-70
OmniaScience
Barcelona, España

Available in: <http://www.redalyc.org/articulo.oa?id=331131296002>

- How to cite
- Complete issue
- More information about this article
- Journal's homepage in redalyc.org

redalyc.org

Scientific Information System
Network of Scientific Journals from Latin America, the Caribbean, Spain and Portugal
Non-profit academic project, developed under the open access initiative

FLOW EXPERIENCES IN EVERYDAY CLASSES OF SPANISH COLLEGE STUDENTS: THE FIT BETWEEN CHALLENGE AND SKILL

Jordi Escartín Solanelles¹, Lucia Ceja Barba², Montse Celdrán Castro¹, Javier Martín Peña³¹Faculty of Psychology, University of Barcelona²IESE Business School, University of Navarra³Faculty of Social Sciences and Work, University of Zaragoza

Spain

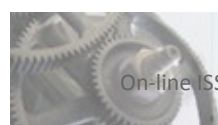
jordiescartin@ub.edu, LCeja@iese.edu, mceldran@ub.edu, jmape@unizar.es*Received November 2013**Accepted January 2014***Abstract**

This study is concerned with the flow state as a high intrinsic motivation experience. Following Csikszentmihalyi's theoretical model (1990), we analyze in which contents within the social psychology subject, students experience more flow. Participants were Spanish college students from a general course on Social Psychology. They completed a diary study during 12 master classes through the academic semester. The results showed that students experienced different states of consciousness in different sessions: relaxation, apathy, flow and anxiety, respectively. These findings provide new insight into the relationship between an academic subject and students, facilitating the creation of new and innovative strategies for learning. The ultimate goal is to modify and improve the dynamics and learning activities for the teaching course, increasing the experience of flow in class (and reducing the levels of anxiety, apathy or relaxation).

Keywords – College's students, Diary study, Flow, Intrinsic motivation, Social psychology**1 INTRODUCTION**

During the university period, learning encompasses an important living space, where academic success and subjective well-being is pursued by students and teachers. However, it is known that not all students are performing well and enjoy the learning activities in which they engage. In any university classroom, students may be unmotivated and uncommitted with the dynamic activities taking place in the classroom. Therefore, to promote motivation and enjoyment in the teaching and learning processes has generated considerable interest in recent years. One of the most acclaimed psychological constructs by the positive psychology movement is "flow" (or optimal experiences), term advocated by Csikszentmihalyi (1990). This concept refers to the state of consciousness when a person is completely absorbed in an activity for its own pleasure and enjoyment, during which time flies, and actions, thoughts and movements succeed each other without pause (Csikszentmihalyi, 1990). This author pointed out that the main problem is that students do not want to get involved in the activities and learning, and therefore, universities end up with an emotional or motivational problem rather than a cognitive or intellectual problem.

Specifically, we pretend to assess the level of flow, as well as other states of consciousness previously examined by Csikszentmihalyi (1990), such as anxiety, apathy or relaxation experienced by university students during each course theme in an entire semester. The aim is to find out which aspects of social psychology facilitate the experience of different states of consciousness, in order to modify and improve the dynamics and learning activities.



1.1 The balance between challenges and perceived skills in college students

One of the most important characteristics of flow is the emphasis given to the balance between the challenge of a given activity and the skill of the person on that task (Csikszentmihalyi, 1990). If the challenge in an educational activity exceeds the student's skill level, anxiety is likely to emerge, and discouragement increases the likelihood of not reaching the required learning level. If the activity does not challenge the students' skills, then relaxation may appear, resulting in the same consequences as in the previous example. If skills and challenge are both low in an educational activity, apathy can take place. Finally, students can experience flow when their skills and the challenges they face are high and in balance (Nakamura & Csikszentmihalyi, 2002) (see Figure 1). And it is in the state of flow during the processes of teaching and learning that students can learn more and with more interest. The theory of flow is inherently related to learning (Shernoff & Csikszentmihalyi, 2009). In fact, flow theory has suggested that it is possible to enjoy and learn something relevant at the same time.

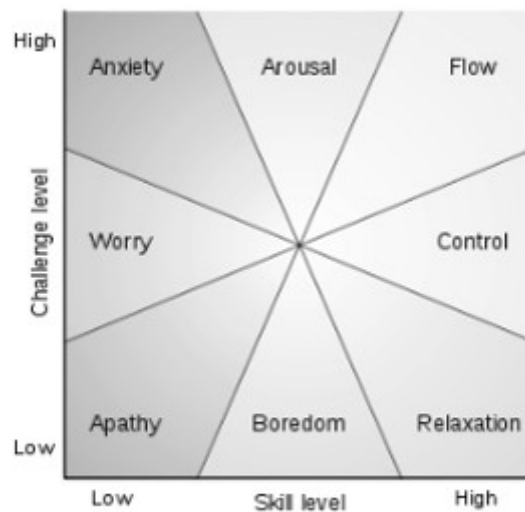


Figure 1. Mental states in terms of challenge level and skill level, according to Csikszentmihalyi's flow model (Csikszentmihalyi, 1998; Delle Fave, Massimini & Bassi, 2011)

1.2 The consequences of experiencing flow in educational settings

As background to optimal experiences, research has found that proposing challenging tasks (i.e., solving complex problems, express high levels of creativity) to students facilitate flow experiences, which is important to most college students, but especially to people with high level of skill (Scager, Akkerman, Pilot & Wubbels, 2012). On the other hand, studies on the consequences of flow have found a positive relationship between this peak experience and good humor, psychological well-being, interest in the task, and high performance (Steele & Fullagar, 2009). Some research has suggested positive states like welfare, can produce flow, increase attention, cognitive and behavioral skills, enhance intellectual and social resources, and facilitate learning and academic performance (Fredrickson & Branigan, 2005). The link between learning activities and flow has short-term consequences in terms of intrinsic gratification. But it can also have long term consequences by promoting greater perseverance and effort reflected in the time spent studying, a focus on challenging and ambitious learning objectives, and a desire to pursue high academic standards.

Despite the positive association between flow and academic performance and the considerable number of investigations in academic contexts, the concept of flow has been poorly studied in relation to the discipline of social psychology, especially in specific cultural contexts such as Spain. Therefore, the present study is one of the first studies interested examining flow experiences during the teaching-learning process of a social psychology course.

2 METHODOLOGY

2.1 Participants

Fifty college students from the Faculty of Psychology at the University of Barcelona (Spain) were recruited for this study. Sixty per cent of the sample was female and most participants were aged between 18 and 19 at the beginning of the study. All of the participants agreed voluntarily to be part of the continuous assessment in the subject of Social Psychology, a basic training course with a total of 6 credits offered in the second semester of the first year of the bachelor program.

2.2 Procedure

The present research study has been developed using longitudinal repeated measures. Specifically, we used the experience sampling method (Hektner, Schmidt & Csikszentmihalyi, 2007), a method that has been described as a powerful educational tool when linked to other variables (i.e., academic performance). More than providing information about how students spend time in class, this method allows students to understand how they feel during the sessions and the course.

At the end of the 12 master classes during the whole semester, a brief questionnaire was administered to gather information about

- the most relevant information for students regarding that specific teaching session, and
- the perceived challenges and skills. Each participant answered the questionnaire twelve times, so the data obtained represented a total of 600 data points (50 x 12) throughout the course. Formative assessment activities (i.e., multiple choice exams), independent work sessions and tutorials were leaved aside.

The topics for each of the 12 sessions were, based on the Spanish translation of the Handbook “Social Psychology” (Baron & Byrne, 2005):

- non-verbal communication;
- attributions of causality, both from the Social Perception theme;
- mental frames;
- potential sources of error in the social cognition, both from the Social Cognition theme;
- the formation of attitudes;
- attitudes change, both from the Attitudes theme;
- the power of the situation;
- acceptance or condescension techniques, both from the Social Influence theme;
- factors that influence attraction and
- psychosocial explanations of attraction, both from the Interpersonal Attraction theme; and
- romantic relationships;
- the triangular love model, both from the Intimate Relationships theme.

2.3 Instrument

The flow diary contained three questions covering the three aspects under examination: Activity, perceived challenge and skill level. The variables “level of challenge” and “level of skills” were chosen because of their key role as “flow conditions”, this is, when perceived challenges and skills are in balance and they are high (Stein, Kimiecik, Daniels & Jackson, 1995) (see Figure 2).

Flow diary

Name: _____

Topic of the day from the Social Psychology subject): _____

Regarding this session, describe in the following text box the ideas that you consider more relevant:

Please, now answer the following questions with an X in the box that you consider more convenient:

1.- How challenging do I find today's topic?

Nothing	Little	Pretty	Much	Too much
0	1	2	3	4

2.- What is my skill level for correctly following this activity?

Non	Few	Some	Most	All
0	1	2	3	4

Figure 2. Flow diary

3 RESULTS

3.1 The different mental states at the Social Psychology course

First, the 600 data points were analyzed together in order to discern the percentage of the four different states within the social psychology course: flow, anxiety, apathy and relaxation. The data revealed that most students spent most of the time in situations of relaxation or apathy (30% and 30%, approximately) (i.e., the class situation challenged them slightly). The majority of the time the students had low skills (apathy) or high skills (relaxation) to face such challenges. In contrast, about 20% of students felt in flow during the various sessions of the course (i.e., they felt there was a great challenge and in turn that their skills were also high to handle it). Finally, just over 10% of students felt anxious (meaning that their capabilities were overwhelmed by the challenge that involved the class activity). After analyzing the students' experiences in the 12 sessions of the social psychology course, we will analyze the different sessions individually.

3.2 The different states within each individual session

From the 12 master classes, the three sessions with higher levels of flow were Sessions 3, 7 and 8. The sessions with higher levels of anxiety were 5, 9 and 10. The sessions with higher levels of apathy were 1, 4 and 12. Finally, the sessions with higher levels of relaxation were 2, 6 and 11 (See Table 1).

	Session (%)	Session (%)	Session (%)	Main teaching tools used
Relaxation	2 (43%)	11 (43%)	6 (41%)	Advanced Power points, images
Apathy	4 (45%)	12 (39%)	1 (37%)	Introductory Power points
Anxiety	5 (31%)	9 (17%)	10 (17%)	Power points, scientific articles
Flow	3 (27%)	8 (27%)	7 (23%)	Power points, videos, scientific articles, extra material

Table 1. Sessions with the major indexes of relaxation, apathy, anxiety and flow

3.2.1 Experiencing flow in the classroom

During session 7, three classic experiments in Social Psychology that are probably the best known psychology experiments ever undertaken, were extensively explained and discussed with student participants:

- Solomon Asch's conformity to majority experiment investigated the extent to which social pressure from a majority group could affect a person to conform (Asch, 1951).
- Stanley Milgram's obedience to authority experiment investigated people's reluctance to confront those who abuse power (Milgram, 1974).
- Philip Zimbardo Stanford' Prison Experiment investigated the psychology of imprisonment (Zimbardo, 1971).

During session 8, the six principles for convincing others to say "yes" (reciprocity, commitment, social proof, liking, authority and scarcity), were extensively explained and discussed with student participants: Robert Cialdini's Six Principles of Influence (Cialdini, 1984). When analyzing these two sessions, we can see that both form part of the Social Influence topic within Social Psychology.

3.2.2 Experiencing anxiety in the classroom

During sessions 9 and 10 we focused on the antecedents and theoretical explanations of interpersonal attraction. Both issues form part of the Interpersonal Attraction topic within Social Psychology. During these two sessions, several theoretical perspectives were analysed, such as

- Donn Byrne's reinforcement-affect model of attraction (Byrne, 1992);
- Robert Zajonc' mere-exposure effect (Zajonc, 1968) or
- Theodore Newcomb' similarity hypothesis (Newcomb, 1956).

3.2.3 Experiencing apathy and relaxation in the classroom

Finally, within the different topics, apathy and relaxation were mostly combined. For instance, in the topics of social perception (sessions 1 and 2) or intimate relationships (sessions 11 and 12) these states equally appeared. In relation to Csikszentmihalyi's flow model seen in Figure 1, these two states are related to low levels of challenge, although with different level of skills (when high, relaxation, when low, apathy). Specifically for the state of relaxation (sessions focused on attributions, attitude change and romantic relationships) the students perceived that those contents were easy and attainable with their present level. And in the case of the state of apathy (sessions focused on non-verbal communication, sources of error in social cognition and the love models) the students perceived that those contents were easy but not attainable with their present level.

4 DISCUSSION

The results revealed that students in the subject of Social Psychology experienced different states of relaxation, apathy, flow or anxiety during different master class sessions. During the course, about one fifth of the participants have experienced the flow experience during the sessions. It is relevant since it is known that it promotes intrinsic motivation, and therefore enhancing it during the learning process is a key factor to improving the quality of learning (Nakamura & Csikszentmihalyi, 2002).

Since several teaching tools were used in order to introduce and discuss the themes during the semester, we retrospectively checked the teaching tools used in the different sessions related to the four different states (see right column from Table 1). Regarding the sessions with higher levels of flow, original videos of the experiments, scientific publications (for instance, where similar experiments have been conducted; Burger, 2009), as well as extra material (i.e., internet material) were used.

In line with most scientific research, the experiences of relaxation and apathy affected almost two-thirds of the college's students (Shernoff & Csikszentmihalyi, 2009). A vast majority of participants experienced low levels of challenge with varying degrees of skill. Perhaps due to empathy with their students, teachers have been able to generate learning situations too simple or too predictable, parceling and structuring them at the highest degree, which, from the perspective of positive psychology, it would seem counterproductive to generate greater psychological well-being, and a greater interest in the task and a higher performance (Steele & Fullagar, 2009). Specifically, regarding the sessions with higher level of relaxation, the different topics approached there

were explained and discussed with student participants, mainly with the use of extensive and self-explanatory power points (mainly only based on the text-book) and images. And regarding the sessions with higher level of apathy, the power points used were more introductory and not very detailed.

Finally, a relatively low number of students suffered from anxiety during the learning process, which may have hindered their learning. Thus, an excessive perception of complexity or difficulty could discourage and negatively affect their self-esteem and motivation to continue learning. Although scientific publications were utilized together with the power point presentations, no other teaching tools were used.

To sum up, it could be the case that “how” the master classes were enriched (only power point presentations versus adding videos, scientific articles, images, etc.) is related to the different states of consciousness of college students. For instance, it seemed that a combination of a challenging task and high skills regarding social topics of highly emotional relevance and proximity was translated in high levels of flow. Moreover, “when” the master classes take place can also be related to different mental states. It could explain why the first and final (1 and 12, respectively) master classes were related to the mental state of apathy due to the inverted “u” of every learning process.

4.1 Future research

Future studies are necessary in order to go beyond the present results and to shed more light into the different factors that alone, or in combination with contents of the subject, can facilitate higher levels of flow experiences, while reducing the levels of relaxation, apathy and anxiety. In that sense, analyzing and learning from these thematic sessions in which more experiences of flow occurred, should help in designing methods to enhance student’s experience in other sessions in which the balance between challenge and skill is lower (apathy), or when there exists too much challenge (anxiety) or too much perceived skills (relaxation).

Teachers play a key role in providing complex educational challenges that are tailored to the abilities of their students (Bassi, Steca, Delle Fave & Caprara, 2007). Regarding future research in social psychology, there are some aspects that in our view should be studied:

- The relationship of “flow-academic performance” in different and larger samples, as well as the possible “contagion” of flow between teachers and students.
- The explanatory factors of optimal experiences based on the type of teaching activities (besides the ones used in the present study “master class”, other types, such as case resolution and exercises, etc.). Measuring quantitative differences between “flow-themes” and “flow-teaching activities” could allow the formulation of hypotheses concerning the antecedent variables that are inherent (or not) to the course contents, allowing for the comparison of each part.
- Complementing the above points, the form of study and measurement of “flow”, in addition to expressing the relationship between the student profile and the profile of the contents, could also contribute to the understanding of the teachers’ skills (Escartín, Ferrer, Pallàs & Ruiz, 2008). For example, it may be the case that topics usually considered as “theoretical” generate high levels of flow, and conversely, some practices and case studies generate lower levels of flow but apathy, relaxation or anxiety. This could manifest the high level of skills of the teacher to achieve a balance between challenge and skill in his master classes; or a low ability of the teacher to find such balance by sharing case studies and practical exercises.

5 CONCLUSION

This is one of the first studies that have focused on the different states of consciousness of Spanish college’s students regarding the contents of their Social Psychology course within the Bachelors degree in Psychology. It represents a first step in order to understand the impact of these contents on students’ perceptions regarding the challenges of each topic and the skills they have to handle them. From a practical point of view, this study has implications for education that can contribute positively to the motivation and enjoyment of students during the learning process. From this point forward, the possibilities to enhance, modify, or reduce the course materials and the teaching tools are enormous. This study offers insight into how some master classes facilitates the state of flow, and therefore, many lessons can be learned. Similarly, this research also facilitates the comprehension regarding which master classes can lead students to states of anxiety (high challenge, low skills), relaxation (low challenge, high skills) or apathy (low challenge, low skills). Several changes can be adopted

in order to reduce the perceived challenge (in the case of anxiety), or increase this challenge (in the case of relaxation and apathy). Summing up, the logical next step may consist on fostering flow states in other classes where anxiety, relaxation and apathy existed. And in order to do so, we can adapt changes to the different levels of challenge and skills detected.

REFERENCES

- Asch, S.E. (1951). Effects of group pressure upon the modification and distortion of judgment. In H. Guetzkow (ed.), *Groups, leadership and men* (pp. 177-190). Pittsburgh, PA: Carnegie Press.
- Baron, R.A., & Byrne, D. (2005). *Psicología Social*. Madrid: Prentice Hall.
- Bassi, M., Steca, P., Della Fave, A., & Caprara, G.V. (2007). Academic self-efficacy beliefs and quality of experience in learning. *Journal of Youth and Adolescence*, 36, 301-312. <http://dx.doi.org/10.1007/s10964-006-9069-y>
- Burger, J.M. (2009). Replicating Milgram: Would People Still Obey Today?. *American Psychologist*, 64(1), 1-11. <http://dx.doi.org/10.1037/a0010932>
- Byrne, D. (1992). The transition from controlled laboratory experimentation to less controlled settings: Surprise! Additional variables are operative. *Communication Monographs*, 59, 190-198. <http://dx.doi.org/10.1080/03637759209376261>
- Cialdini, R. (1984). *Influence: The Psychology of Persuasion*. New York: HarperCollins.
- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: HarperCollins.
- Csikszentmihalyi, M. (1998). *Finding Flow: The Psychology of Engagement With Everyday Life*. New York: Basic Books.
- Delle Fave, A., Massimini, F., & Bassi, M. (2011). *Psychological selection and optimal experience across cultures*. Dordrecht: Springer Science. <http://dx.doi.org/10.1007/978-90-481-9876-4>
- Escartín, J., Ferrer, V., Pallàs, J., & Ruiz, C. (2008). *El docente novel, aprendiendo a enseñar*. Barcelona: Octaedro.
- Fredrickson, B.L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition and Emotion*, 19(3), 313-332. <http://dx.doi.org/10.1080/02699930441000238>
- Hektner, J.M., Schmidt, J.A., & Csikszentmihalyi, M. (2007). *Experience sampling method. Measuring the quality of everyday life*. London: Sage Publications.
- Milgram, S. (1974). *Obedience to Authority: An Experimental View*. New York: Harper and Row. An excellent presentation of Milgram's work is also found in Brown, R. (1986). *Social Forces in Obedience and Rebellion*. Social Psychology: The Second Edition. New York: The Free Press.
- Nakamura, J., & Csikszentmihalyi, M. (2002). The concept of flow. In C. R. Snyder, & J. S. Lopez (Eds.), *Handbook of positive psychology* (pp. 89-105). New York, NY: Oxford University Press.
- Newcomb, T.M. (1956). The prediction of interpersonal attraction. *Psychological Review*, 60, 393-404. <http://dx.doi.org/10.1037/h0063098>
- Scager, K., Akkerman, S., Pilot, A., & Wubbels, T. (2012). Do honors students have more potential for excellence in their professional lives?. *Higher Education*, 64(1), 19-39. <http://dx.doi.org/10.1007/s10734-011-9478-z>
- Shernoff, D.J., & Csikszentmihalyi, M. (2009). Flow in schools: Cultivating engaged learners and optimal learning environments. In Rich, G. E., Scott, L., & Michael J. F. (Eds.), *Handbook of Positive Psychology in Schools* (pp. 131-145). New York, NY: Routledge.
- Stein, G.L., Kimiecik, J.C., Daniels, J., & Jackson, S.A. (1995). Psychological antecedents of flow in recreational sport. *Personality and Social Psychology Bulletin*, 21, 125-135. <http://dx.doi.org/10.1177/0146167295212003>
- Steele, J.P., & Fullagar, C. (2009). Facilitators and outcomes of student engagement in a college setting. *Journal of Psychology: Interdisciplinary and Applied*, 143(1), 5-27. <http://dx.doi.org/10.3200/JRLP.143.1.5-27>
- Zajonc, R.B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, 9, 1-27. <http://dx.doi.org/10.1037/h0025848>

Zimbardo, P.G. (1971). The power and pathology of imprisonment. *Congressional Record*. (Serial No. 15, 1971-10-25). Hearings before Subcommittee No. 3, of the Committee on the Judiciary, House of Representatives, Ninety-Second Congress, First Session on Corrections, Part II, Prisons, Prison Reform and Prisoner's Rights: California. Washington, DC: U.S. Government Printing Office.

Citation: Escartín Solanelles, J., Ceja Barba, L., Celdrán Castro, M., & Martín Peña, J. (2014). Flow experiences in everyday classes of spanish college students: The fit between challenge and skill. *Journal of Technology and Science Education (JOTSE)*, 4(2), 62-70. <http://dx.doi.org/10.3926/jotse.93>

On-line ISSN: 2013-6374 – Print ISSN: 2014-5349 – DL: B-2000-2012

AUTHOR BIOGRAPHY

Jordi Escartín

Received the Bachelor degree in Psychology and the M.S. degree in Work and Organizational Psychology from the Universitat de Barcelona (UB) in Barcelona, Spain, in 2003, and 2006, respectively. He received an European PhD in Work and Organizational Psychology at the University of Barcelona through an Interuniversity Study Program, in 2009. He completed postdoctoral training in social and organizational psychology at Goethe University, Frankfurt am Main. Since 2004 he is professor in the Department of Social Psychology at the University of Barcelona, Spain. Actually, he is finishing his M.S. degree in Systemic Coaching from the Universitat Autònoma de Barcelona (UAB), Spain. His research interests concern organizational behaviour and techniques for assessment and learning within university contexts. Dr. Escartín has authored or co-authored about 26 scientific papers in journals and conference proceedings and 35 books and book chapters. He belongs to the Psychological Violence Research Group at the University of Barcelona and to a teaching innovation group called GID-PSISOCIAL group (teaching innovation group in social psychology).

Lucia Ceja

Obtained her PhD in Work and Organizational Psychology from the University of Barcelona, Spain. She holds a MSc in Occupational Health Psychology from the University of Nottingham, UK and a MSc in Systemic Coaching from the Autonomous University of Barcelona. Lucia is a researcher in the Family-Owned Business Chair at IESE Business School, University of Navarra. She has received several international research awards such as the Gallup Strength Scholar Award and the Barcelona Chamber of Commerce Family Business Research Award. Lucia works as a happiness consultant for companies in Europe, USA and Latin America. Her current research interests involve the application of the nonlinear dynamical systems theory to the study of employee well-being and the fields of systemic coaching and family-owned business. Her work is published in journals including the European Journal of Work and Organizational Psychology, Journal of Organizational Behavior, Human Relations and Journal of Happiness Studies.

Montserrat Celdrán

Obtained her PhD in Educational Psychology and M.S. degree in Neurosciences and Ageing Psychology. She is a full-time professor at the Department of Developmental and Educational Psychology at the University of Barcelona. Her main research interests are intergenerational relationships, volunteering and education of old people. Her work has been published in several international journals including The Gerontologist, Ageing and Society or European Journal of Ageing. She belongs to the Gerontological Research Group at the University of Barcelona and to a teaching innovation group called GIDPsiDe (teaching innovation group in developmental psychology).

Javier Martín-Peña

Obtained his European PhD in Social Psychology from the University of Barcelona (Spain). He obtained his MSc degree in Social Psychology. He completed pre-doctoral training in social psychology at Tilburg University (The Netherlands) and City University of New York (USA). He was Research Assistant and Professor at Faculty of Psychology and Faculty of Law, at University of Barcelona. Since 2012, he is Lecturer Professor within Sociology and Psychology, teaching within the social psychology area, at the Faculty of Social Sciences and Work (University of Zaragoza, Spain). He has received a research award by the University of the Basque Country. His current research interests concern to human behavior and assessment from a psychosocial approach. Dr. Martin-Peña has authored or co-authored about 18 scientific papers in journals and 7 book chapters. With respect to innovative higher education, he is interested in applications from positive psychology such as personal strengths. He belongs to the Psychological Violence Research Group at the University of Barcelona and to a teaching innovation group called GID-PSISOCIAL group (teaching innovation group in social psychology).

Published by OmniaScience (www.omniascience.com)



Journal of Technology and Science Education, 2014 (www.jotse.org)



Article's contents are provided on a Attribution-Non Commercial 3.0 Creative commons license. Readers are allowed to copy, distribute and communicate article's contents, provided the author's and JOTSE journal's names are included. It must not be used for commercial purposes. To see the complete licence contents, please visit <http://creativecommons.org/licenses/by-nc/3.0/es/>