TEACHING RESEARCH METHODS IN NURSING USING ARONSON'S JIGSAW
TECHNIQUE. A CROSS-SECTIONAL SURVEY OF STUDENT SATISFACTION

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ABSTRACT

Background: To adapt nursing studies to the European Higher Education Area, new teaching methods have been included that assign maximum importance to student-centered learning and collaborative work. The Jigsaw Technique is based on collaborative learning and everyone in the group must play their part because each student's mark depends on the other students. *Home group* members are given the responsibility to become *experts* in a specific area of knowledge. Experts meet together to reach an agreement and improve skills. Finally, experts return to their home groups to share all their findings.

Objective: The aim of this study was to evaluate nursing student satisfaction with the jigsaw technique used in the context of a compulsory course in research methods for nursing.

Methods: A cross-sectional study was conducted using a self-administered anonymous questionnaire administered to students who completed the Research Methods course during the 2012-13 and 2013-14 academic years. The questionnaire was developed taking into account the learning objectives, competencies and skills that should be acquired by students, as described in the course syllabus. The responses were compared by age group (younger or older than 22 years).

Results: A total of 89.6% of nursing students under 22 years believed that this methodology helped them to develop teamwork, while this figure was 79.6% in older students. Nursing students also believed it helped them to work independently, with differences according to age, 79.7% and 58% respectively ($p=0.010$). Students disagreed with the statement "The jigsaw technique involves little workload", with percentages of 88.5% in the group under 22 years and 80% in older students. Most believed that this method should not be employed in upcoming courses, although there were differences by age, with 44.3% of the younger group being against and 62% of the older group ($p=0.037$).

Conclusion: The method was not highly valued by students, mainly by those older than 22 years, who concluded that they did not learn more with it than with other traditional techniques. The results of this study question whether this form of learning meets students' learning needs and its compatibility with individual and group realities.

Keywords

Teaching, Jigsaw, satisfaction, collaborative learning, nursing

Introduction

Teaching and learning research methods in nursing science is relatively new in Spain, resulting from the inclusion of nursing studies within the university. Traditionally, the teaching of this discipline has followed the guidelines and prevailing currents in the distinct historical moments of the country, with the most common methodology being traditional lectures. Since 2010, Spanish universities have adhered to the European Higher Education Area (EHEA), following the guidelines set by the Bologna Plan, which places the student at the center of the entire teaching, learning and assessment process and assigns them a much more active role ("European Higher Education Area website 2010-2020| EHEA," 2014). Since then, independent and collaborative work has gained ground and consequently lectures have become less prominent.

The EHEA promotes collaborative learning in small groups, facilitating the acquisition of skills and knowledge through reflection, criticism and knowledge integration. This new model of teaching and learning requires a continuous and formative assessment through a close and productive lecturer-student relationship. The term "competence"

encompasses a whole range of skills, attitudes and knowledge, as well as the complex processes of decision-making that encourage the required performance level at each moment (García-San Pedro, 2009).

Background

Nursing studies in Spain are structured by practicums, using constructivism as a pedagogical reference, in which students learn to do and learn by doing, in a reflective, critical and inclusive dialogue between theory and practice (Kinsella, 2006). One feature of the Bologna Plan refers to competence assessment and continuous learning and evaluation (Keeling, 2006). This distinguishing feature requires new methods of collaborative teaching and learning that motivate students to acquire knowledge, skills and attitudes in an independent and collaborative manner, as in the case of the Jigsaw Technique (JT) proposed by Aronson (1978). The JT is a methodology based on collaborative learning that goes beyond teamwork, as each student is essential for the whole group and each student's contribution is also essential to the task. Everyone in the group must play their part because each student's mark depends on the other students. Firstly, *home groups* are created with up to six students in which each student is responsible for becoming an expert in their topic. Secondly, groups of *experts* discuss together and learn from each other. Thirdly, students return to home groups and present the knowledge learned about the topic to the rest of the home group (Figure 1 and Table 1). The JT is fairly similar to other collaborative learning methods, such as Problem Based Learning (PBL). The main difference is that using JT requires students to become "experts" in specific areas. Each "specialist" teaches the rest of the group; thus, not all the students in the home group have to study everything by themselves. The JT is also slightly more directive than PBL, leaving space for lecturers to intervene and explain contents when needed.

The JT has been used in various fields, such as mathematics (Camp Mora et al., 2007; Lluch Peris, 2007), microbiology (Baviskar, 2013; Soto et al., 2011), computer programming (Anguas et al., 2007), physical education (Navarro Leandro et al., 2008), chemistry (Davis-McGibony, 2010; Doymus, 2008) and medicine and nursing (Buhr et al., 2014; Renganathan, 2013), producing positive results in satisfaction and the acquisition of knowledge. The technique has also been shown to increase students' self-efficacy in French language and mathematics courses (Darnon et al., 2012). Conversely, studies such as that by Bratt (2008), using a large sample of adolescents ($n=162$), did not show positive results following the use of the JT, especially regarding outgroup attitudes, common in group identity, empathy, or attitudes toward learning.

Most publications report results related to intervention groups, without comparing the intervention with a control group. Thus, in view of these methodological limitations, results of the effectiveness of the technique should be interpreted with caution (Bratt, 2008; Moskowitz et al., 1985). Because of the lack of strong evidence and the variety of the results on the JT, lecturers in our center were unable to make an evidence-based decision; there was therefore a need to examine the method in our context and analyze the experience and the results obtained.

In the ESIM, the course on research methods in nursing has a workload of 6 European Credit Transfer System, equivalent to a total of 150 hours, of which approximately 30% (45 hours) involve face-to-face classroom work and the remaining 70% (105 hours) independent work. This course had been always been taught using expository traditional lectures producing low satisfaction among students and lecturers. At the end of 2011-2012, the lecturers and the dean agreed that the JT could be an excellent way to facilitate learning on research methods, given the competencies assigned to the course (Table 2) and the collaborative nature of the method. It was also considered that, because of the innovative and

teamwork focus of the method, it would motivate students to acquire attitudes and abilities, as well as knowledge. Lower stress levels were also expected due to role changes and the ongoing evaluation process.

The research methods course acts as a central focus during the 4-year degree, acquiring special importance at the final baccalaureate dissertation and the advanced practicum. The course has theoretical and practical contents with a strong impact, both academic and professional, throughout the degree and bears a close relationship with another subject taught in the same year: demographics, biostatistics and epidemiology. After completing two academic courses using the JT (2012-13 and 2013-14), comments indicating student dissatisfaction were received, citing a huge workload and the difficulty of time management. This dissatisfaction was also evident in the classroom; the JT required a change of attitude, which in turn required time. To review the implementation of the new teaching methodology and its organization, it was deemed appropriate to evaluate student satisfaction with the JT. Therefore, the main objective of this study was to evaluate nursing students' satisfaction with the JT used in the research methods course.

Methods

A cross-sectional study was conducted using a self-administered questionnaire. The study population was composed of all the 157 students who completed the course on research methods during the academic years 2012-13 and 2013-14. This course is taught in the second year of the nursing degree. The sole criterion for inclusion was having taken the course in the aforementioned academic years, and being present on the day when the questionnaires were presented and completed.

Data were collected in March 2015 through a specifically-designed questionnaire. To obtain the maximum response rate, the questionnaire was administered in the classroom

(within another course), after acceptance by the lecturer in charge, who coordinated it. To avoid influencing the responses, the researchers were only present to explain the study objective and the dynamic/content of the questionnaire to the students. Once these had been explained, the researchers withdrew and returned to collect the questionnaires at the end of the class. Participation was voluntary; only two students returned the questionnaire blank.

The questionnaire was anonymous and consisted of 40 statements in which the students had to indicate their level of agreement or disagreement. Each question was answered using a Likert scale with scores from 1 to 5, where 1 was the most negative response and 5 the most positive. The questionnaire assessed satisfaction with the teaching method based on five areas: knowledge, skills, attitudes, type of assessment, learning tools and general satisfaction. The questionnaire was developed by both authors of the study, taking into account the learning objectives, competencies and abilities that should be acquired by the students, as described in the course syllabus. Demographics such as age, sex, academic year in which the students took the subject and route of access to the university (entrance exams or professional training) were collected.

A random sample of 106 individuals would be sufficient to estimate, with a 95% confidence interval and an accuracy of ± 5 percentage units, a population percentage that is expected to be around 30%. Due to the ease of access to an accessible number of individuals, the questionnaire was administered to all students. A class attendance of 80% is mandatory, and consequently a sufficient number of responses was anticipated.

A descriptive, univariate and bivariate statistical analysis was conducted using IBM SPSS 21.0 software. Comparison of variables was performed using the chi-square test established at the statistical significance level of 0.05. To facilitate interpretation of the information, responses were grouped into three categories: scores 4-5 formed the category "I agree", score 3 "Indifferent", and scores 2-1 "I disagree".

The study was approved by the Ethics Committee for Clinical Research of Hospital del Mar, Parc de Salut Mar (Barcelona).

Results

A total of 129 valid responses were obtained, representing 82.2% of students who completed the course. Table 3 describes the characteristics of the participants, most of whom were women (78.3%) and 64.3% gained access to the course through university entrance exams. Over half (54.3%) of responses were from students who completed the course during the academic year 2012-13.

The results are presented according to age; for this purpose, data were categorized into two groups. One category included students younger than 22 years, most of whom gained entry to nursing studies through university entrance exams (93.7%); the second group consisted of students older than 22 years, most of whom entered the university through professional training. The second group showed a large dispersion in age, with a range of 22 years (Table 3).

Analysis of attitudes (Table 4) showed that most students agreed that the JT helped them work together (< 22 years: 89.6%; ≥ 22 years: 79.6%) and independently (79.7% and 58%, respectively), with a higher percentage in the younger group ($p = 0.010$). The students also agreed that they attended the jigsaw sessions with all the materials previously prepared (94.9% and 98%) and had a responsible and positive attitude (97.4 and 95.9%, respectively).

Analysis of knowledge revealed that most reported they had acquired knowledge on qualitative research, with percentages of 74.7% and 58%, respectively (Table 4). The percentage of students agreeing that they had acquired knowledge on quantitative research was significantly lower in the older group (60.8% vs. 36%; $p=0.021$). The same was found for understanding of the characteristics of evidence-based nursing (58.2% vs. 36.0%, $p=0.048$).

Many students disagreed that they had learned more with this methodology with other methods (50.6% and 58%, respectively).

Regarding skills, the only difference between the two groups was found for the statement that the teaching method had helped them develop information management skills, with a higher percentage of younger students agreeing with this statement (68.4% vs. 50%; $p=0.032$). The students generally disagreed that the JT had helped them to develop basic computer skills (50.6% and 52%), but 20% of the older group believed it had been helpful ($p=0.033$).

Table 4 also presents the results of the type of assessment. The students generally agreed that assessment was continuous (76.9% vs. 68%). A total of 64.4% of the younger students believed that it reflected the stated objectives, while only 38% of the older age group agreed with this statement, with statistically significant differences ($p=0.005$).

Finally, in relation to overall satisfaction, 40.5 % of the younger group and 54% of the older group were fully or somewhat in agreement with the statement "*I am satisfied with the puzzle method*". In contrast, 60.8% of the younger group and 62.5% of the older group believed that it should not be applied to other courses; however, in the older age group, 22.9% thought it should be applied again ($p=0.027$). Most students believed that the JT should not be used in future research methods courses, although there were differences by age (44.3% and 62% [$p=0.037$]). Both groups agreed that the lecturers were proficient in the method, although with differences by age group: in the younger group, 74.7% of the younger group agreed, but only 47% of the older group did so ($p=0.007$).

When the data were analyzed by the academic year when the students attended the course, 93% of those in the 2013/14 academic year disagreed with the statement "*This method involves little workload*", while this percentage dropped to 78.3% in those in the 2012/13 academic year ($p=0.014$). There were also significant differences in agreement with

the statement that the JT requires more effort than other courses: 60% of those in 2012/13 neither agreed nor disagree, while this percentage was only 3.4% among those in 2013/14 ($p < 0.000$). Finally, students in both academic years agreed that the lecturers demonstrated good skills in the teaching method, although agreement was higher in the 2012/13 academic year (74.3% vs. 52.5% respectively), with statistically significant differences ($p=0.031$).

Discussion

Although nursing students reported they had acquired some knowledge, overall satisfaction with JT was fairly low, the main reason being the heavy workload. This finding has been previously described in the literature, and students can become irritated by overwork and feel they are doing the lecturer's job (Barkley et al., 2005). In this study, the students did not believe that the JT was more effective than other teaching methods. However, satisfaction with teamwork was high (89.6% and 79.6%, respectively), as well as with aspects related to the management and analysis of scientific information skills (68.4% in the younger group vs. 50% in the older group). This finding differs from those of Charania et al. (2001), in which most students considered the JT a great help to clearly understand concepts, promoting independence and accountability and increasing self-confidence. Overall, those authors described JT as a fun, stimulating, meaningful and effective learning technique and even suggested that traditional classes should be replaced by collaborative learning activities such as the JT.

Aspects evaluating student involvement itself, such as doing the homework or the attendance rate, are always scored positively. From our faculty perspective, this is unrealistic and could compromise the realism and veracity of the criticisms contributed. Notably, one of the criticisms of self-administered questionnaires is that respondents always show their best

side or the one they believe should be portrayed based on the study objectives (Parahoo, 1997).

Although the final evaluation of the course was fairly positive, student evaluation of the JT was less positive. Several structural and planning elements could have influenced these results. The classrooms where students met and worked (the whole group) had tables and chairs fixed to the floor, making it difficult for group discussion and concentration. It is fairly difficult to work actively with 80 people in 1 to 3 separate classrooms, with fixed furniture; therefore, the dedication and motivation of both students and lecturer could have been affected. Moreover, jigsaw sessions were mainly scheduled every 48 hours and therefore students may not have had enough time to work independently in depth. Barkley et al., (2005) suggest that, given the artificial structure of the JT, sessions should be planned no more than once or twice every 6 months to maintain students' interest.

Two important factors might explain the results of this study. One factor was the lecturers' inexperience with the JT: although they had more than 10 years' teaching experience, they designed, implemented and evaluated the activities without previous experience of this specific method, despite being familiar with other similar methodologies such as problem-based learning. Additionally, research methods is one of the less attractive courses to nursing students in our environment, based on our personal perceptions and exchanges with colleagues from other centers. The literature also shows evidence of how, historically, interest in research and satisfaction with the teaching of this subject are not high, and the discipline has even been considered as somehow elitist and academic (Laschinger et al., 1990; Niven et al., 2013). This could explain why many of the new students do not recognize the importance of research for professional practice (Clark et al., 2009). This finding could provide answers to the concerns of many researchers who suggest that nurses

encounter difficulties in understanding the relationship between research and the application of effective care (Cutcliffe and Bassett, 1997; Taylor and Muncer, 2000).

Possibly, the lecturers' motivation and development of the JT could have influenced student satisfaction in the second year of using the technique. It was known from the previous year's comments that students did not like the JT and somehow it was sensed that the assessment would not be very positive. Another question is whether the JT is the most suitable technique to stimulate learning, taking into account the technical profile of many of the students and the unattractiveness of the topic itself. Many students said, on more than one occasion, that traditional lectures, based on memorizing and expository learning would be preferred, since the workload was lower. This finding agrees with those identified by Charania et al., (2001) who state that some students claim to have experienced a sense of insecurity when using the JT since it hindered note-taking, which could have a negative impact on the final evaluation. This finding demonstrates that some students have a "watermark" with regard to learning preferences, still preferring traditional lectures and memorization. Recent findings, however, show a different learner profile and indicate that the JT is well-received and leads to good knowledge acquisition (Baviskar, 2013; Buhr et al., 2014). The previous background of students and faculty, financial resources, and differences in group size could have had an impact in the results published.

Limitations and recommendations

The length of the questionnaire could have influenced the results. A forty statement questionnaire may have caused fatigue and been a negative factor in the responses.

Satisfaction with the JT could have been biased by the type of final evaluation. In this study, the students had to pass weekly online tests and a final written assignment. Fear of failing these exercises could have had an impact on general satisfaction of JT. Another issue that could have affected the results was the time lapse between the completion of the JT and

administration of the questionnaire, which ranged between 1 and 2 years, which may have led some students to express their opinion based on memories that may have faded (Cea D'Ancona, 2001).

This study lacked a control group, making it impossible to determine whether traditional lectures or the JT provides greater learning opportunities. Although it was beyond the scope of this study, future research should evaluate efficacy of the method using longitudinal prospective designs.

Nursing educators wishing to use the JT should be ready to strongly motivate their students for a deeper and satisfactory learning experience. A question that remains to be determined is whether educators need to provide these opportunities consistently, despite low student satisfaction. It must be asked whether this technique meets students' learning needs and is compatible with individual and group realities. Exploration of these factors from a qualitative perspective could help to elucidate some of these questions and provide valuable first-hand information. Given the impact that the implementation of the JT can have on an organization and the resources needed, more research on the topic is required, particularly within nursing studies.

An in-depth review of the implementation and the resources available is needed. The appropriateness of the method in second year students should be analyzed bearing in mind that most of the students have no experience of collaborative learning methods. Some collaborative activities could be introduced in previous courses to help accustom students to these methods.

Conclusions

The students in this study were not satisfied with JT, reporting that they did not learn more with this method than with other traditional techniques and that it generated a heavy

workload. However, students agreed that the JT was useful to increase the ability to develop teamwork and to work independently. Participants in the younger group strongly agreed that the course assessment corresponded with the goals set in the syllabus, while the opinions of the older were more divided. The latter group believed this method should not be applied in future courses.

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Figure 1. Jigsaw Technique Dynamics Representation

Table 1

Steps proposed by Elliot Aronson to develop the Jigsaw Technique (Adapted from “The Jigsaw Classroom,” 2015)

1. The whole class is divided into small heterogeneous groups of 5-6 students (mother groups).
2. Within each group, a leader or secretary should be chosen.
3. Divide the topics in 5 or 6 segments.
4. Assign a segment to each student so that the student becomes an expert on the topic.
5. Assign each student adequate time to work on the necessary materials.
6. Set up discussion groups of experts in each topic, which will identify the strengths and weaknesses of the topic, and get the students to rehearse the presentation that will be given to their jigsaw group.
7. Gather students within the jigsaw groups.
8. Each expert explains his or her segment to the group. The rest of the group must intervene by asking questions to clarify concepts.
9. The teacher moves from group to group to observe the process and intervenes only when problems arise that the group leader cannot solve.
10. At the end of the activity students should conduct a quiz that demonstrates the importance and didactic goal of the activity.

Table 2: Competencies developed in the course on Research Methods in Nursing

GENERAL COMPETENCIES
Capacity for analysis and summarization
Ethical commitment
Basic general knowledge
Capacity for organization and planning
Oral and written communication in the native language
Knowledge of a second language
Basic computer skills
Information management skills (ability to retrieve and analyze information from different sources)
Critical and self-critical abilities
Quality concerns
Problem solving
Decision making
Interpersonal skills
Ability to work in an interdisciplinary team
Understanding of the cultures and behavior of other countries
Ability to communicate with experts from other fields
Recognition of diversity and multiculturalism
Ability to work in an international context
Learning capacity
Project design and management
Research skills
Ability to put knowledge into practice
Adaptability to new situations
Creativity
Autonomous work ability
Initiative
SPECIFIC COMPETENCIES
Apply new technology, information systems and communication in health care
Know and apply the principles underlying general nursing care

Apply the methods and procedures to identify the most important health problems in a community
Analyze statistical data related to population studies, identifying possible causes of health problems
Base nursing interventions on scientific evidence and available resources
Be familiar with health information systems

Table 3. Characteristics of students completing the survey

		Age group			<i>p</i>
		Total	≤21	≥22	
Total answers		129	70	59	
Sex					
	female	78.3%	84.0%	77.6%	
	male	21.7%	16.0%	22.4%	0.479
Access to university					
	University Entrance Exams	64.3%	93.7%	22.0%	
	Professional Training	22.5%	6.3%	56.0%	
	Other degree	6.2%	0.0%	14.0%	
	Others	3.1%	0.0%	8.0%	<0.000*
Academic year					
	2012-13	54.2%	55.7%	52.0%	
	2013-14	45.8%	44.3%	48.0%	0.719

*Significant at p-value <0.001

Table 4 Main responses according to age group

		≤21 years		≥22 years		<i>p</i>
ATTITUDES		<i>n</i>	%	<i>n</i>	%	
Jigsaw Technique has helped me to develop a critical attitude	Disagree	19	24.1	24	48.0	<i>0.018*</i>
	Neither agree nor disagree	35	44.3	14	28.0	
	Agree	25	31.6	12	24.0	
Jigsaw Technique has helped me to work independently	Disagree	4	5.1	10	20.0	<i>0.010*</i>
	Neither agree nor disagree	12	15.2	11	22.0	
	Agree	63	79.7	29	58.0	
KNOWLEDGE						
Jigsaw Technique has helped me to understand the characteristics of quantitative research	Disagree	19	24.1	18	36.0	<i>0.021*</i>
	Neither agree nor disagree	12	15.2	14	28.0	
	Agree	48	60.8	18	36.0	
Jigsaw Technique has helped me to understand the characteristics of evidence-based nursing	Disagree	11	13.9	10	20.0	<i>0.048*</i>
	Neither agree nor disagree	22	27.8	22	44.0	
	Agree	46	58.2	18	36.0	
SKILLS						
Jigsaw Technique has helped me develop information management skills	Disagree	5	6.3	10	20.0	<i>0.032*</i>
	Neither agree nor disagree	20	25.3	15	30.0	
	Agree	54	68.4	25	50.0	
Jigsaw Technique has helped me develop basic computer skills	Disagree	40	50.6	26	52.0	<i>0.033*</i>
	Neither agree nor disagree	34	43.0	14	28.0	
	Agree	5	6.3	10	20.0	
ASSESSMENT TYPE						
The course assessment has responded to the goals set in the syllabus	Disagree	8	10.1	14	28.0	<i>0.005**</i>
	Neither agree nor disagree	20	25.3	17	34.0	
	Agree	51	64.6	19	38.0	
LEARNING TOOLS						
On-line knowledge questionnaires have been a useful complement to the Jigsaw Technique	Disagree	13	16.5	18	36.0	<i>0.026*</i>
	Neither agree nor disagree	23	29.1	8	16.0	
	Agree	43	54.4	24	48.0	
OVERALL SATISFACTION						
Jigsaw Technique should be applied in other courses, given its usefulness	Disagree	48	60.8	30	62.5	<i>0.027*</i>
	Neither agree nor disagree	24	30.4	7	14.6	
	Agree	7	8.9	11	22.9	
Jigsaw Technique should be kept in this course in future years	Disagree	35	44.3	31	62.0	<i>0.037*</i>
	Neither agree nor disagree	29	36.7	8	16.0	
	Agree	15	19.0	11	22.0	
Teachers are proficient in conducting Jigsaw Technique groups	Disagree	9	11.4	14	28.0	<i>0.007**</i>
	Neither agree nor disagree	11	13.9	12	24.0	
	Agree	59	74.7	24	48.0	

*Significant p-value <0.05

**Significant p-value <0.01

HIGHLIGHTS

- Students believed that the jigsaw technique helped them to acquire knowledge of Research Methods, those in the older group being less satisfied.
- Students believed that they did not learned more with it than with other traditional techniques
- Students believed that the jigsaw technique involved a heavy workload and required more effort than other methods
- Students thought that this technique should not be used in future Research Methods courses.
- Students believed that the jigsaw technique helped them to develop information management skills.