

Dual system as an option for technical education in El Salvador: a students' perspective

El "Sistema Dual" como opción para la educación técnica en El Salvador desde la perspectiva de los estudiantes

Recibido: 14 de octubre 2014, aceptado: 13 de marzo 2015

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Abstract

In El Salvador, the German Dual System was first applied in higher education in 2008 in the technical career of Mechatronics. This new system was implemented in order to raise the level of competence in technical education and to ensure that students were adequately prepared for employability, giving them a chance for a decent job. In this article, the opinion of the students formed under this new system is compared with those formed in the traditional system.

Keywords: German Dual system, opinions of the students, El Salvador Education, employability, Technical education, competence, enterprise practice.

Resumen

En El Salvador, el Sistema Alemán de Formación Dual se comenzó a aplicar en el año 2008 en la carrera técnica de Mecatrónica. Este nuevo sistema se puso en práctica con el fin de elevar el nivel de las competencias en la educación técnica y para asegurar que los estudiantes se prepararan adecuadamente para la vida laboral, dándoles la oportunidad de un trabajo decente. En este artículo se presenta la opinión de los estudiantes sobre su formación en este nuevo sistema en comparación con aquellos que se formaron en el sistema tradicional.

Palabras clave: Sistema Alemán de Formación Dual, opiniones de los estudiantes, El Salvador Educación, empleabilidad, educación técnica, las competencias, la práctica empresarial.

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German Dual System

To form students with competences that prepare them for the working life is the main objective of the German Dual System. The system develops the cooperation between the schools (or academies) and the enterprises as two complementary places for the students' learning. In this way, the students carry out theoretical studies and laboratory practices at the school/academy, and in-practice training at the enterprises.

In the dual system, a combination of learning and working provides the basis for teaching vocational skills. The system seeks to teach theory and practice, and to provide structured knowledge and active competence, in their proper context. The different learning sites involved, the company and the vocational school, interact and keep their different emphases; but their tasks are not rigidly divided: school is not reserved solely for teaching theory, and in-company training involves more than simply practice. Under the dual system, vocational schools and companies have a joint educational responsibility. Trainees spend one or two days in vocational school and three or four days in their company (BMBF, 2003).

Dual system in technical education (formal education) in El Salvador

According the Central American Technological Institute (ITCA) 2010 annual report, the dual system in El Salvador was first applied in the technical career of Mechatronics in 2008 at ITCA¹, which counted with German technical assistance. The project began with the development of a technical career in Mechatronics; it required planning, curriculum design, academic processes, establishment of relations with the employers and the approval of the Ministry of Education. With this first career applying the Dual system, the importance that graduates had competences in accordance with the requirements of companies was proposed. It required to face the students with solving real working-life problems during their formation.

Competence terms

For the purposes of this research, the terms used by European Commission (2003), OECD and John Erpenbeck and Lutz von Rosenstiel, have been the guide to understand how to measure and identify the achievement of the competencies in the students. DeSeCo Project refers to the term competence as the ability to successfully meet complex demands in a particular context. Competent performance or effective action implies the mobilization of knowledge, cognitive and practical skills, as well as social and behavior components such as attitudes, emotions, and values and motivations (OECD, 2003).

On the other hand, the European Commission (2003), uses the term key competencies to represent a transferable, multifunctional package of knowledge, skills and attitudes that all individuals need for personal fulfillment and development, inclusion and employment. These should have been developed by the end of compulsory school or training, and should act as a foundation for further learning as part of their lifelong learning.

1. ITCA is called the Academy for the purposes of this research. ITCA is a technical institute in El Salvador.

The other term is the explanation about competencies developed by John Erpenbeck and Lutz von Rosenstiel in their book "Handbuch Kompetenzmessung" (p. XI) where they describe competencies as "...dispositions of self-organized acting, as self-organizational dispositions". These authors accentuate also, that there is a deep connection between competences and performance. Therefore, competencies are defined based on four basic features (Wiesner, 2008)"

- Competence is a disposition of, which appears in complex situations; unity of knowledge, ability and will.
- Competence is apparent in doing of a person, which takes place in typical professional problem situations.
- A competence could exist in different grades.
- Competences could be acquired in different ways".

Education and employability for the youth

Based on the world ranking, El Salvador is not in a good position in education and competitiveness; according the Global Competitiveness Index, the country has weaknesses in the quality of the education system (WEF, 2010). Moreover, in a workshop developed in El Salvador in 2008 with the stakeholders of education, there was an evaluation, which included the perception and aspirations of the students. In this, students between 13 and 19 years old expressed their expectations. Among others, they pointed out that they hoped to graduate from high school, attend a university, and have a decent job that would allow them to improve their living conditions and their families (Barraza, 2008).

A recent World Bank study (World Bank, 2011) notes that, the quantity and quality of employment in El Salvador have improved very little. This is because of a significant deficiency of human capital, which is reflected in a poorly educated population, low employability and vulnerability. Moreover, the study remarks that the employment in El Salvador shows a precarious labor panorama, especially for youth, with an increase of just 1%, which is insufficient to absorb new cohorts who enter the labor market.

Mechatronics Technical Career

This career was implemented in two ways: one in the traditional system and another one under the dual system. The curriculum was the same for both systems, and the students had the same classes, modules and teachers. The difference between the two curricula was that students who registered in the Traditional System had in-company training for a period of 1½ months (6 weeks) at the end of their Career (See Illustration 1). The in-company practice is carried out in a free form and it is not oriented; the enterprise decides what students have to do, and there is no work binnacle.

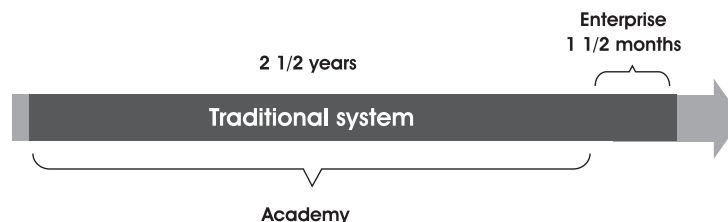


Illustration 1. Traditional system at Mechatronics – Timeline

Under the Dual System, the Mechatronics technical major is completed in two and half years. Twenty months are used for theoretical and practical classes at the Academy, and ten months are used for the in-company practice. The role of the enterprise in the formation process is to support the students in their practices within the company's facilities, according the Curriculum. These practices are carried out alternating with theoretical studies. The students who enroll in this career under the Dual System, attend 2 months at the academy and 1 month at the company (See Illustration 2).

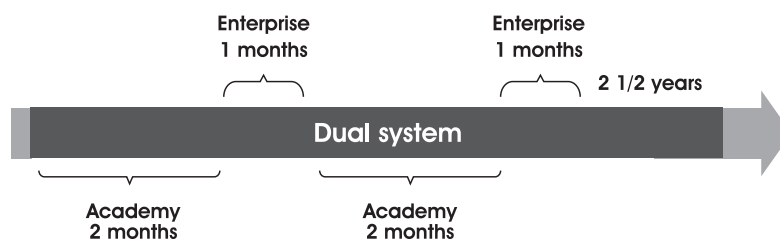


Illustration 2. Dual system at Mechatronic – Timeline

In both approaches, the traditional and the new system, the Academy maintains a connection with the enterprises, which is more intensive under the new system, where students have to do in-company practices for 10 months (1760 hours)², and where they have tutors that help them with their apprenticeship according to the student guide developed with the curricula of the career.

Purpose of the study

At the technical level of education, this was the first experience with the dual system in El Salvador. The incorporation of the Dual System in Mechatronics and its impact on the level of the competences developed by the students and its incidence on the employability of technicians formed in the first cohort has been the main purpose of this study.

Depending of the results, the dual system could be an alternative for improving the quality of higher education, establishing a better connection with the enterprises. This research was necessary because the dual system has not always given good results in Germany, as pointed by Reinhard Stockmann (1999) where he analyzes the low impact of these kinds of projects.

Aim, questions and hypothesis

The aim, question and hypothesis presented in this article are related to the students' opinions about their formation in this new system. These results are part of the "Research on rising competences in technological education by implementing dual systems elements under El Salvador conditions in the field of Mechatronic" (De Alvarado RD, 2013).

Aims

To determine if the students of cohort 2008-2010 who studied using dual system's elements acquired

2. In the Traditional system, students only spend half a month (260 hours) in an internship at the end of their career.

better professional competences to be inserted in the productive process than those formed under the traditional system.

Questions

Related with the aim, part of the research was conducted in order to find the answer to this question: (1) What is the students' point of view about the new system?

Hypothesis H1

H1: Students of Cohort 2008 to 2010 that were formed under some elements of the Dual System (new system), have acquired better competences than students in the same cohort that were formed in the traditional system.

2. Empirical research

Methodology

This research is about the results of implementing the dual system (new system) to a group of students of the Mechatronics technical career of the 2008 -2010 cohort, and comparing them with the results of another group of students who were formed under the traditional system in the same career and the same cohort. To reach the aims in this research, I applied a qualitative-quantitative approach, which included questionnaires and interviews for the students.

Population in the study

The population of this study was the students of the career of Mechatronics of the 2008-2010 Cohort. It consisted of 56 students, where 39 belonged to the dual system (70%) and 17 to the Traditional System (30%).

2.1. Questionnaires

With the purpose of exploring the students' opinions about the formation they were receiving, under the new system and under the traditional system, three questionnaires were designed. In every instrument, the objectives were established, the sample was defined, the method for collecting the data was described, the time, the type of survey, the valuation scale, the categories, the variables, the statement of agreement, and the questionnaire. These were non-parametric tests.

Goals

The main purpose was to explore the opinion of the Mechatronics students about their formation process, both under the new system and under the traditional system. The objectives were

- To explore the students' opinions about their formation at the Academy.
- To identify students' opinions about in-company practice (for students under the dual systems).
- To have information about students opinion related to advantages and disadvantages of their study system (dual and traditional).

Sample size and research design

Population

Student populations in Mechatronic career of the cohort 2008-2010 are 56. From this population 39 students belong to Dual System and 17 to Traditional System.

Sample

Because of the small the size of the population, the questionnaire was passed to the whole universe, except to those who were not willing to participate.

Almost all the students in the different systems participated giving their perception and opinion about the formation process; 96% in the first measurement, 88% in second and 91% in the last questionnaire. The same situation was for tutors' participation where 100% did the first measurement, 96% the second and 89% the last questionnaire.

Type of survey design

Repeated questionnaires were passed three times between the year 2008 and 2011. This was done in order to record the opinions of students and tutors during a period of time, pinpointing how their opinions changed in time. The technique was a Survey and the instrument used was a questionnaire.

Valuation scale

Likert Scale

Most of the questions use Likert Scale with the following typical five-levels: (1) Strongly disagree (--), (2) mainly disagree (-), (3) neither agree nor disagree (+/-), (4) mainly agree (+), (5) strongly agree (++), and (6) included the decline option: Do not know (?).

Open question

Open questions were included in the questionnaire with the proposed of obtaining extra information about a particular topic.

Categories to explore in the survey

- Formation at the Academy
- In-company practice
- Advantages and disadvantages of the study system (dual or traditional)
- Preconditions information

Matrix by categories

Table 1. Questions: Student's questionnaire

Category	Related objective	Variable	item #	Question
Academy formation (Both: students in dual and in traditional system)	To explore students' opinions about their formation at the Academy	Useful Knowledge, skill, abilities	1.	The Academy is giving me ... a) Knowledge b) Skills c) Abilities ... That will be useful for me in my professional development
		solve problems in autonomous way, with support	2	At the Academy, I am developing the ability to solve real labor problems... a) in an autonomous way b) with support
		Interpersonal relations	3	At the Academy, I have not learned how to improve my relations with others, like teachers and students
		Apply the knowledge	4	Applying knowledge gives great pleasure to me when I do practices at the Academy
		Practice fulfill expectation	5	The practices at Academy fulfill my expectations of professional development all in all
		Teachers behavior	6	I do not feel satisfied with the guide that I receive from the teachers
		Condition of formation	7	Academy gives me the followings resources... a) Learning materials b) Computer workstations c) Internet access d) Library facilities e) Furnishing of Classrooms f) Equipped workshops g) Equipped Laboratories ... which are useful to me in order to have quality in education
Enterprise practice (Only students in dual system)	To identify students opinion about enterprise practice (for students in dual systems)	Relation between theory and practice	8.	I do not feel satisfied with the relation between the theory and the practice at workshops
		Knowledge, skill, abilities	9.	In the enterprise practice, I am getting... a) Knowledge b) Skills c) Abilities ... That will be useful to me in my professional development

		solve problems in autonomous way, with support	10	At the in-company practice, I am developing abilities to solve real work problems... a) In autonomous way b) With support
		Labor relations	11.	I have not learned how to improve my labor relations with others employees
		Understanding word labor's demands	12	The practice in the company is helping me to understand the labor world's demands
		Activities in the enterprise	13	I feel satisfied with the diversity of activities that I make in my enterprise practice
		Apply the knowledge	14	Applying knowledge gives great pleasure to me when I do the enterprise practice
		Practices fulfill expectation	15.	The practices in the company does not fulfill my expectations of professional development
		Tutor's behavior	16.	I feel satisfied with the guide that I receive from the tutor
		Tutor's behavior	17.	If I have a question , then I can always ask my tutor
		Resources of the company	18.	I consider that the company where I do my practices does not have all the necessary resources for my formation
Advantages and disadvantages (both: dual and traditional)	To have information about students' opinions related to advantages and disadvantages of their study system (dual or traditional) and their expectative about job opportunities	Job opportunities	19.	I expect to have a job opportunity after I finished my studies
		Recommendation to other students	20.	I would not recommend other students to participate in this study program
		Disadvantages	22.	According your experience studying with study system (dual or traditional), which are the most important disadvantages of its. Your answers could be in relation to the practice at Academy , the tutors if you are in dual system, the teachers, the enterprise where you do the practice (for dual system), between others

	Extra comments	23.	In case that you want to give extra comment about the questionnaire, about the dual or traditional system or more that you think is important for my knowledge, please feel free to do it here
Precondition information	Age	24	My age is in this range: <input type="checkbox"/> Between 18 - 21 <input type="checkbox"/> Between 22- 25 <input type="checkbox"/> Between 26 - 29 <input type="checkbox"/> 30 and older
	Previous experience	25	I have had labor experience (any kind of job) before to start my studies in Mechatronic at Academy. <input type="checkbox"/> Yes <input type="checkbox"/> No If your answer is YES, please explain which your experience is: _____

Applied method

For Liker items, the analysis was with Liker scale; where the additive scale was calculated by the sum of responses on several Liker items, and getting the equivalent point in the scale. Besides, open questions were analyzed.

Validity and Reliability of the scale

Validity

All the questionnaires were validated with professional who work with Mechatronic, one enterprise tutor, one student and expert researchers from the Faculty for Education from Technische Universität Dresden in Germany

Reliability

The reliability of the scale was tested by internal consistency measurement using Cronbach coefficient in order to determinate if answers to the items of the questionnaires were coherent. If in every measurement the Cronbach Alpha was close to one, the reliability was very acceptable.

2.2. Interviews

The interviews were done with the purpose of exploring the students' opinions about the formation development students under the new system were receiving. In every instrument, the objectives were established, the sample was calculated, the method for collecting the data was defined, the time was measured, the type of interview was selected, and the categories, the variables, the statement of agreement, and the interview protocol were specified. Students were selected randomly, choosing 5 out of 39 students as the sample . The analysis was made using the Qualitative Content Method (Mayring, 2000).

Student interviews

The students' interviews were designed to obtain the students' opinions about the formation process they were undergoing under the new system. The specific objectives were

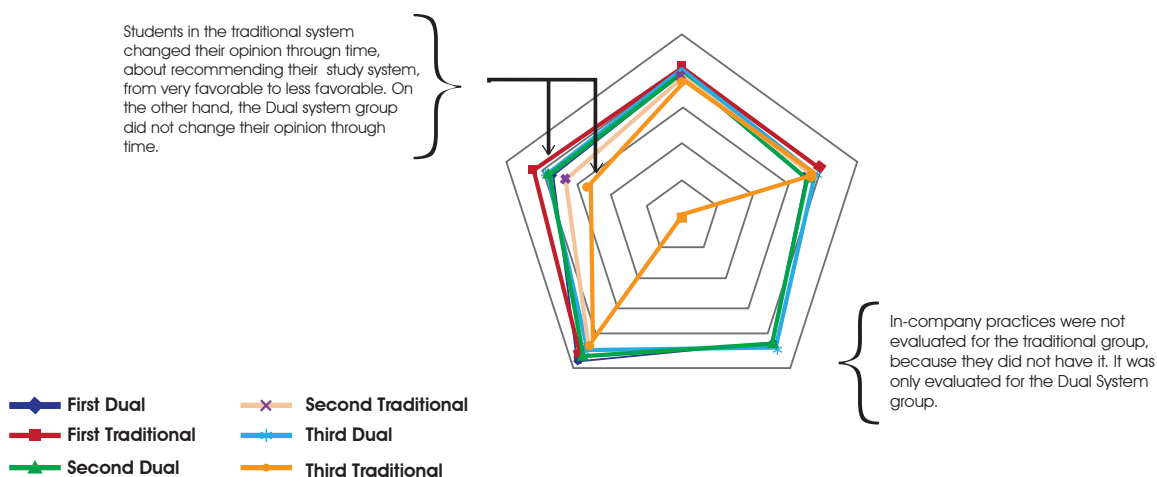
- to find out if they were employed in their area of formation
- to explore the experience of being formed under the Dual system
- to identify difficulties in the development of their studies
- to explore about the evaluation of the competences they have had
- to explore how their studies have had an impact on better job opportunities
- to know their opinion about the dual system expansion

Five semi structured interviews including open questions were administered to students enrolled in the dual system. The Categories explored were (a) Work in the area of formation (b) experience in the system, (c) limitations, (d) evaluation method, (e) job opportunities, and (f) measures to expand the system.

3. Results

3.1. Questionnaire results

Comparing the students' opinions by variable, with every measurement by system of study, there are changes in the traditional group. At the beginning of their studies, they had a more favorable opinion; but this changed to less favorable in the last measurement. In **Graph 1**, the red line is the first measurement and the orange belongs to the third for traditional students, where the decrease in the favorable opinion is evident. In the same graph, there was a major difference between two groups regarding their opinion about recommending the system of study they were formed by to others (variable "Recommend others"), because the students in the Dual system maintain their opinion, but students in traditional systems decrease from a very favorable opinion (4.2) to an unfavorable opinion (2.7).



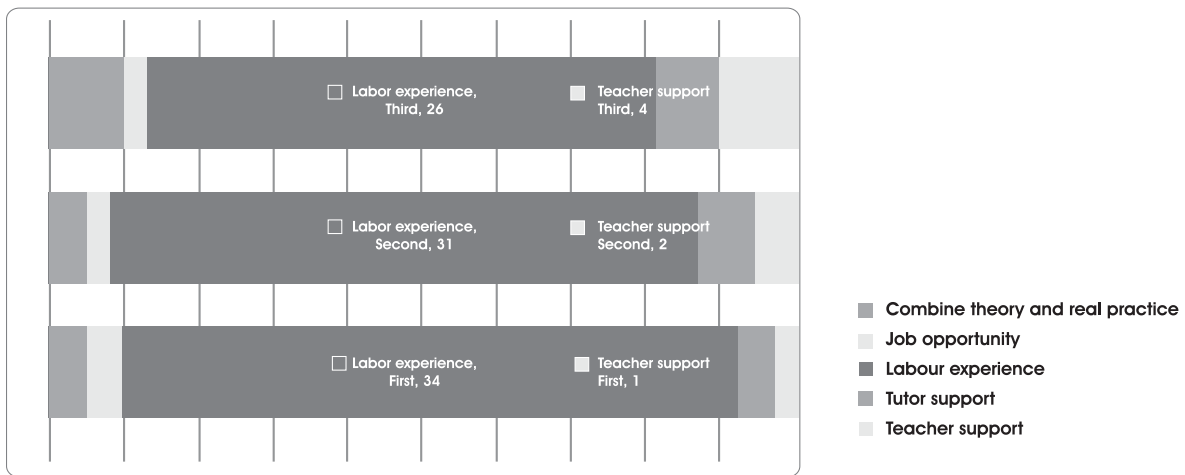
Graph 1. Students' opinion: all measurements by group of variable

Advantages and disadvantages

The purpose of this section was to have information about students' opinions related to advantages and disadvantages of their study system (dual or traditional); the results were

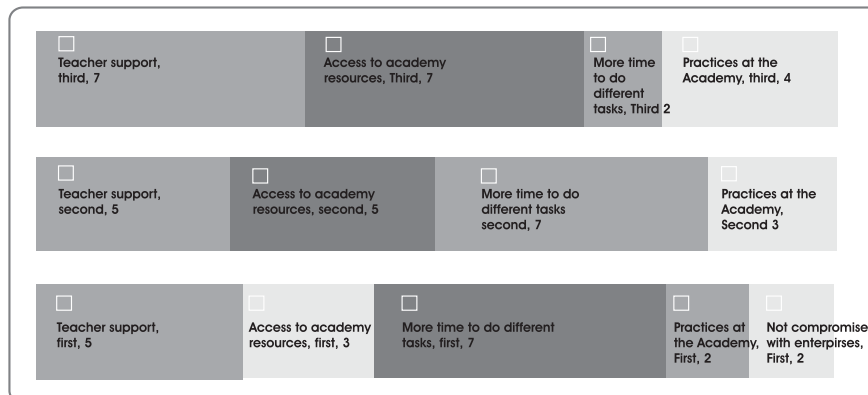
Advantages

Basically, there were five factors that students pointed out about the advantages of the Dual system: Combined theory and real practice, job opportunity, labor experience, tutor support and teacher support; but they recognized as the most important advantages the "Labor experience" (See Graph 2), opinion that was present in the three measurements.



Graph 2. Dual system: Advantages according to the students' opinions

The traditional group regarded as advantages the teacher support, the access to academy resources, more time to do different tasks, the practices at the Academy and the fact that there was no compromise with the enterprises. As the time of their formation had passed, this group gave more importance to the teacher support, the resources at the academy and the practices (See Graph 3).



Graph 3. Traditional system: Advantages according to the students' opinions

Disadvantages

The disadvantages according each group of students are listed in **Table 2**. These disadvantages are the opportunity to improve the system in El Salvador, considering that this was the first experience.

Dual system disadvantages Students' opinions	Traditional system disadvantages Students' opinions
<ul style="list-style-type: none">• Lack of coordination• Study plan is not completely developed• Lack of resources at the Academy• Inexperienced teachers	<ul style="list-style-type: none">• Lack of coordination• Lack of resources at the Academy• Inexperienced teachers• No in-company practice

Table 2. Disadvantages according to the students' opinions

3.2. Interviews

Work in the area of formation

All the students that were interviewed were employed in a field related to their formation.

Experience in the system

Important facts pointed out by students about their experience in the system relate to their satisfaction for the knowledge acquired at the Academy and how useful it has been for them. It was considered as a good way of making the formation process with practice in the real world. Practices at the enterprise make the incorporation to the company easier. At the enterprise, the students have a chance to learn and discovered new knowledge, solving real problems, working in teams, learning from others, and developing social competences. The economic support from the enterprises was a good motivation and it is important to continue with this effort. This experience has included the evaluation of areas that according to the students need to be improved. Through the students' opinions, it was possible to discover the dimension of competencies mentioned by Erpenbeck and Von Rosenstiel (2003) about (a) personal competences, (b) activity and implementation-oriented competencies, (c) technical and methodological competences, and (d) social and communicative competences.

Limitations

Because it was the first time applying the Dual system, this still needs to be improved. Among the things that need to be improved are the evaluation method, the communication between the Academy and the enterprises and the curriculum overload. There was some difficulty with the technology found at the enterprises. Some of them did not have all the equipment, but the students finished their practice at other enterprise. According to some students, it is necessary that enterprises trust the students and provide more space for in-company practice, besides improving the salary conditions.

Evaluation method

The dual system was positively evaluated by the students regarding the competences under assessment. The students' assessment was carried out using tests, lab practice and other tasks at the Academy. According to the students, the competences are evaluated regarding how they put into practice the knowledge acquired and can they help others to use that knowledge.

The enterprises kept a binnacle which was used to plan the work practice, and included good feedback regarding the learning outcomes and attitudes. The way the Academy evaluates attitudes was not clear for the students. Evaluations at Academy were before to go to the enterprise, it means that the competences after enterprise practice were not evaluated.

Job opportunities

The students acknowledged that the job opportunities they had were because of the Dual system and their in-company practice.

Measures to expand the system

Important facts have been recommended to ensure the expansion of the system, such as the design and development of careers or programs that respond to the needs of the enterprises; to improve the administration, the teachers have to show they have experience in the real labor world. The need for the enterprises to support more students and for the government to offer scholarships and equipped laboratories so other students can have access to this kind of system.

Conclusion

At the beginning, both groups, under the dual and traditional systems) had a very favorable opinion for each variable regarding the system of study. These opinions changed at the end of their studies. At this point, the dual system has a more favorable opinion than the group working under the traditional system. This change was evident in the variable 'Recommend other', where the question was if they would recommend others to study under the system they were formed by. Students in Dual the system recommended others to study in this system (4.2)³, whereas students studying under the traditional system had a more unfavorable opinion (2.7) when it comes to recommend others to study under the same system.

In general, the students' interviews have confirmed that there is a good opinion about the Dual system. There are favorable opinions regarding the process, even though they recommend to review the study plan, since most of them think that it is overloaded with contents, and, hence, they cannot finish it. Regarding the evaluation, it has to be considered that evaluation at the Academy takes place before the in-company practice; this means that the Academy does not evaluate their students performance after the in-company practice. All of them agreed that with the Dual system they have the opportunity to get a job in less time. Finally, with regard to the expansion of the Dual system, they believe that the enterprise needs need to be taken into account, including governmental support, and motivating the students for the new system must also be considered.

3. The scale to measure the opinion was a liker scale from 1 to 5, where 5 is the most favorable opinion and 1 is the most unfavorable opinion.

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