Psychology, 2014, 5, 358-364
Published Online April 2014 in SciRes. http://www.scirp.org/journal/psych
http://dx.doi.org/10.4236/psych.2014.55046

Perceived Self-Efficacy in Problem Solving and Scientific Communication in University Students. A Gender Study

Francisco Javier Flores[1], Daniel Mayorga-Vega[2], José René Blanco[1,3], Humberto Blanco[1]

[1]Faculty of Physical Culture Sciences, Autonomous University of Chihuahua, Chihuahua, Mexico
[2]Department of Physical Education and Sport, University of Granada, Granada, Spain
[3]Faculty of Sports Organization, Autonomous University of Nuevo León, Nuevo León, Mexico
Email: hblanco@uach.mx

Received 11 February 2014; revised 13 March 2014; accepted 11 April 2014

Abstract

The purpose of the present study was to compare the profiles of perceived self-efficacy in problem solving and scientific communication between men and women university students. A total sample of 2089 participants, 902 women and 1187 men, aged 17 - 20 years participated in this study. The sample was constituted by all the freshmen university students from each degree offered by the Autonomous University of Chihuahua (Mexico). A quantitative approach with a descriptive and transversal survey design was used. All the participants completed the *Self-Efficacy Problem Solving and Communication Scale*. The results of the one-way multivariate analysis of variance, followed by the one-way univariate analyses of variance, showed that the men reported statistically significant better perceived self-efficacy in problem solving than the women ($p < .05$), but they had lower scores in the possibility for improving self-efficacy perceived than the women ($p < .05$). Regarding the scientific communication, the females reported statistically significant greater desired and reachable self-efficacy than the men ($p < .05$). However, for all the other variables statistically significant differences were not found ($p > .05$). Because of the differences between men and women in their perception of self-efficacy found, these findings suggest that in order to design any intervention for improving the perceived self-efficacy of the students, the variable gender should be taken into account.

Keywords

Student's Beliefs, Gender Differences, Higher Education, Academic Performance, Student Characteristics

How to cite this paper: Flores, F. J. et al. (2014). Perceived Self-Efficacy in Problem Solving and Scientific Communication in University Students. A Gender Study. *Psychology, 5,* 358-364. http://dx.doi.org/10.4236/psych.2014.55046

1. Introduction

People continuously are trying to achieve certain goals, and the own motivation drives us to perform specific behaviors depending on the achievements that people want to reach. It is not enough to know clearly neither what one wants to achieve, nor the best way to accomplish it. Additionally, it is not enough to be able to achieve something, one must also judge his/her ability to use their personal aptitudes and skills in a variety of circumstances (Blanco, 2010; Blanco, Martínez, Ornelas, Flores, & Peinado, 2011). The people's perception about their own efficacy becomes a key requirement in order to successfully develop actions aimed at achieving personal goals (Bandura, 1997; Ornelas, Blanco, Gastélum, & Chávez, 2012). This self-perception, called self-efficacy, has a strong influence on the choice of tasks and activities, as well as on the effort and perseverance of individuals when faced with certain challenges and even experiencing emotional reactions to difficult situations (Castañeda, Pineda, Gutiérrez, Romero, & Peñalosa, 2010; León-Rubio, Cantero, & León-Pérez, 2011; Vera, Salanova, & Martín-del-Río, 2011; Wolters, 2004).

The beliefs that people have about themselves represent a basic factor for the achievement of their activities or decisions-making that they will have to face throughout their lives. The greater the perceived efficacy is, the greater will be the degree of effort invested and the persistence in the achievement of the proposed goal; this is a situation of the utmost importance for a person who is involved in a learning process to be successful (Bandura, 1997; Ornelas et al., 2012). In short, the self-efficacy beliefs constitute a cognitive mechanism that mediates between the knowledge and the action, and define together with other factors, the success of your own actions (Carbonero & Merino, 2008; Ornelas, Blanco, Rodríguez, & Flores, 2011; Zimmerman & Kitsantas, 2005).

According to the results of previous research studies (Asbún & Ferreira, 2003; Betz & Hackett, 1981; Hackett, 1995; Pajares, 2001), it seems that the gender differences in the perceived self-efficacy may be due to the different ways in which men and women experience each of the four sources of the self-efficacy. In this line, considering the achievements of earlier performance as one of the most important sources of self-efficacy, it can be seen that boys are exposed to a wider range of experiences in a greater number of areas outside the home, while girls are traditionally exposed to a greater number of experiences inside the home. Based on a process of differential gender socialization, this differential exposure to each of the sources of self-efficacy might allow women to develop a lower self-efficacy than men for typically masculine tasks. Hence, the gender differences in the academic motivation can be better explained by the beliefs that students have about their own attributes of their gender than by inherent variables to the gender itself.

In this line, previous studies found that the self-efficacy beliefs act as moderators of the gender differences in the degree choices, courses, and occupations (Borgen & Betz, 2008, 2011). Therefore, unlike men who show consistency in their estimates of self-efficacy, women tend to have much lower perceptions of traditionally masculine occupations than of those that are traditionally female (Betz, 2007). Unfortunately, to our knowledge, there are no studies examining the influence of gender in the perceived self-efficacy in problem solving and scientific communication. Consequently, the purpose of the present study was to compare the profiles of perceived self-efficacy in problem solving and scientific communication between men and women university students. The results of the present study might provide knowledge that would help to find out how to promote educational interventions within an educational perspective for attention to the diversity in the classroom.

2. Method

2.1. Participants and Design

A sample of 2089 university students, 902 women and 1187 men, aged 17 - 20 years (M = 18.23; SD = .74) participated in the present study. The sample was constituted by all the freshmen university students from each degree offered by the Autonomous University of Chihuahua (Mexico). A convenience sampling was used in order to try to cover representation of all the degrees (**Table 1**). Regarding the design of the study, a quantitative approach with a descriptive and transversal survey design was used (Hernández, Fernández, & Baptista, 2006). The independent variable was gender (women and men) and the dependent variables were the mean scores in the four scenarios in both the problem solving and scientific communication.

2.2. Instrument

The self-efficacy in problem solving and scientific communicationwas measured by the *Self-Efficacy Problem*

Table 1. Distribution of the participants according to the subject and gender categories.

Subject	Women	Men	Total
Physical education	81	214	295
Education and Humanities	96	72	168
Health sciences	121	108	229
Social and administrative sciences	176	124	300
Politics sciences	200	89	289
Engineering and Technology	143	449	592
Agricultural sciences	85	131	216
Total	902	1,187	2,089

Solving and Communication Scale (Aguirre, Muñoz, De Rueda, & Blanco, 2012). This questionnaire consists of an 11-item scale with two subscales: problem solving (6 items) and scientific communication (five items). According to previous studies (Blanco, Martínez, Zueck, & Gastélum, 2011; Viciana, Cervello, & Ramirez, 2007), due to the fact that in the Mexican academic context students are commonly assessed by a scale from 0 to 10, in the present study a Likert-type scale from 0 to 10 was chosen. For each domain (item) of the problem solving and scientific communication competences (subscales), the participants were asked about how capable they feel, how much interest they have, and if they would make an effort to change how capable they will be to... Therefore, all the participants responded to each of the 11 items of the questionnaire in the three different scenarios: 1) *Scenario of perceived ability*, responding in the context "how capable I feel to… to manage in each of the domains of the competences above mentioned"; 2) *Scenario of interest in being able*, responding in the context "how much interest I have in being able to... to manage in each of the domains of the competences above mentioned"; and 3) *Scenario of change to be able to*, responding into the context "if I would make an effort to change, how much capable I will be able to... to manage in each of the domains of the competences above mentioned".

When calculating the scores for the both dimensions problem solving and scientific communication, four different values were calculated: 1) *Perceived self-efficacy*, obtained from the average scores in the scenario of perceived ability; 2) *Desired self-efficacy*, calculated from the average scores in the scenario of interest of being able; 3) *Reachable self-efficacy*, obtained from the mean scores in the scenario of being able; and 4) *Possibility of improvement in the perceived self-efficacy*, calculated from the mean difference between reachable self-efficacy and perceived self-efficacy. A higher score indicates greater self-efficacy, whereas a lower score represents lesser self-determination. The *Self-Efficacy Problem Solving and Communication Scale* demonstrated adequate psychometric properties (GFI = .924; RMSEA = .086; Cronbach coefficient alphas = .887 and .836 for problem solving and scientific communication, respectively) (Aguirre et al., 2012).

2.3. Procedure

All the freshmen university students from each degree offered by the Autonomous University of Chihuahua in the semester January-June of 2012 were invited to participate in the present study. These university students were fully informed about all the features of the project. Then, all the students that had agreed to participate were asked to sign a written informed consent. After the students' approvals were obtained, participants completed the above mentioned questionnaire by means of the instrument module administrator of the Scales Editor Version 2.0 (Blanco et al., 2013).

Participants completed the questionnaire in the computer rooms of their faculties during a session. At the beginning of the session the researchers gave a general introduction about the importance of the research and how to access the questionnaire thought the software. When the participants were in the editor, the instructions about how to fill out the questionnaire correctly appeared before the instrument. Additionally, the participants were advised to ask for help if confused concerning either the instructions or the clarity of a particular item. Completion of the entire questionnaire took approximately 25 minutes. At the end of the session their participation was welcomed. Afterward, when all the participants completed the questionnaire, the data were collected by means of the results generator module of the Scales Editor Version 2.0 (Blanco et al., 2013).

2.4. Data Analysis

Descriptive statistics (means and standard deviations) for all the variables were calculated. Subsequently, after verifying that the data met the assumptions of parametric statistical analyses, a one-way multivariate analysis of variance (MANOVA), followed by the one-way univariate analysis of variance (ANOVA), were used to examine the differences between the men and women in both the reported self-efficacy in problem solving and scientific communication scores. Moreover, the effect size was estimated using the eta-squared (η^2). The internal consistency reliability of the each variable was estimated using the Cronbach coefficient alphas (ICC) and the 95% confidence intervals (CI). All statistical analyses were performed using the SPSS version 20.0 for Windows (IBM® SPSS® Statistics 20).The statistical significance level was set at $p < .05$.

3. Results

3.1. Problem Solving Factor

Table 2 shows the mean values and standard deviations of the self-efficacy in problem solving, as well as the results of the MANOVA and the follow-up univariate ANOVAs. The MANOVA results indicated overall statistical significant differences between genders in the self-efficacy in problem solving scores (Wilks' $\lambda = .992$; $p = .001$; $\eta^2 = .008$). Subsequently, the follow-up ANOVAs showed that the men reported statistically significant better perceived self-efficacy in problem solving than the women ($F_1 = 7.503$; $p = .006$), but they had lower scores in the possibility for improving self-efficacy perceived than the women ($F_1 = 14.995$; $p < .001$). However, in the desired and reachable self-efficacy statistically significant differences were not found ($p > .05$). Finally, the internal consistency reliability of the problem solving factor was very high: perceived self-efficacy .897 (.890 - .904), desired self-efficacy 0.906 (.900 - .912) and reachable self-efficacy 0.905 (.899 - .911).

3.2. Scientific Communication Factor

Table 3 shows the mean values and standard deviations of the self-efficacy in scientific communication, as well as the results of the MANOVA and the follow-up univariate ANOVAs. The MANOVA results indicated overall statistical significant differences between genders in the self-efficacy in scientific communication scores (Wilks' $\lambda = .994$; $p = .009$; $\eta^2 = .006$). Subsequently, the follow-up ANOVAs showed that the women reported statistically significant greater desired and reachable self-efficacy in scientific communication than the men ($F_1 = 10.378$; $p = .001$, and $F_1 = 7.259$; $p = .007$, respectively). However, in the perceived and the possibility for improving self-efficacy statistically significant differences were not found ($p > .05$). Finally, the internal consistency reliability of the scientific communication factor was very high: perceived self-efficacy .841 (.830 - .852), desired self-efficacy .870 (.861 - .879) and reachable self-efficacy .864 (.855 - .873).

Table 2. Results of MANOVA for the gender differences in the four variables of self-efficacy for problem solving.

	Women (n = 902)	Men (n = 1187)	F	p	η^2
			5.530	<.001	.008
Perceived self-efficacy	7.40 (1.34)	7.57 (1.32)	7.503	.006	.004
Desired self-efficacy	8.65 (1.19)	8.63 (1.20)	.066	.798	.000
Reachable self-efficacy	8.95 (1.00)	8.94 (1.00)	.000	.992	.000
Possibility for improving perceived self-efficacy	1.54 (.96)	1.38 (.93)	14.995	<.001	.007

Note: Descriptive values are reported as mean (standard deviation).

Table 3. Results of MANOVA for the gender differences in the four variables of self-efficacy for scientific communication.

	Women (n = 902)	Men (n = 1187)	F	p	η^2
			3.891	.009	.006
Perceived self-efficacy	7.78 (1.29)	7.70 (1.33)	1.853	.174	.001
Desired self-efficacy	8.95 (1.11)	8.78 (1.21)	10.378	.001	.005
Reachable self-efficacy	9.19 (.90)	8.07 (1.00)	7.259	.006	.003
Possibility for improving perceived self-efficacy	1.40 (.93)	1.37 (1.00)	.622	.431	.000

Note: Descriptive values are reported as mean (standard deviation).

4. Discussion

The purpose of the present study was to compare the profiles of perceived self-efficacy in problem solving and scientific communication between men and women university students. Problem solving dimension refers to being able to apply the different observation techniques for problem solving, distinguishing between the different kind of systems, using different methods to establish alternatives of problem solving, applying the systemic approach to different contexts, using the statistics for the interpretation of results and knowledge construction, as well as analyzing the different components of a problem and their interrelationships. Regarding the results of the present study, although women show less perceived self-efficacy in problem solving than the men, they have better possibility for improving self-efficacy perceived than the men. However, as regards the desired and reachable self-efficacy, the results of the present study did not find any differences between men and women.

On the other hand, the scientific communication dimension refers to collecting, analyzing and applying information from different sources, handling documents and electronic resources that support communication and information search, developing essays from research processes, using and implementing software packages to develop documents, presentations and information databases, as well as reading and interpreting texts. As regards the results of this study, though no differences in the perceived and the possibility for improving self-efficacy between men and women were found, the women perceived themselves with greater desired and reachable self-efficacy in scientific communication than the men.

Saunders, Davis, Williams, and Williams (2004) carried out a research study on the differences in academic self-efficacy between boys and girls among high school students. Similarly to the results of the current study, these authors found that girls reported higher levels of academic self-efficacy than men and greater desires of finishing their studies. On the other hand, in addition to the results obtained in this research, over the last few years a few theoretical bases have served as a framework for explaining the vocational behavior of men and women. Among these theories, the Bandura's (1999) theory of self-efficacy should be highlighted, according to which the self-efficacy expectations are one of the main determinants of gender differences in the academic and professional decisions-making. These differences are the result of the socialization process that leads men and women to have a different perception about the tasks, activities, studies and occupations that are most appropriate for each gender. Therefore, under the implicit assumption that the promotion of self-efficacy will serve as a vehicle for improving other positive outcomes such as the academic achievement and self-esteem, improving the perception of being able to learn is a valuable educational objective. Additionally, it should be taken into account that the continued sense of failure reduces the success expectations and it does not favor any form of either personal learning or personal development (Ornelas et al., 2012).

5. Conclusion

In conclusion, the main finding of the present study is that, although women perceived less self-efficacy in problem solving than the men, they have better possibility for improving perceived self-efficacy than the men. Additionally, the women perceived themselves with greater desired and reachable self-efficacy in scientific communication than the men. These differences found between men and women regarding their perceptions of self-efficacy suggest that when designing any kind of educational intervention aimed at the improvement of self-efficacy, the gender of the individual should be taken into account. The results of the present study might provide knowledge that helps to find out how to promote educational interventions within an educational perspective for attention to the diversity in the classroom. Finally, the importance of carrying out future research studies about this topic among Mexican students in order to expand the knowledge in this field should be highlighted.

Acknowledgements

This study is part of a project funded by the Secretaría de Educación-Pública-Subsecretaría de Educación Superior-Dirección General de Educación Superior Universitaria de México [Mexican Ministry of Education-Department of Higher Education-General Directorate of the University Education] (OF-13-6894). Additionally, the second author is supported by a research grant from the Spanish Ministry of Education, Culture, and Sport (AP2010-5905). Also the third author is supported by a grant from the National Council of Science and Technology of Mexico (520339). Finally, we would like to thank Anna Szczesniak for the English revision.

References

Aguirre, J. F., Muñoz, F., De Rueda, B., & Blanco, J. R. (2012). Composición factorial de una escala de autoeficacia en la solución de problemas y comunicación en universitarios de ciencias sociales. *Formación Universitaria, 5*, 27-38. http://dx.doi.org/10.4067/S0718-50062012000500004

Asbún, C., & Ferreira, Y. (2004). Autoeficacia profesional y género en adolescentes de cuarto de secundaria de la zona sur de la ciudad de la paz. *Revista Ajayu, 2*. http://www.ucb.edu.bo/Publicaciones/Ajayu/v2n1/v2n1a3.html.

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. New York: Freeman.

Bandura, A. (1999). *Autoeficacia: Como afrontamos los cambios de la sociedad actual*. Madrid: Desclée de Brouwer, S. A.

Betz, N. E. (2007). The Career Development of Women. In F. Denmark, & M. A. Paludi (Eds.), *Psychology of Women: A Handbook of Issues and Theories* (pp. 717-752). Westport, CT: Greenwood Press.

Betz, N. E., & Hackett, G. (1981). A Self-Efficacy Approach to the Career Development of Women. *Journal of Vocational Behavior, 18*, 326-339. http://dx.doi.org/10.1016/0001-8791(81)90019-1

Blanco, Á. (2010). Creencias de autoeficacia de estudiantes universitarios: Un estudio empírico sobre la especificidad del constructo. *RELIEVE, 16*, 1-28.

Blanco, H., Martínez, M., Ornelas, M., Flores, F. J., & Peinado, J. E. (2011). *Validación de las escalas autoeficacia en conductas académicas y cuidado de la salud*. México: Doble Hélice Ediciones.

Blanco, H., Martínez, M., Zueck, M. D. C., & Gastélum, G. (2011). Análisis psicométrico de la escala autoeficacia en conductas académicas en universitarios de primer ingreso. *Actualidades Investigativas en Educación, 11*, 1-27.

Blanco, H., Ornelas, M., Tristán, J. L., Cocca, A., Mayorga-Vega, D., López-Walle, J., & Viciana, J. (2013). Editor for Creating and Applying Computerise Surveys. *Procedia Social and Behavioral Sciences, 106*, 935-940. http://dx.doi.org/10.1016/j.sbspro.2013.12.105

Borgen, F. H., & Betz, N. E. (2008). Career Self-Efficacy and Personality: Linking Career Confidence and the Healthy Personality. *Journal of Career Assessment, 16*, 22-43. http://dx.doi.org/10.1177/1069072707305770

Borgen, F. H., & Betz, N. E. (2011). Integrating Self through Personality, Interests, and Self-Efficacy. In P. J. Hartung, & L. M. Subich (Eds.), *Developing Self in Work and Career: Concepts, cases, and contexts* (pp. 141-160). Washington DC: APA Books. http://dx.doi.org/10.1037/12348-009

Carbonero, M. Á., & Merino, E. (2008). Autoeficacia y madurez vocacional. *Psicothema, 16*, 229-234.

Castañeda, S., Pineda, M. D. L., Gutiérrez, E., Romero, N., & Peñalosa, E. (2010). Construcción de instrumentos de estrategias de estudio, autorregulación y epistemología personal. Validación de constructo. *Revista Mexicana de Psicología, 27*, 77-85.

Hackett, G. (1995). Self-Efficacy in Career Choice and Development. In A. Bandura (Ed.), *Self-Efficacy in Changing Societies* (pp. 232-258). New York: Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511527692.010

Hernández, R., Fernández, C., & Baptista, P. (2010). *Metodología de la investigación*. México: McGraw-Hill.

León-Rubio, J. M., Cantero, F. J., & León-Pérez, J. M. (2011). Diferencias del rol desempeñado por la autoeficacia en el burnout percibido por el personal universitario en función de las condiciones de trabajo. *Anales de Psicología, 27,* 518-526.

Ornelas, M., Blanco, H., Gastélum, G., & Chávez, A. (2012). Autoeficacia percibida en la conducta académica de estudiantes universitarias. *Formación Universitaria, 5,* 17-26. http://dx.doi.org/10.4067/S0718-50062012000200003

Ornelas, M., Blanco, H., Rodríguez, J. M., & Flores, F. J. (2011). Análisis psicométrico de la escala autoeficacia en conductas de cuidado de la salud física en universitarios de primer ingreso. *FormaciónUniversitaria, 4*, 21-34. http://dx.doi.org/10.4067/S0718-50062011000600004

Pajares, F. (2001). Self-Efficacy Beliefs in Academic Settings. *Review of Educational Research, 66*, 543-578. http://dx.doi.org/10.3102/00346543066004543

Saunders, J., Davis, L., Williams, T., & Williams, J. H. (2004). Gender Differences in Self Perceptions and Academic Outcomes: A Study of African-American High School Students. *Journal of Youth and Adolescence, 33*, 81-90. http://dx.doi.org/10.1023/A:1027390531768

Vera, M., Salanova, M., & Martín-del-Río, B. (2011). Self-Efficacy among University Faculty: How to Develop an Adjusted Scale. *Anales de Psicología, 27*, 800-807.

Viciana, J., Cervelló, E. M., & Ramírez, J. (2007). Effects of Manipulating Positive and Negative Feedback on Goal Orientation, Perceived Motivational Climate, Satisfaction, Task Choice, Perception of Ability, and Attitude to Physical Education Lessons. *Perceptual and Motor Skills, 105*, 67-82. http://dx.doi.org/10.2466/pms.105.1.67-82

Wolters, C. (2004). Advancing Achievement Goal Theory: Using Goal Structures and Goal Orientations to Predict Students'

Motivation, Cognition and Achievement. *Journal of Educational Psychology*, *96*, 236-250. http://dx.doi.org/10.1037/0022-0663.96.2.236

Zimmerman, B., & Kitsantas, A. (2005). Homework Practice and Academic Achievement. The Mediating Role of Self-Efficacy and Perceived Responsibility Beliefs. *Contemporary Educational Psychology*, *30*, 397-417. http://dx.doi.org/10.1016/j.cedpsych.2005.05.003