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Artículos Científicos

Los exámenes cooperativos en la educación superior: un enfoque desde la perspectiva del estudiante

Cooperative Exams in Higher Education: An Approach from the Student's Perspective

Exames cooperativos no ensino superior: uma abordagem da perspectiva do aluno

Alan Ramírez-Noriega
Universidad Autónoma de Sinaloa, Facultad de Ingeniería Mochis, México
Universidad Autónoma Indígena de México, México
alandramireznoriega@uas.edu.mx
https://orcid.org/0000-0002-8634-9988

Samantha Jiménez
Instituto Tecnológico de Tijuana, Departamento de Sistemas y Computación, México
samantha.jimenez@tectijuana.edu.mx
https://orcid.org/0000-0003-0938-7291

Yobani Martínez-Ramírez
Universidad Autónoma de Sinaloa, Facultad de Ingeniería Mochis, México
yobani@uas.edu.mx
https://orcid.org/0000-0002-4967-9187

José Emilio Sánchez García
Universidad Autónoma Indígena de México, México
esanchez@uaim.edu.mx
https://orcid.org/0000-0001-8018-8426

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Resumen

Los exámenes cooperativos impulsan al estudiante a trabajar en pequeños grupos y así, grupalmente, cumplir una meta. Con este tipo de exámenes, los alumnos reciben comentarios inmediatos de sus compañeros mientras contestan el examen. Esta investigación determinó el impacto y la aceptación de los exámenes cooperativos (dos integrantes) desde la perspectiva de estudiantes de ingeniería de Software de la Universidad Autónoma de Sinaloa. La muestra para el experimento se conformó de seis grupos en etapa terminal de dicha carrera profesional. El experimento consistió en resolver exámenes cooperativos a lo largo del semestre. Para recopilar información, una vez finalizado el semestre, los estudiantes contestaron un instrumento previamente diseñado. Los resultados indican una aceptación de los exámenes cooperativos. Además, según los participantes, estos exámenes brindan retroalimentación y reducen el estrés que provoca el ser evaluados.

Palabras clave: educación superior, evaluación, examen cooperativo, trabajo en equipo.

Abstract

Cooperative exams allow the student to work in small groups and thus, as a group, meet a goal. With these types of exams, students receive immediate feedback from their peers while they answer the exam. This research determined the impact and acceptance of cooperative exams (two members) from the perspective of Software Engineering students from the Universidad Autónoma de Sinaloa. The sample for the experiment was six groups in the terminal stage of said professional career. The experiment consisted of solving cooperative test throughout the semester. To gather information, an instrument was designed and applied with students at the end of the semester. Results indicate an acceptance of the cooperative exams. Besides, according to students, these exams provide feedback and reduce the stress of being evaluated.

Keywords: higher education, evaluation, cooperative exam, teamwork.

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Resumo

Os exames cooperativos incentivam o aluno a trabalhar em pequenos grupos e, assim, como um grupo, atingir um objetivo. Com esses tipos de exames, os alunos recebem feedback imediato de seus colegas à medida que respondem ao exame. Esta pesquisa determinou o impacto e a aceitação dos exames cooperativos (dois membros) da perspectiva dos alunos de engenharia de software da Universidade Autônoma de Sinaloa. A amostra do experimento foi composta por seis grupos em estágio terminal da referida carreira profissional. O experimento consistiu na resolução de exames cooperativos ao longo do semestre. Para a coleta de informações, após o término do semestre, os alunos responderam a um instrumento previamente elaborado. Os resultados indicam uma aceitação dos exames cooperativos. Além disso, de acordo com os participantes, esses testes fornecem feedback e reduzem o estresse de ser testado.

Palavras-chave: ensino superior, avaliação, exame cooperativo, trabalho em equipe.

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Introduction

Education is considered of utmost importance in modern society. It is undoubtedly a complex area due to the interplay of multiple social, economic and cultural factors, among others. As we well know, at the core of education is the teaching-learning process. In this regard, the term teaching is defined as the structuring of different educational situations so that they help students to change through learning (Johnson and Johnson, 2004). On the other hand, learning is the change that occurs in a student by teaching (Johnson and Johnson, 2004).

To determine the impact of teaching on learning, the use of evaluative procedures is required. Assessment involves gathering information on the quality and quantity of change experienced by a student or group of students (Johnson and Johnson, 2004); In other words, it implies valuing knowledge through the issuance of a judgment.

Evaluation can have many functions. While giving a grade is the only one for many teachers, it could be used to motivate the student, reinforce work done, and highlight strengths and abilities. According to Díaz and Hernández (2010), there are techniques and instruments for the correct evaluation of the student, such as informal, semi-informal and formal techniques. This research addresses formal assessment techniques, specifically written tests to

assess theory and practical tests. These techniques require a more sophisticated planning and elaboration process and are often applied in situations that demand greater control.

An exam is an instrument designed to measure knowledge and understanding of defined content. The evaluation is an important activity for the student, since she needs to identify how she performed on the exam and if the results allow her to progress in her studies. Evaluation is also important to the educator. Assessment is a means of identifying whether teaching is effective and how well the student understands the material (Cantwell, Sousou, Jadotte, Pierce & Akioyamen, 2017).

A common misperception is that teaching and assessment are separate activities. In fact, teaching improves considerably when assessment is integrated (Johnson & Johnson, 2004). Most educational institutions assess student learning with independent tests, that is, students complete the test on their own without the help of peers or outside resources. An alternative to this traditional format is the cooperative exam. In this cooperative mode, students work together in small groups to answer the exam questions (Centrella, 2012; Gilley y Clarkston, 2014).

Cooperative learning is a set of teaching methods, techniques, and strategies that make the teaching-learning process more participatory and dynamic (Alarcón, Sepúlveda & Madrid, 2018; Centrella, 2012; Revelo, Collazos & Jiménez, 2018). Cooperation allows the student to share perspectives, debate points, ask and understand other points of view, solve complex problems and reach an agreement, among other important aspects (Amores, 2016; Mahoney and Harris, 2019). This type of learning offers considerable advantages to the instructor: it facilitates the organization of classes and the achievement of personal and social academic objectives, provides a more complete knowledge of their students and allows them to influence their integration processes.

The cooperative examination is a strategy founded on social constructivism, specifically within the theory of social interdependence. According to this perspective, individuals are active agents in a continuous learning process that occurs as a result of interactions with others and the environment (Díaz and Hernández, 2010; Mahoney and Harris, 2019). Man is a social being by nature: he is born, grows and develops in a group and, although learning is an individual or independent process, it is socially conditioned by the groups to which he belongs. That is why it is necessary to integrate this type of learning in the school environment, because in a natural way students are made to teach other students, to relate and

participate with their peers (Alarcón et al., 2018).

Following the cooperative learning philosophy, this research determines the impact that cooperative exams have on software engineering students. To achieve this, an investigation was carried out that designed an instrument to collect information and learn about the experience of students who applied cooperative exams throughout a semester, although they had already had previous experiences. Therefore, answers are sought to the following questions:

1) Do students of the final semesters of the Software engineering career of the Mochis Engineering Faculty of the Autonomous University of Sinaloa accept cooperative exams in pairs?

2) What advantages and disadvantages do students perceive when applying cooperative exams in pairs?

This article is organized as follows. The second section explains the work methodology to collect the information through an experiment. The third section shows the results of the experiment and an analysis of them. Finally, the conclusions and references used in this document are described.

Methodology

Mixed research methods are a powerful tool for the description, understanding and explanation of educational phenomena (Núñez, 2017). These methods involve the collection and analysis of quantitative and qualitative data, with the aim of delving into the problem from two aspects (Hernández, Fernández & Baptista, 2014).

This research applies the mixed method to describe the aspects related to cooperative exams and with students from a qualitative approach, in addition to interpreting structured and statistical data in order to find relationships between variables from a quantitative approach. This combination of methods seeks to determine the acceptance of cooperative examinations in pairs, as well as to determine if there are relationships between variables. Data retrieval and analysis procedures include observation and application of online questionnaires.

Sample and participants

The sample type is non-probabilistic for convenience. This approach makes it possible to select those accessible cases that agree to be included. This is based on the convenient accessibility and proximity of the subjects to the researcher. However, it should be clarified that the subjects must meet certain characteristics related to the objectives of the experiment (Hernández et al., 2014).

The classes and evaluations were applied at the Mochis Engineering Faculty of the Autonomous University of Sinaloa. The students were in the seventh and ninth semesters of software engineering majors. There were three groups each semester for a total of six groups. The total number of respondents was 55 of 69 students belonging to the groups. Some did not answer for various reasons: they did not apply cooperative tests as a couple, they did not find out about the survey, they dropped out of the race or simply because they were not willing to answer the instrument.

Process

The way to develop the experiment is as follows:

- Classes were taught with an assessment based on cooperative exams in pairs during one semester. The subjects were "Decision support systems" and "Data mining". There were three evaluations (one per partial) per subject and per group.
- A survey was designed using Google Forms[1]. La encuesta contiene seis preguntas de datos generales y nueve preguntas referentes a la experiencia de los estudiantes al aplicar exámenes en pareja.
- The survey was applied at the end of the semester the students were studying at that time. That is, the first semester of the 2019-2020 school year.
- The survey was distributed through the Internet. The survey was sent to the group leaders and they were in charge of distributing it among their colleagues.
- The data was collected automatically by the survey system used; even the system generated some graphs of easy interpretation.
- Finally, the data were obtained and processed for analysis.

[1] https://www.google.com/intl/es_mx/forms/about/.

Survey

The survey is divided into two aspects: general data and experience with the exams. Below are the general data collected by the students (the type of response to the requested data in parentheses):

- Sex (Woman, Man, I prefer not to say it)
- Age (Integer)
- Semester (1, 2, 3, 4…)
- Current average (Real)
- Group (101, 102, 103, 201, 202, 203, 301, 302, 303, 401, 402, 403, 501, 502, 503)
- Are you a regular student? (If not)

These data are used to make comparisons between the different attributes collected. The name of the student or any type of trace was not requested so that they would answer as reliably as possible. Regarding the last question, regular students are those who do not have pending subjects to pass.

The questions where respondents expressed their opinion according to their experience applying cooperative examinations in pairs are:

- Approximately how many couple tests have you taken in college? (Discrete quantitative)
- I have felt comfortable taking tests in pairs (Likert of five points)
- I consider that pair tests reinforce the knowledge that I have weak (Likert of five points)
- There is feedback from my classmates when solving the test in pairs (Likert of five points)
- I feel that my knowledge is better after finishing the test in pairs than before taking the test in pairs (Likert of five points)
- The exams should be in pairs (Likert of five points)
- Pair exams are useful in: (Theory, Practice, Both, Neither)
- What disadvantages do you see when taking a couple test? (Open)
- What advantages do you see when taking a test as a couple? (Open)

Statistic analysis

For the treatment and analysis of the data, the SPSS statistical tool is used. This tool offers advanced statistical analysis, as well as being easy to use, flexible, and scalable. Likewise, this tool has integrated a variety of graphs to represent the work information, which allows to interpret the data in a better way. The graphs of the research and some tables were generated with SPSS.

In order to delve into the information collected, the chi-square statistical test was applied. In order to apply this test, the stanin technique (Thorndike, 1982) had to be applied in the survey questions where the Likert scale was used. The technique consists of transforming the data set by adding two attributes. The first represents the sum of the questions where Likert was used. The second attribute consists of the discretization of the first attribute. The discretization is generated with two cutoff points considering the standard deviation and following the following formulas:

$$a = \bar{X} - (0.75 * \sigma) \qquad \textbf{(1)}$$

$$b = \bar{X} + (0.75 * \sigma) \qquad \textbf{(2)}$$

Two cuts are generated to obtain three categories. Category one corresponds to the values lower than the cutoff value a (formula 1). Category two corresponds to values greater than or equal to the value of cut-off a and less than the value of cut-off b (formula 2). Category three corresponds to values greater than or equal to the value of cutoff b. It was not considered to call the categories as bad, neutral and good, as if it were a Likert scale, since the results show that there are no negative opinions, rather it is a globalized scale of all the responses using Likert.

The categories were used to perform an intrasubject analysis, that is, the same experiment was applied to all students and internal aspects of the sample were analyzed to explore whether the results obtained are related to some aspects of the students. For this case, the chi-square was applied with sex, semester and if the student is regular or irregular (status). Therefore, three independent hypothesis tests are defined.

- H_{0_sexo}: Sex does not influence the opinions of students.
- H_{1_sexo}: Sex does influence student opinions.
- $H_{0\_semestre}$: The semester taken does not influence the opinions of the students.
- $H_{1\_semestre}$: The semester taken does influence the opinions of students
- H_{0_status}: Status does not influence student opinions.
- H_{1_status}: Status does influence student opinions.

H_0 corresponds to the null hypothesis and H1 to the alternative hypothesis. According to the chi-square test, if the significance value is less than 0.05, then H0 is rejected and H1 is accepted, otherwise, H0 is accepted and H1 is rejected. This with a confidence level of 95%.

Results

As mentioned above, 55 students participated, 43 men (78.2%) and 12 women (21.8%). It is common, at least in the faculty of application, that very few women are interested in engineering careers, therefore, the percentages of women are low compared to men.

The average age of the students was 22.4 years (men = 22.4, women = 22.3). Men showed a higher standard deviation (2.4) than women (1.6), which implies a greater variety of ages far from the average in men.

A total of 37 (67.3%) students belonged to the seventh semester and 18 (32.7%) to the ninth semester. In addition, 46 (83.6%) students are considered regular students and 9 (16.4%) irregular. These students answered 3.6 pair tests on average in college.

Figure 1 shows the students' preference for solving the exams in pairs. The majority feel comfortable in this form of evaluation (90.01%); a low percentage were indifferent to the way of working (9.09%). There were no students in disagreement for this evaluation form.

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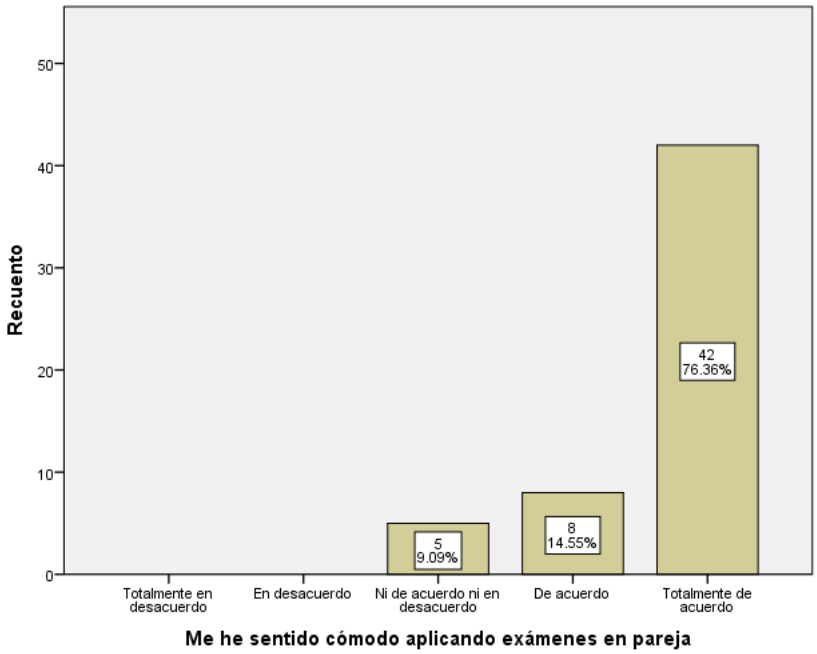
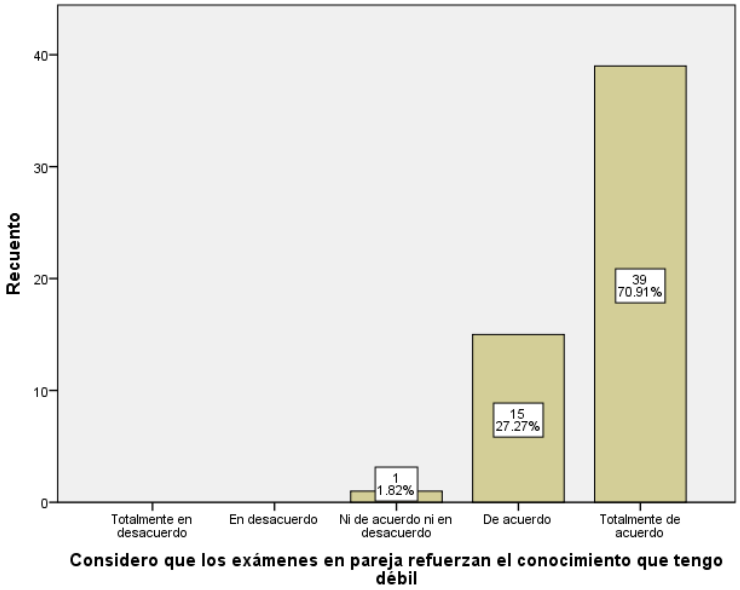
Figura 1. Respuestas a la afirmación "Me he sentido cómodo aplicando exámenes en pareja"



Fuente: Elaboración propia

Los estudiantes consideran que los exámenes en pareja refuerzan su conocimiento menos desarrollado: arriba de 98 % está de acuerdo con la afirmación (ver figura 2).

Figura 2. Respuestas a la afirmación "Considero que los exámenes en pareja refuerzan el conocimiento que tengo débil"



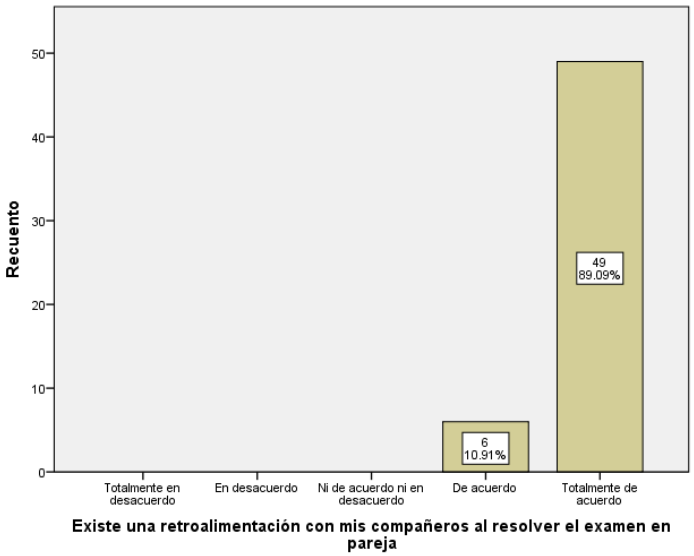
Fuente: Elaboración propia

All the surveyed students consider that they have feedback with their peers when answering tests in pairs. Figure 3 shows the results.

Most of the respondents (90.01%) consider that their knowledge is better when finishing the exams; a low percentage (9.09%) consider the statement neutral (see figure 4).

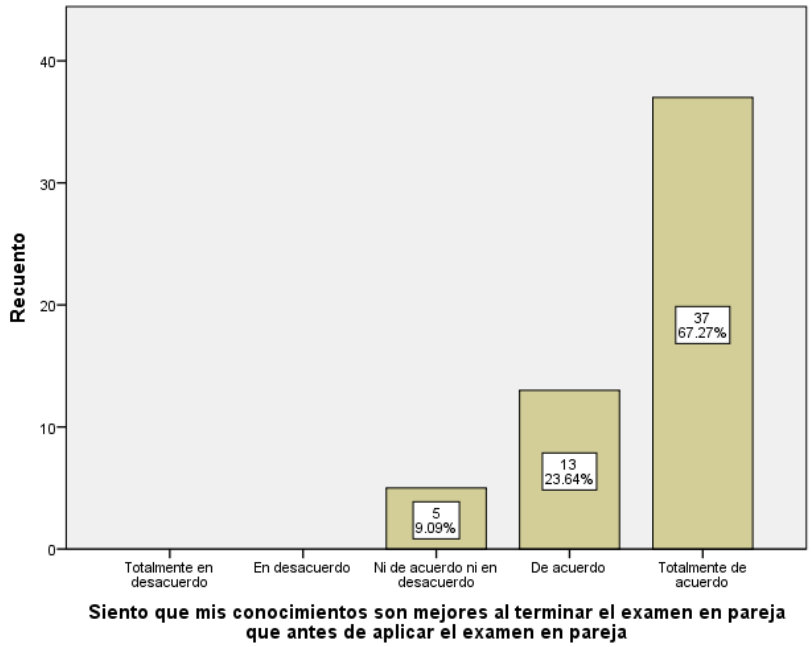
Figure 5 shows the preference for pair tests. The majority prefer it (70.91%), although there is a percentage with indecision (27.27%) and the same, minimal (1.82%), prefer not to do the exams as a couple.

Figura 3. Respuestas a la afirmación "Existe una retroalimentación con mis compañeros al resolver el examen en pareja"



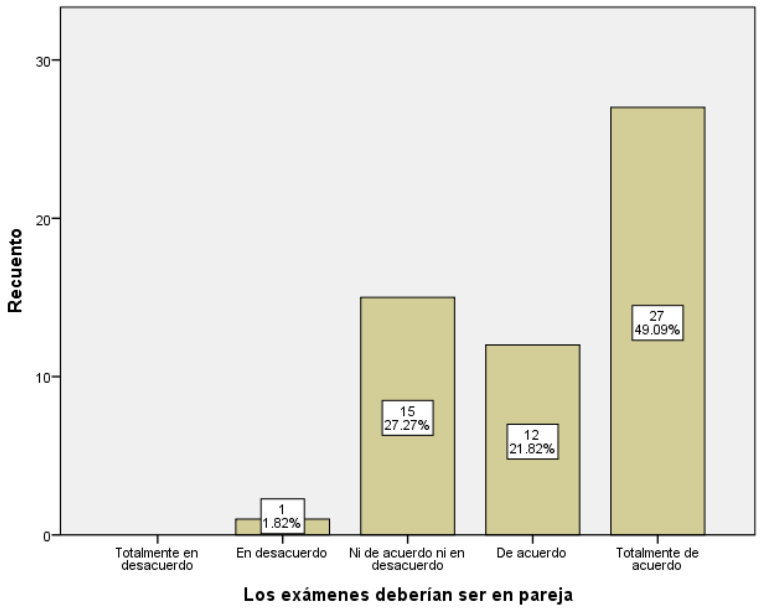
Fuente: Elaboración propia

Figura 4. Respuestas a la afirmación "Siento que mis conocimientos son mejores al terminar el examen en pareja que antes de aplicar el examen en pareja"



Fuente: Elaboración propia

Figura 5. Respuestas a la afirmación "Los exámenes deberían ser en pareja"



Fuente: Elaboración propia

In the last statement, students consider that pair tests are useful in practice and theory (72.7%), a low percentage think that only in practice (14.5%) and the rest that only in theory (12.7%); no student thinks these types of tests are not useful.

Now, the stanin test yielded the data represented in table 1. With these values the cut-off points were calculated: a = 21.3 and b = 24.6. These were used to form the three categories. Table 2 shows the frequency of the categories defined according to the stanine technique.

Tabla 1. Estadísticos descriptivos, suma de preguntas que emplean Likert

	N	Mínimo	Máximo	Media	Desv. típ.
suma_preguntas	55	17	25	23.02	2.198
N válido (según lista)	55				

Fuente: Elaboración propia

Tabla 2 Frecuencias de las categorías generadas con la técnica de estaninos

		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válidos	Categoría 1	12	21.8	21.8	21.8
	Categoría 2	22	40.0	40.0	61.8
	Categoría 3	21	38.2	38.2	100.0
	Total	55	100.0	100.0	

Fuente: Elaboración propia

With the results present in Table 2 and the variables considered (sex, semester, status), the chi-square test was applied. The statistical analysis indicated that there is no relationship between the opinion regarding cooperative exams and the sex of the students (p-value = NS, gl = 2). There was also no dependence between the semester taken by the students and their opinion regarding the cooperative exams in pairs (p-value = NS, gl = 2). Finally, it was not possible to establish a relationship between the student's status and their opinion regarding cooperative exams in pairs. (*p*-valor = NS, gl = 2).

Discussion

The information of the results was concentrated in table 3. The statements of the figures were labels (A1, A2, A3, A4 and A5) to be able to be referenced. Globally, acceptance of the couple exams is appreciated; only one student disagreed about taking the tests as a couple. The first column represents the statements and the rest is the Likert scale. Values are represented in percentages.

In general, students are comfortable with pair tests (A1), based on the information collected. Gilley and Clarkston (2014) mention that cooperative exams can reduce anxiety commonly associated with taking a test, increase positive relationships between students, improve students' perception of the course, increase motivation to study, and decrease the rate. of dropping out of classes. All these aspects make students feel confident and calm about the exam.

Tabla 3. Concentrado de resultados por preguntas en escala de Likert

Afirmaciones	Totalmente en desacuerdo (%)	En desacuerdo (%)	Ni de acuerdo ni en desacuerdo (%)	De acuerdo (%)	Totalmente de acuerdo (%)
A1. Me he sentido cómodo aplicando exámenes en pareja.	0.00	0.00	9.09	14.55	76.36
A2. Considero que los exámenes en pareja refuerzan el conocimiento que tengo débil.	0.00	0.00	1.82	27.27	70.91
A3. Existe una retroalimentación con mis compañeros al resolver el examen en pareja.	0.00	0.00	0.00	10.91	89.09
A4. Siento que mis conocimientos son mejores al terminar el examen en pareja que antes de aplicar el examen en pareja.	0.00	0.00	9.09	23.64	67.27
A5. Los exámenes deberían ser en pareja.	0.00	1.82	27.27	21.82	49.09

Fuente: Elaboración propia

Statements A2, A3 and A4 are directly related. Pair exams reinforce the less developed

knowledge of students because there is feedback from their exam partner. This makes them acquire new knowledge or reinforce weak knowledge at the time of the exam. The results show acceptance of the three statements with a high percentage (96.3%), only about six opinions out of 165 (combining the three statements) are considered neutral to the statements, although not in disagreement. The results obtained coincide with those of Cantwell et al. (2017), who argue that cooperative exams encourage active participation in the learning process as group members discuss exam questions, debate, and problem-solving to determine the best answers and communicate supporting reasons. for your particular answer.

According to the results of the students, a high percentage (70.91%) argue that the exams should be in pairs. The value is high, but not as high as the percentages in the previous statements, since 27.27% of students are unsure if the exams should be like this. This implies that, despite the advantages that the method entails, they perceive some negative aspect that makes them not inclined towards examinations in pairs. Research students perceive the following disadvantages of pair tests:

- It may be that the exam partner does not have a similar level of knowledge, which would load the cognitive work towards a single element.
- A closed mindset of people to adequately discuss various ideas or opinions of a question, which leads to disagreement.
- Little disposition to work in a team.
- It may be the case of only dividing what has been learned and not studying comprehensively, as if it were an individual exam.
- Randomness of peers as a preferred student is not available.

These disadvantages coincide with some of those specified by Mahoney and Harris (2019). They argue that in class groups there are many types of individuals with different motivations, personalities, and social phenomena that make it difficult to control student collaboration. They specifically allude to the motivations of the members to work, the compatibility of the personalities of the team members, social intimidation and conformity, attempts to avoid embarrassing situations and control of conflicts.

Despite some negative aspects found, there are positive aspects. The students of this investigation argue the following:

- There is teamwork to complement knowledge among colleagues.
- There is a dialogue and reasoning to reinforce knowledge.
- Theoretical and practical aspects can be complemented.
- Reduces the stress imposed by evaluation.
- Build confidence to answer the exam.

These aspects are replicated in Leight, Saunders, Calkins, and Withers (2012) and Cantwell et al. (2017). Both groups of researchers mention that students perceive that they learn better in cooperative exams and exhibit better scores than in individual tests. In addition, they improve critical thinking skills, improve collaboration and teamwork among peers, increase learning skills and motivation to study material, reduce test anxiety and, in general, achieve better performance and greater confidence when being evaluated.

An important aspect in this research is the number of people on the team. Being only two elements, a real teamwork is required, to complement the responses of both and generate feedback. On the contrary, more than two students on the team could bring an imbalance. Alarcón et al. (2018) reinforce this idea by specifying that, although a large number of activities can be carried out in groups, on many occasions one or two students end up doing the work of the whole team. If we reduce the work team to a minimum, we will have a greater probability of a correct evaluation, without giving grades to students who do not contribute to the team. Therefore, this research considers that two elements are indicated for cooperative exams, which is why it was chosen to apply exams in pairs.

Students believe that this type of exam can be applied both in theory and in practice. According to Pressman (2010), software engineering is made up of processes, methods or practices and tools that allow professionals to develop high-quality computer software. Therefore, theoretical aspects have to be analyzed before entering the practice, so it is common to apply theoretical and practical exams in the career, even at the same time in some cases.

Finally, the statistical analysis for the three hypothesis tests developed determines that the significance values (sex = 0.396, semester = 0.449 and status = 0.153) are not less than 0.05, therefore, the null hypothesis is accepted for each case. This indicates that gender, semester, and status are unrelated to students' opinions; that is, these variables behave indifferently before cooperative examinations. It is probable that other variables such as personality, the student's perception of his partner, affinity between partners, the subject under evaluation, to name a few, can influence the student's perception regarding this evaluation

methodology, as well as regarding to the final or partial qualifications under this methodology.

However, even with all these benefits of cooperative work, the idea still persists in schools that work in small groups can be a waste of time that does not guarantee success in the academic performance of students and they prefer to continue with the model traditional. The justification is wrong. Lara (2005) establishes that this happens because the student is seen as a mere repository of information that must be assigned a number to qualify their academic skills. Likewise, there is the underlying idea that everyone is equal and will learn in the same way. In addition, as knowledge learned by heart must be evaluated on paper and pencil tests, activities that promote individualism and memorization should prevail. This traditional model is holding back the development of social skills, such as teamwork, decision-making, leadership, organization and proactivity. Many of these qualities are becoming more and more in demand in the professional field, specifically and more recently in the areas of computing, and therefore, students need to develop them throughout their training.

Conclusions

This research designed an instrument to collect information in order to determine if Software engineering students from the Mochis Engineering Faculty of the Autonomous University of Sinaloa tend to accept exams in pairs. For this, cooperative exams were applied in pairs during a semester. In addition, an instrument was designed to collect the opinion of the students.

The results indicate an acceptance of cooperative examinations in pairs. It can be argued that learning occurs through cooperative examinations because students have the opportunity to actively develop, rebuild, and advance their knowledge through interaction with others. The results also indicate that acceptance of cooperative exams is not related to gender, status or semester.

Participants point out that this method has negative aspects that affect collaboration between partners, especially if the couple does not have the regular knowledge to take the exam. On the other hand, students indicate positive aspects, feedback with their classmates and increased confidence to take the exam, mainly. The joint projects, although they are learning strategies focused on reflection, analysis and understanding of the contents, also provoke the development of skills in problem solving, leadership and contribute to forging a spirit capable of creating environments in which the debate provides a more organized and

systematic level of thought development. Undoubtedly, in interaction with others, opportunities are given where students stimulate their zones of proximal development.

As future work, it is planned to analyze the acceptance of cooperative work techniques in software development areas. On the other hand, the study has a focus on the student, although the teacher's perspective can also be analyzed: one more line of research. In addition, another investigation could be established focused on verifying that the knowledge acquired through cooperative examinations is a more substantial knowledge than that acquired through individual examinations. Cooperative work is increasingly consolidated as a valid and pertinent didactic strategy that undoubtedly provides benefits in professional training. Now more than ever, the use of social and intercultural tools and the development of social and cooperation skills is required by software engineers.

References

Alarcón, E., Sepúlveda, M. P. y Madrid, D. (2018). Qué es y qué no es aprendizaje cooperativo. Ensayos: Revista de la Facultad de Educación de Albacete, 33(1), 205-220. Recuperado de https://dialnet.unirioja.es/servlet/articulo?codigo=6536516.

Amores, E. (2016). El aprendizaje cooperativo a examen: Resultados de una experiencia longitudinal. (tesis de pregrado). Universidad de Castilla-La Mancha, España.

Cantwell, E. R., Sousou, J., Jadotte, Y. T., Pierce, J. and Akioyamen, L. E. (2017). Protocol: Collaborative Testing for Improving Student Learning Outcomes and Test-Taking Performance in Higher Education: A Systematic Review. Campbell Systematic Reviews, 13(1), 1-18. Retrieved from https://onlinelibrary.wiley.com/doi/full/10.1002/CL2.186.

Centrella, A. (2012). Collaborative testing as posttest review. Nursing Education Perspectives, 33(1), 340-341.

Díaz, F. y Hernández, G. (2010). Estrategias docentes para un aprendizaje significativo: Una interpretación constructivista (3.a ed.). México: McGraw-Hill Education.

Gilley, B. and Clarkston, B. (2014). Research and Teaching: Collaborative Testing: Evidence of Learning in a Controlled In-Class Study of Undergraduate Students. Journal of College Science Teaching, 43(3), 83-91. Retrieved from https://doi.org/10.2505/4/jcst14_043_03_83.

Hernández, R., Fernández, C. y Baptista, M. (2014). Metodología de la investigación (6.a ed.).

México: McGraw-Hill.

Johnson, D. and Johnson, R. (2004). Assessing Students in Groups: Promoting Group Responsibility and Individual Accountability. United States: Corwin Press.

Lara, R. S. (2005). El aprendizaje cooperativo: un modelo de intervención para los programas de tutoría escolar en el nivel superior. Revista de la Educación Superior, 34(133), 87-104.

Leight, H., Saunders, C., Calkins, R. and Withers, M. (2012). Collaborative testing improves performance but not content retention in a large-enrollment introductory biology class. CBE- Life Sciences Education, 11(4), 392–401.

Mahoney, J. W. and Harris, B. (2019). The effects of collaborative testing on higher order thinking: Do the bright get brighter? Active Learning in Higher Education, 20(1), 25-37. Retrieved from https://doi.org/10.1177/1469787417723243.

Núñez, J. (2017). Los métodos mixtos en la investigación en educación: Hacia un uso reflexivo. Cadernos de Pesquisa, 47(164), 632-649. Recuperado de https://doi.org/10.1590/198053143763.

Pressman, R. (2010). Software Engineering: A Practitioner's Approach (7th ed.). New York, United States: McGraw-Hill.

Revelo, O., Collazos, C. and Jiménez, J. (2018). Collaborative work as a didactic strategy for teaching/learning programming: a systematic literature review programming. TecnoLógicas, 21(41), 115-134.

Thorndike, R. L. (1982). Applied Psychometrics. Houghton Mifflin College Division.

Rol de Contribución	Autor (es)
Conceptualización	Alan Ramírez-Noriega
Metodología	Alan Ramírez-Noriega
Software	No aplica
Validación	Samantha Jiménez
Análisis Formal	Samantha Jiménez (Principal) Alan Ramírez-Noriega (Apoyo)
Investigación	Yobani Martínez-Ramírez
Recursos	Yobani Martínez-Ramírez
Curación de datos	Samantha Jiménez
Escritura - Preparación del borrador original	José Emilio Sánchez García (Principal) Alan Ramírez-Noriega (Apoyo)
Escritura - Revisión y edición	José Emilio Sánchez García (Principal) Alan Ramírez-Noriega (Apoyo) Yobani Martínez-Ramírez (Apoyo)
Visualización	José Emilio Sánchez García
Supervisión	Alan Ramírez-Noriega
Administración de Proyectos	Alan Ramírez-Noriega
Adquisición de fondos	Alan Ramírez-Noriega Samantha Jiménez Yobani Martínez-Ramírez José Emilio Sánchez García Contribución igual