



The Effect of Concept Map Training on Increasing Self-Directed Learning in Thinking and Commercial Media Literacy Course

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Abstract

The current study aimed to compare the effect of using concept map teaching and traditional education on improving self-directed learning indicators of high school students in the thinking and media literacy course. The experimental and control groups via the quasi-experimental research method were used. Three classrooms were selected by purposive sampling as random arrangement (one concept map presentation class, one concept map presentation, and one construction class, and one control class). The course materials in the presentation and construction (combined) group were offered to the learners in the form of a concept map. Using the teacher-made and combined concept map method, the experimental groups were trained in 8 sessions separately and the control group was trained in the traditional method. In all groups, the Fisher et al., standard questionnaire was used to assess students' self-directed learning preparation. The research findings revealed that using teacher-made and combined concept maps have increased and improved the self-directed learning index and the traditional training has had a significant effect on the components of self-directed learning. The results disclosed that teaching by concept map method in a combined and teacher-made manner had a significant effect on the self-learning of all of them.

Keywords: Concept map, Lecture method, Presentation and construction of concept map, Self-directed learning.

Introduction

Nowadays, the biggest challenge for students is the rapid increase in knowledge and the massive amount of information they need to learn. Due to this fact, students spend a lot of time to learn new material, so learning a proper study method is necessary (Amani & Zamani, 2019).

The chief and important issue in education is learning and the meaningfulness of education is attained via the learners' learning. Consequently, facing a massive amount of knowledge and information with the continuous advancement of technology necessitates people to learn more not to lag behind others. The creation and production of new knowledge depending on preceding studies and knowledge has grown quickly,

hence to keep pace with this increasing trend of science and knowledge, people must act in a way that increases the speed of learning and need fewer direct instruction by the instructor. The technology progression has provided a suitable platform for learning from teacher-centered education to self-direction education. Self-directed learning leads to learning inclusive needs through search and follow-up. Due to the foregoing, the (Gillies et al., 2008) of self-directed learning skills have become one of the chief goals of education in the last two decades, in a way that research in this field is increasing worldwide. Self-direction is teaching and learning in any situation that learners are in (Kazemi & Omidinajafabadi, 2012) and (Radfar & Nakhoda, 2018).

Researchers have indicated that the massive amount of information and the fast growth of science have made traditional education systems unresponsive; so people need to guide their training towards a direction that requires less training. Cyberspace, communication networks, and the World Wide Web have offered a good infrastructure for the self-direction of people (Chou Pao, 2012).

Self-directed learning lets one follow and learn what one needs. So the role of the educator is to move from an all-knowing person in the learning scene to a director in a self-directed learning environment. In self-directed learning, the role of the learner changes from passive to active (Fisher et al., 2001) and (Radfar & Nakhoda, 2018).

Consequently, nowadays, one of the education goals is to help learners to use their knowledge efficiently to solve problems in their upcoming lives. On the other hand, since the useful life of each field of human knowledge is shortening and new rules and regulations are continually substituting outmoded rules and regulations, learners must be equipped with knowledge that will

never be in distress. To attain this goal, one needs to reconsider the teaching methods so that move from traditional knowledge-based teaching methods to new process-oriented methods in which learners consolidate their knowledge and learning by thinking and reasoning. Generally, in the models that are formed with this approach during education, teachers are considered as guides in the educational process and most of the activities of the educational process are the responsibility of learners (Heidari et al., 2015).

Self-directed learning is a process in which learners search and learn the required content with their inventiveness and creativity. In the meantime, the role of the educator changes from an all-knowing teacher-centered person to a director is the direction of a self-directed learning environment (Fisher et al., 2001).

Thus, according to (Knowles, 1990), self-directed learners are people that their learning is done through active learning and on their initiative by learning more than passive learners in a better way.

Regarding this approach, based on Ausubel's structural theory, and self-directed learners can be considered as active and self-aware learners, from which a concept map is derived (Safavi, 2006).

Constructivism is one of the significant theoretical frameworks that plays a key role in shaping and managing new appraisals and new educational activities. Constructivism usually emphasizes that individuals must actively construct knowledge. Advocates of this opinion argue that preceding knowledge is used as a framework for new learning. In this approach, people create their mental schemas that are the basis of their mental activities in the future (Vosoughi, 2009).

The concept map is one of the modern educational approaches that is rooted in the constructivist approach. Concept maps can be used in all diverse stages of education from



content preparation to implementation and evaluation level. The concept map is a tool to display the relationships between concepts coherently and hierarchically that facilitates meaningful learning because in this method the concepts are not scattered but are in the form of a network of relationships (Mesrabadi, 2007).

Concept maps have a great effect on students' learning. The knowledge structure of individuals contains insights and concepts they perceive of a subject or concept and how to communicate between these concepts. These maps, due to this special feature, are effective in meaningful learning. Likewise, concept maps, due to their unique features, are effective in simplifying creative thinking (Novak, 2010).

On the other hand, the concept map is one of the educational strategies and a subset of organizational strategies that is closely related to the philosophy of constructivism and can also expedite meaningful learning (Sun, 2004).

The constructivist classroom offers learners opportunities to actively understand and construct knowledge through first-hand experiences and generate knowledge (Seif, 2015). Classrooms run through constructivism often have a workshop-like atmosphere. These classes provide students with the opportunity for active discovery, exploration, and experimentation (Aghazadeh, 2005).

The concept map method is located in the constructivist learning category correctly. The theoretical framework of the concept map teaching method is based on Ausubel's meaningful learning theory. The basic idea in David Ausubel Psychology is that learning takes place by connecting new concepts and topics with existing concepts in the prevalent cognitive structure (Novak & Canas, 2008).

In Ausubel's learning theory, meaningful learning means that the learner can connect

new material with the material in the cognitive structure. As a strategy, a concept map helps learners to organize their cognitive framework in a strong integrated model. Regarding concept maps, numerous studies show that concept maps can improve learning and learners' independent learning (Chiou, 2008).

Conceptual mapping is one of the active teaching methods that can help teachers nurture creative and thoughtful students. The theoretical framework of the concept map is based on Ausubel's meaningful learning. He believes that learning occurs when the learner can organize and connect new concepts and information to his cognitive mental structures. Regarding Ausubel's theory of meaningful learning, (Novak & Canas, 2008) developed the concept map teaching method. A concept map is a visual representation of meaningful relationships between concepts. A concept map consists of cores and relationships. In nodes, it is a concept, phrase, or question that connects to other nodes via relationships. The communication lines between the cores may signify relationships such as identity (*same-as*, two synonymous concepts), specialization (*subclass-of*, *superclass-of*, defining hierarchies), and compositional (*component-of*, *composed-of*, indicator the parts and components of the concept) (Sun, 2004). Concept maps are usually organized hierarchically and more general and comprehensive content is placed at the top, and the closer we get to the bottom, the concepts and content become more detailed (Novak, 2010).

To develop the educational conditions in the field of different sciences, particularly the course of thinking and media literacy, which has doubled the importance of learning in today's world, the educational elements of this field, including educational groups, curricula, teachers and faculty members, equipment and hardware and software fields,

should be carefully appraised. Consequently, the penetration of outdated approaches in the learning-teaching system of thinking and media literacy, including the lack of attention to key and recent educational concepts, especially self-directed learning in these processes, is the subject matter of the present study.

In the current study, the advancement of self-directed learning indices, which is revealed in three components of self-management, self-control, and learning motivation, has been considered by changing the teacher-centered learning style to learning based on teaching concept maps.

Concept maps can be drawn both with pen and paper and with advanced computer software. Inspiring students to draw concept maps leads to engaging their minds with the concepts and logical relationship between them, and this is of great significance in the process of teaching and learning and the methods of achieving cognition and metacognition. Thus, this study aims to compare the effect of conceptual and traditional map training on improving self-directed learning skills in the course of thinking and media literacy.

So, regarding the mentioned issues, teaching students who have suitable academic performance is one of the goals that all educational systems are trying to achieve. Hence, investigating the effect of concept map-based learning on learners as a way to improve self-directed learning skills can be vital; if the effectiveness of this method is proven, education specialists can invest more in this method and use it to improve learning and increase students' academic performance. Regarding the research background, by examining internal and external information sources, the following can be mentioned.

(Allah Karami & Babamorad, 2017) in a study on the effect of concept map teaching method on self-regulation and academic self-

concept of third-grade junior high school male students in Quds city in the academic year of 2015-2016. This study consisted of 60 third grade junior high school students. Participants were divided into experimental and control groups by the two-stage cluster random sampling method. Self-regulation questionnaire by (Gillies et al., 2008) and (Nadi, 2018) academic self-concept scale were the research tools. The results revealed that using the concept map teaching method is effective in improving students' self-regulation and academic self-concept. Consequently, considering the effectiveness of the concept map in creating meaningful learning and its effectiveness on important variables in the field of education such as self-regulation and academic self-concept, its use can be one of the significant missions of education.

(Bressington et al., 2018), in a study called "Concept mapping to promote meaningful learning, help relate theory to practice and improve learning self-efficacy in Asian mental health nursing students: A mixed-methods pilot study" on nursing students of the School of Mental Health in Hong Kong in the form of two experimental groups of 12 people and a control group of 28 people with a quasi-experimental design revealed that using a concept map as an educational strategy on learning self-efficacy and improving nurses' performance has been advantageous.

(Nadi & Kazemi, 2005) inspected the relationship between self-directed learning and academic performance and life satisfaction in students using a survey method and a standard questionnaire. The results indicated that there is a significant positive relationship between self-directed learning and its dimensions (self-management, learning desire, and self-control) with life satisfaction and academic performance. In other words, self-directed learning



components are a good predictor of life satisfaction and academic performance. Factors affecting students' self-directed learning readiness were also investigated in (Kazemi & Omidinajafabadi, 2012) research via survey method. The results of stepwise regression revealed that the variables of mastery goals, performance goals, goal clarification, superficial learning approach, in-depth learning approach, and general skills explain the major changes in self-directed learning readiness.

A review of preceding research confirms that self-directed readiness assessment has been considered by researchers in several studies, especially in the field of education. Likewise, concept maps and participatory learning techniques have been mentioned in various texts to improve the teaching-learning process. However, so far no basic research has been done using the quasi-experimental method to improve self-directed learning indicators with emphasis on the two methods in the field of thinking and media literacy.

Research Hypotheses

Hypothesis 1: There is no significant difference between the pre-test scores of the self-directed learning questionnaire of students in three groups (two groups of concept map presentation and the experimental group of the concept map and the control group).

Hypothesis 2: The use of concept maps has a greater effect on students' self-directed learning in thinking and media literacy than the traditional method.

Materials and Methods

The research design of the present study was a quasi-experimental design with pre-test and

post-test and a comparison group. The statistical population was all male students in the tenth grade of high school in district one of Shiraz during 2018-2019, whose number is 3496 individuals. In this study, due to the limitations of research in terms of special conditions for controlling influential variables, administrative issues, satisfaction of subjects and the need to keep the effects of the teacher constantly, purposive nonprobability sampling method was used. In this method of sampling, the researcher, based on his knowledge of the characteristics of the community, in a non-probable manner selected 3 pre-formed classrooms that 61 students were studying in these classes. Then, in a random arrangement to teach a class by combined method map method (presentation and construction of concept map), a class by teacher-made concept map method and a class by conventional method (traditional) in the form of two experimental groups and a control group are considered.

In this study, in order to maximize the homogenization of the experimental and control classes, all three groups were located in the same school and one teacher taught in all three classes. Furthermore, the mean scores of the subjects in each group were examined and there was no significant difference between the means of the groups. A single research method was used to control teacher-related characteristics such as teaching abilities, motivation methods, and willingness to cooperate. Then, due to the similarity of the teacher, an effort has been made for all three groups to have the same conditions in terms of education. Researcher-made academic achievement test was also used to measure academic achievement.

Academic achievement test: Teacher-made academic achievement test was used to measure the cognitive interval. Students' level of knowledge and comprehension was measured above Bloom using the test.

Academic achievement test from the content of chapter one to the beginning of chapter 5 of the book of thinking and media literacy of the tenth grade of high school in different levels of Bloom's cognitive domain in two parts of knowledge level and level of understanding was prepared by three experienced teachers.

Content validity was used to determine the validity of the academic achievement test. To determine the content validity of the test by the method of S.H. Lawshe, the judgment of experts on the extent to which test questions represent the content and objectives of the program was used and its value was 0.78. In this study, to determine the reliability of the test, 20 students from other classes who had already passed this course were tested and the reliability of the test was calculated by Kuder-Richardson 20 method (suitable method for four-choice tests) as 0.807. This value was obtained after the test of 0.791.

Teacher-made concept map: The concept maps that were used to be presented in the experimental group classes by considering all the conditions for preparing a good concept map and in consultation with the teachers from the contents of the chapters of the thinking and media literacy book. Prepared Maps in different parts of the teaching, such as the pre-training stages (as a pre-organizing tool), the training stage (as a content presentation tool) and the post-training stage (as a lesson summary tool) were used.

Methods of applying research: In this study, the subjects participated in two experimental groups (a combined concept map class and a teacher-made concept map class) and a control group. The implementation details of the research process are presented in the following steps:

1. Preparation stage: In this stage, preparations for experimental application were provided. After identifying the examples, the

necessary coordination was done and the textbooks were identified and concept maps were prepared for these textbooks with the help of the researcher and educational colleagues. Then, during two sessions of the pilot classes, the teacher received the necessary training regarding the goals of the project and how to teach based on the concept map to implement the mentioned method with the necessary preparation and awareness.

2. Concept map development stage for textbooks: Also in this stage for the textbook using Cmap Tools software version 6.8 onwards, concept maps were prepared and reviewed by the researcher and three experienced teachers of media thinking and literacy.
3. Implementation stage: The present study was performed in 8 sessions of 90 minutes in the experimental group classes. During these sessions, learners in one presentation group, one presentation and construction group (combined) and one control group were taught the same educational material simultaneously but in different ways. The details of the implementation in the experimental groups are as follows: In the experimental group, before presenting the teaching of the desired learning unit, the teacher placed a concept map poster next to the board and used it regularly in all stages of the teaching. The teacher first asked the learners to look at the concept maps to create a background of the subject in mind. The teacher then summarized the topics with reference to a concept map. At this stage, during the teaching, the maps were used as a tool for presenting the content, and



after the explanations, the position of the presented materials and its relationship with other contents in the maps was indicated. After the training, concept maps were used as a tool to summarize the lesson. In the combined experiment group, in addition to all the steps described in the presentation group, after the end of the lesson, students were asked to draw the taught material individually and in groups on a piece of paper in the form of a concept map. Furthermore, before drawing a concept map, learners were taught how to prepare it.

4. Test implementation stage: In this stage, after the end of the training (teaching), the experimental and control groups performed the test without knowing about the test.

Results

The research findings were analyzed in this section. To test the research hypotheses, Wilcoxon analysis and covariance were used in SPSS 23 software.

Hypothesis 1: There is no significant difference between the pre-test scores of the self-directed learning questionnaire of students in three groups (two groups of concept map presentation and the experimental group of the concept map and the control group).

In line with the study of the first hypothesis, at first, the researchers examine the pre-test scores of the three experimental and control groups. As can be seen in (Table 1), the self-directed learning pre-test means score in the combined group is 3.94, teacher-made 3.97, and control 3.95, and is higher than the average value of 2.5. But these three values are not significantly different from each other.

Table 1. Descriptive statistics of the components of self-directed learning readiness of experimental and control groups before applying the educational intervention

Groups	Count	Mean	SD	Mean standard error
Combined	20	3.94	0.1718	0.0384
Teacher-made	20	3.97	0.2057	0.0460
Control	21	3.95	0.3429	0.074
Total	61	3.96	0.2491	0.0319

The Kolmogorov-Smirnov test was used to test the second hypothesis about the normality of the distribution of scores. According to the results of the Kolmogorov-Smirnov test and Levene's test at a significance level of 0.157, this is more than

0.05. It can be said that the assumption of normal data is confirmed and the variances of the experimental and control groups are not significantly different from each other, in other words, they are homogeneous (Table 2).

Table 2. Comparison results of the average self-directed learning pre-test

	Total square	DF	Mean Square	F	Sig
Between groups	0.004	2	0.004	1.0870	0.937
Within groups	3.71	58	0.064		
Total	3.72	60	0.065		

According to (Table 3), the results of one-way ANOVA show ($DF=2$, $F=1.087$, $Sig=0.344$) that there is no significant difference between the scores of these three groups in the pre-test of the self-directed learning questionnaire. That is, the second hypothesis of the research was confirmed.

Based on the above results and the homogeneity of the experimental and control groups before applying the independent variable, merely the post-test scores were considered to compare the scores of the

experimental and control groups after applying the concept maps training.

Hypothesis 2: Using concept maps has a greater effect on students' self-directed learning in thinking and media literacy than the traditional method.

To assess the effect of using concept maps and their construction on increasing students' self-directed readiness indicators, the nonparametric Wilcoxon test was used, and the following table reports the results.

Table 3. Mean pre-test and post-test results by Wilcoxon method

Variable	Pre-test average	Post-test average	Test statistics	Sig. level
Learning motivation, self-control, self-management	3.96	4.11	0.001	0.95

According to the obtained data, the significance level (0.001) is smaller than the alpha value (0.05), so the assumption of means equality, i.e. H_0 , is rejected and the assumption of the difference of means is confirmed, i.e. by applying teaching by concept maps, a significant difference is shown in promotion of students' self-directed learning indices from an average of 3.96 to 4.11 and the hypothesis of the effect of concept maps on students' self-directed learning in media thinking and literacy is confirmed.

Discussion

Research Hypothesis: Using concept map teaching has a greater effect on students' self-directed learning in thinking and media literacy than the traditional method.

Regarding the results, before applying the concept map method, all the means of all three groups of combination, presentation, and control were higher than average and even in some cases were close to high. These results are consistent with the findings of (Kazemi & Omidinajafabadi, 2012),(Soltani Arabshahi et al., 2012) and (Lai Horng, 2011).



A short interval from the completion of the first year of high school and the experience of planning the selection of major in the second year of high school and related classes, which is a complete exercise of self-control and self-management in the learning process and students' interest in subjects with good points were also cited as a strong motivating factor for learning.

Also, Tables (2) and (3) show that the average of the three indicators of self-directed readiness after applying concept maps in the method of combined and teacher-made concept map was significantly different from the traditional method. These results are in line with (Soltani Arabshahi et al., 2012) findings and in terms of learning motivation, it is in line with the findings of (Gillies et al., 2008) and terms of learning environment management, it is in line with the findings of (Pons Rosa et al., 2014).

In explaining this hypothesis, it can be said that the concept of self-directed learning originated from adult education, regarding the benefits of self-directed learning outcomes, educational and organizational environments, its importance is emphasized and its value has been considered as a necessary skill for education and works in the 21st century. Evidence demonstrates that people who take the initiative to learn (active learners) learn more and better than those who passively attend and receive instruction (passive learners). They enter the field of learning with greater determination and motivation and likewise benefit more from what they have learned compared to passive learners. The second reason is that self-directed learning is more harmonious with the natural human psychological development processes. An important dimension of maturity is the formation of the ability to take on increasing responsibility, that is, to become increasingly self-directed. The third reason is that most of the

developments in education have left learners largely accountable for taking the initiative and learning and learners who enter these programs without the skills of search and self-direction with their teachers will fail. The fourth reason is that, regarding other types of quick understanding of knowledge, it is no longer realistic to state that the goal and learning is knowledge transfer. The key aim of teaching and learning is now to create and shape research and exploration skills.

Conclusion

So, regarding the theoretical foundations that were discussed, it can be concluded that in most of the theories that have been presented in the field of school learning, implications can be found in the field of the concept map effect. They support Ausubel's theory of verbal learning, Brunner's theory, existing theories of cognition and metacognition, and information processing theories. Also, regarding the alignment of the above research findings and the results of the current study, it can be concluded that concept map-based education can have a positive effect on increasing academic achievement indicators and improving the skills of learners' self-directed learning indicators. It is suggested that future research be conducted as follows.

1. In an independent study, using concept map methods in different educational levels (primary and secondary) should be studied and its effectiveness in improving various educational indicators must be assessed.
2. Factors affecting the readiness of self-directed learning in students of different educational levels and their efficiency should be appraised in the post-graduation period and continuance of lifelong learning.

References

- Amani V. & Zamani K. (2019), A review of the use of concept map software in facilitating and improving the quality of chemistry education and learning, *Scientific Journal of Research in Chemistry Education*, 15(2): 174-189.
- Kazemi H. & Omidinajafabadi M. (2012), "Factors affecting the level of self-directed learning (SDLR) readiness of students of the Faculty of Agriculture, Tehran Research Sciences Branch". *Quarterly Journal of Agricultural Extension and Education Research*, 27(6): 212-227.
- Radfar A. & Nakhoda M. (2018), "Study of the process of improving self-directed learning indicators by using the concept map technique and collaborative learning in the field of information science and cognition" (Case study: University of Tehran), *Library and Information Science Studies*, 25(3): 225-252.
- Chou Pao N. (2012), "Effect of Students' Self-Directed Learning Abilities on Online Learning Outcomes: Two Exploratory Experiments in ElectronicEngineering", *International Journal of Humanities and Social Science*, 6(2): 98-117.
- Fisher M. & King J. & Tague G. (2001), Development of a self-directed learning readiness scale for nursing education, *Nurse Educ Today*, 21(6): 45-58.
- Heidari R. & Hayati A. & Hassanlou N. (2015), "Pathology of social science education in high school from the perspective of teachers" (Case study: 30 high school social science teachers in Zanzan province), the second national conference on sustainable development in educational sciences and psychology, social and cultural studies, Tehran: Soroush Hekmat Mortazavi Center for Islamic Studies and Research, Mehr Arvand Institute of Higher Education, Center for Strategies for Achieving Sustainable Development, 12(4): 84-99.
- Knowles M. (1990), "The Adult Learner: A Neglected Species (4th ed.)", Houston: Gulf Publishing, 17(5): 134-152.
- Safavi A. (2006), Teaching methods, techniques, and patterns, Tehran: Organization for the Study and Compilation of University Humanities Books (SAMT), 26(3): 164-172.
- Vosoughi A. (2009), Comparison of the effect of concept map teaching method and traditional teaching method on learning social sciences in the pre-university course, Master Thesis Abhar Islamic University, 13(9): 170-189.
- Mesrabadi J. (2007), The effects of a concept map (construction and presentation) and input characteristics of learners on cognitive-emotional outcomes of biology learning, Ph.D. Thesis. Tabriz University, 15(2): 130-149.
- Novak J. (2010), Learning, creating, and using knowledge: Concept maps as facilitative tools in schools and corporations, Routledge, 20(4): 175-189.
- Sun Y. (2004), "Methods for automated concept mapping between medical database", *Journal of Biomedical Informatics*, 37(5): 162-178.
- Seif A. (2015), Modern Educational Psychology: Teaching and Learning Psychology, Seventh Edition, Tehran: Doran Publishing, 25(3): 196-208.
- Aghazadeh M. (2005), New teaching methods, Tehran: Abiz Publications, 19(5): 207-219.
- Novak J. & Canas A. (2008), "The Theory underlying concept maps and how to construct and use them", Technical report IHMC Cmaptools, 2006-01 Rev 01-2008, Florida institute for human and machine cognition, 9(4): 44-53.
- Chiou C. (2008), The effect of concept mapping on students' learning achievements and interests, *Innovations in Education and Teaching International*, 45(4): 375-387.
- Allah Karami A. & Babamorad A. (2017), The effect of concept map teaching method on students' self-regulation and academic self-concept, *Educational Studies*, 6(1): 105-124.
- Gillies R. & Ashman A. & Terwel J. (2008), "The teacher's role in implementing cooperative learning in the classroom", Springer Science, Business Media, LLC, 16(5): 147-185.
- Nadi M. (2018), Exploratory relationship between epistemological beliefs and self-directed learning among nursing students, *Iranian Journal of Medical Education*, 18 (4): 12-24.
- Bressington D. & Wong W. & Lam K. & Chien W. (2018), Concept mapping to



- promote meaningful learning, help relate theory to practice and improve learning self-efficacy in Asian mental health nursing students: A mixed-methods pilot study, *Nurse Education Today*, 60(3): 47-55
- Nadi M. & Kazemi E. (2005), Self-directed learning in multi-grade classes, *research in curriculum planning*, 11(5): 129-146.
 - Soltani Arabshahi K. & Naimi L. & Bigdeli S. (2012), "Self-directed learning readiness in medical students", *Quarterly Journal of Education Strategies*, 5(3): 170-189.
 - Lai Horng J. (2011), "The Influence of Adult Learners' Self-Directed Learning Readiness and Network Literacy on Online Learning Effectiveness: A Study of Civil Servants in Taiwan", *Educational Technology & Society*, 14(2): 98-106.
 - Pons Rosa M. & Prieto María D. & Lomeli C. & Bermejo María R. & Bulut S. (2014), "Cooperative learning in mathematics: a study on the effects of the parameter of equality on academic performance", *Servicio de Publicaciones de la Universidad de Murcia*, 30(4): 832-840.