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# Improving Access to Better Job Opportunities for Students in an Apprenticeship-Based High School Program

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# Dedication

My deepest gratitude goes to all who are in my life.

To God. For a truly blessed life.

To my partner in crime, in love, in friendship, in hardship, and many more. Without your support and your genuine belief in my abilities, I would have never been able to complete this degree.

To my mom and dad. It is because of you that I found my true calling and that I built my character to achieve my wildest dreams and become the man who I am.

To my sister. A real-life shero, your fortitude is a true testament of strength and courage embodied in one of the most caring humans I know.

To my brother-in-law. Your life on this Earth will always be remembered. Rest in peace.

To my brother. My childhood roommate and now coworker. For many more days together in this journey we call life.

To my nephew and nieces. Being your uncle is a joy. Know that if you set your mind and work to accomplish something, it is possible.

To my friends, my chosen family. For making the difference in my life, for making the ordinary moments the most extraordinary.

To all my students and colleagues. Because in every lesson I was the teacher, I was also a student.

To all my Vanderbilt professors. You were there to help me learn to widen my perspective on education but more importantly, on life and to help me realize that privilege provides more opportunities and at same time, more responsibility.

To the Dual Institute and its students. Know that this project was in no way just a fulfillment to complete my degree, but it was a reminder that education can improve the quality of life in our communities.

To the pandemic. It taught me to remember the genuine value of life and of being human.

To my capstone advisor. Thank you, thank you, thank you.

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# Introduction

During 2020, specific sectors in Mexico saw an increase in employment: automotive, computer components, and electronics industries. Exports have increased, possibly due to the global reconfiguration in commercial relationships. The Ministry of Finance expects these sectors to continue to grow and that they will have the potential to employ young Mexicans who, in turn, will contribute toward national productivity.

The Dual Institute (a pseudonym is used in the present work to maintain the confidentiality of the organization), funded by private and public sectors, initiated the process of adapting the high school dual-apprenticeship model from Germany to the Mexican socio-cultural context more than a decade ago. The Institute's adapted program resulted in what is known today as the Mexican Model of Dual Formation (MMDF), which is a technical high school program that addresses the obstacles young people face when entering the labor market: lack of competencies and professional experience. In particular, Mexican technical high school programs include courses and training to develop the required technical skills for a certain job in a particular field.

Through the Dual Formation program, students develop knowledge, skills, and attitudes and gain work experience before they graduate high school. As a result, graduating students have a higher success of employment and better opportunities toward a higher quality of life while playing an important role in improving productivity in the country.

The purpose of this project is to help the Dual Institute identify factors in the MMDF that contribute to access higher-income jobs across the technical careers in certain locations in the Mexican state of Nuevo Leon. Its findings will provide local, state, and national authorities with the opportunity to develop initiatives within the MMDF model that could give students improved access to better employment.

## Organization Context

The Dual Institute was founded in 1978 by the Secretary of Education in collaboration with German private investors. The primary objective was to implement a technical diploma in the Mexican education system based on the German *Beruffachschule* that uses the apprenticeship concept to develop workers in specific disciplines. This initiative was intended to help Mexicans to be better prepared to join the workforces of the German international manufacturing and automotive companies present in their country—in particular, Volkswagen and Mercedes Benz.

In 2009, the Federal Institute of German Professional Formation (abbreviated as BIBB in German) and the Dual Institute signed a collaboration agreement to ensure a skillful workforce in Mexico through the MMDF. In the last decade since this agreement was signed, many educational policies have been put into place to give the Institute an autonomy that boosts its coverage across the nation. In September 2019, the General Law of Education was ratified to declare the MMDF a high school option with government recognition. This program's purpose is to reduce unemployment among young people, increase productivity, provide a better quality of life, and develop the region's economy.

The MMDF provides the opportunity for high school students to learn skills in the workplace while at the same time receiving an academic formation that allows them to enter the workforce or continue to higher education. All students with a secondary school diploma are eligible to apply to any of the 312 locations in the country offering seven fields of study and 61 technical-career pathways that last three years. The first year is academic in nature during which students go to a Dual Institute school, with the second and third years being a combination of academic online classes and their career-related internships.

Dual Institute teachers and instructors are required to have at least a college degree, two years of experience as a high school instructor, and three years working in the field of

study. The teachers' union classifies instructors into five categories depending on the number of years as an instructor, their work in the specific area of study, and professional development. In 2016, there were around 16,000 people in the teaching staff.

The stakeholders for this project are varied in hierarchical level and across organizational departments. The General Director of Productivity Policy and Projects (GDPPP) of the Mexican Ministry of Finance coordinates distinct Ministries of the Federal Public Administration to develop, integrate and implement public policies focused on economic productivity. The Director leads the Special Productivity and Competitiveness Program at the national level and works in coordination with other federal and local government institutions, business chambers, unions, and academia on the design of recommendations that aim to boost economic activity.

In collaboration with the GDPPP, the Director of the Dual Institute works toward increasing enrollment in and successful graduation from the Dual Education Model. As a consequence of better education opportunities, productivity and competitiveness can be improved at a national level. The findings and recommendations from this project will facilitate better-informed decisions to allocate resources and to design public policies.

# Problem of Practice - Area of Inquiry

The Dual Institute's enrollment in 2020 was 307,031 across the country in its technical high school programs, but only roughly 3,000 students had graduated from the MMDF by January 2020. The Dual Institute's national objective is to increase enrollment from the current 9,000 students up to 11,000 students within two years. This data underscores the importance of making the MMDF program more attractive for students by ensuring the program offers the best educational and working experience possible.

Recent data from 2018 shows that 52% of the MMDF's graduated class was employed by the end of their high school program, compared to 37% of students who graduated from the traditional technical high school. This important advantage motivates the Institute to direct their efforts toward achieving the 11,000-student mark in two years. However, the monthly income distribution might not make attractive reading for graduated students. Table 1 shows that 39% earn less than 5,000 Mexican Pesos per month, which is just under the national minimum wage in 2020.

| Monthly Income (in Mexican Pesos) | Percent of graduates |
|---|---|
| **Less than 5,000 Pesos** | 39% |
| **5,001 – 10,000** | 33% |
| **10,001 – 15,000** | 13% |
| **15,001 – 25,000** | 9% |
| **25,001 – 50,000** | 5% |
| **50,001 or more** | 1% |

**Table 1. National Monthly Income Distribution. Source: Anonymized.**

After a three-year program of work and study, this might not be very attractive for potential candidates graduating secondary school. Nonetheless, 28% of the students earn more than 10,000 pesos which is an above-average salary in formal and informal jobs in Mexico.

With only 3,000 students having graduated from this program, there is still insufficient information about their trajectories before, during, and after the MMDF.

For the Dual Institute to make decisions with higher impact in improving the MMDF, information related to the variables that enable MMDF graduates to access higher earning jobs is needed. The lack of available data and analysis related to this program is the problem of practice that this project has identified. This capstone project will analyze the students' perspective on both their academic and working pieces of the program.

The Dual Institute has established an institutional strategy with five focus areas: (1) joint identification of technical personnel needs; (2) the definition of desirable skills, competencies and standards; (3) collaborative development of educational options aligned with specific industrial demands; (4) technological change by industry and labor market; and (5) prospective studies (Anonymized, 2019).

The present study will provide the Dual Institute with findings and recommendations aligned to its second focus area. Knowing how students see themselves in the workplace and their experience in the apprenticeship section of the MMDF will help the organization target their marketing and recruiting plans more effectively, improve the apprenticeship's structure and organization, and increase the number of students with higher earnings. Not understanding the students' experience in this program would put at risk obtaining the Dual Institute's enrollment objective.

# Literature Review

Research in Mexican dual-apprenticeship programs is scarce for two main reasons. Firstly, the MMDF as it is today has been an official program for only four years. Secondly, the enrollment in these technical-high school programs represents only 6% of the student population in Mexican high schools. The present literature review is based on studies in countries that have had such dual programs implemented for over 100 years, such as Germany, Switzerland, Austria, and England. Latin American studies in this field rely mostly on internal documents released by private or public institutions that are dedicated to this educational sector.

To better understand historically successful dual apprenticeship programs, reviewing the following key areas is important: self-socialization conceptualized by German sociologists and researchers in dual apprenticeship, attracting students and employers to dual-apprenticeship models, and dual education in Mexico.

## Self-socialization

In today's society, each individual lives a sequence of partial transformations of self-identity that are accomplished by linking their own history and the outcomes of having selected between certain pathways. There is little research for vocational education and training for adolescents and young adulthood in American countries. Heinz et al. (2002) have grounded their research under the assumption that transitions from education to employment are related to self-socialization, which gives meaning to experiences with occupational selection, employment opportunities and career options as biographical events that inform but do not determine future decision making.

In contrast to the notion of socialization, which focuses on the internalization of norms and meanings, German sociologist Walter R. Heinz developed the concept of self-socialization

to describe the process of a person accepting the outcomes of their own actions by constructing a meaningful link between the biographical past and future in the present. Self-socialization refers to the notion that the relationship between social structure and personality development is nondeterministic and nondual (Heinz et al., 1998). Self-socialization is based on two theoretical frameworks: (1) social cognitive theory; and (2) symbolic interactionism.

Similarly, both theories highlight the significance of personal agency to explain actions people take in order to define their future (Heinz et al., 1998). Social cognitive theory stresses the importance of the individual's belief in self-efficacy, whereas symbolic interactionism emphasizes on interpersonal relationships and the construction of meaning as central aspects of social activities.

Self-socialization refers to the whole sequence that results in planning and performing an action, while emphasizing the individual's assessment of their action's results considering their expectations, means used, and resources. Heinz (2002) uses two principles in his self-socialization framework: (1) Individuals build their own life course by attempting to come to terms with opportunities and constraints concerning transition pathways and life stages; and (2) individuals select pathways, act and appraise the consequences of their actions in terms of their self-identity in reference to social contexts which are embedded in institutions and labor markets. Shared cultural meanings, institutional regulations, and interpersonal relationships inform the timing of transitions and the duration of life stages (Heinz, 2002).

Heinz et al. (1998) propose six modes of biographical agency as a reflection of self-identity that vary across the transitions and career lines that consequently create different patterns of course decisions and actions and stretch across all spheres of life. These modes help identify how people actively shape their career transitions.

1. Company identification: Job security and social relations in the workplace are essential.
2. Wage-worker habitus: Work requires a fair material compensation and employment is more a necessity than self-realization.

3. Career involvement: Advancement to higher level positions by continuing with education.
4. Optimizing opportunities: Occupational success, advancement, and a scope of shaping one's work history is most important. People in this mode see work as the binding domain in life and try hard to develop their skills and career.
5. Personal autonomy: Fulfillment of personal interests. Work is seen as a path to self-realization.
6. Self-employment habitus: Work is a means to economic success and independence.

In addition to the six modes of biographical agency, the concept of occupational self-socialization was introduced by Heinz et al. (1998) to describe how young people and adults integrate experience in social life and organizational participation with their expectations and skills before and after transitions in order to shape their vocational career.

## Dual Apprenticeship

Apprenticeships denote learning programs that combine formal education with training and experience in the workplace and result in an externally recognized vocational qualification (Valiente et al., 2017). Dual forms of apprenticeship differ significantly from simple forms of apprenticeship, in that dual forms are subject to strict institutional regulation and are guided by principles of social collaboration between capital, labor, and the state (Valiente et al., 2017).

There are potential advantages of dual apprenticeship programs. Firstly, situated learning increases motivation in some students and facilitates learning more than classroom programs (Gonon, 2009). Also, learners benefit from learning skills and the requirements in the workplace. Thirdly, dual apprenticeships help smooth the transition between school and work (Ryan, 2001).

UNESCO (2019) found critical areas of consideration for dual programs in development:

- Transfer of dual training to local conditions
- Outreach to industries and businesses

- Training of tutors and instructors
- Student recruitment and selection
- Development of personalized training schedules
- Evaluation and accreditation
- Certification of competencies

## Attracting employers

A general assumption exists that the involvement of the companies and employers in dual apprenticeship programs is mainly a result of cost-benefit analysis (Juul Jorgensen, 2011; Smith et al., 2011). Two conditions need to be present for employers to participate in dual apprenticeship programs: a lower cost of the apprentice versus his or her productivity during the training period and the compensation of cost of selecting well-trained candidates in the labor market versus the investment in training (Valiente et al., 2017). In addition, Acemoglu and Pischke (1998) found that a critical element for employer participation is the involvement of selecting and recruiting students. However, these are not the only factors that are considered by employers (Valiente et al., 2017).

One of the variables that also influences participation of employers in dual programs is the size of the firm; in particular, small and medium enterprises that are dealing with specific conditions—such as a lack of financial resources, lack of organizational resources, and specificity of economic activity (Valiente et al., 2017). For instance, creating a training center in a small enterprise increases the cost and reduces the feasibility of a project of this nature. State intervention through policy making and sharing the cost of training between employers and the government attracts more employers to dual apprenticeship programs (Troltsch and Walden, 2011). The role of the government as facilitator and regulator in collaboration schemes for dual apprenticeship programs is vital to ensure the program's sustainability (Betts and Smith, 2006).

Vormfelde (2017) suggests the following factors risk the sustainability of dual apprenticeship programs: (1) inadequate participation in selecting and recruiting the apprentices; (2) apprentices are seen as students rather than collaborators; (3) insufficient organizational resources for training; (4) training has no curricular value—when it is only fulfilling a program's requisite; (5) organizational structure does not support training; (6) real needs of the employer are not satisfied by the training program; (7) inexistent policies that strengthen the dual apprenticeship program; and (8) unskilled instructors.

## Attracting students

In order to attract students from different social backgrounds, policymakers and leaders of dual apprenticeship programs should focus on providing training at the highest standards of quality that meets the demands of the most competitive companies, but also an academic formation that fulfills the requirements to succeed in higher education studies (Valiente et al., 2017).

Transforming the workplace into a space for high-quality training provides apprentices with the opportunity to acquire knowledge and awareness of workplace dynamics and to establish social and professional ties (Burt, 2001). As part of socialization and personality development for young apprentices, real labor relations play a meaningful role in this experience. Dual apprenticeships must offer legal protection to the student and the employer in a contract, which has significant symbolic value to becoming a member of a community with a shared set of values and culture (Heinz, 2000).

Making dual apprenticeships attractive to students also involves the availability of experienced and capable trainers and mentors in the workplace (Valiente et al., 2017). Both trainers and school teachers integrate the workplace experience in the educational program using personalized learning plans, projects, learning logs, and more (Tynjälä Virtanen, 2008). Additionally, the organizational and physical infrastructure need to be suited to apprentice

training. External departments participate in inspecting, monitoring, and evaluating the training environment to guarantee the quality of learning. In Germany, Denmark, and the Netherlands, the corresponding Department of Education oversees the dual apprenticeship programs, while some monitoring activities are shared with other social partners like local chambers of commerce. In other countries, the Departments of Finance or Labor perform this function (Valiente et al., 2017).

## Dual Education in Mexico

Dual Institute is the leading institution in vocational training for junior high school graduates. It combines general preparation in generic and technical competencies pertinent to the state-level labor markets. Its academic model entails a close collaboration between local businesses and schools.

The MMDF was recently institutionalized—in 2015—after extensive studies of best practices in Switzerland, Germany, and France (Ortega, 2020). Mexico's Dual Program has been strongly influenced by the German vocational system and France's Polytechnic Institute (Weiss, 2019). For the Germans, practice takes a more important role than theoretical knowledge; ideally, 80% of German dual programs would take place in industrial plants or businesses (Ibarrola, 2019; Weiss, 2019). However, the MMDF counts 60% of the credits for the time spent in the workplace, the rest is academic work.

### Mexican Model of Dual Formation

The MMDF is an educational alternative for students finishing their secondary education (grade 9). The main objective is to improve students' well-being and their integral development. This mixed modality offers a combination of professional training with a mentor in a local company and academic learning at school, in either face-to-face or virtual teaching. Collaboration between businesses and schools is needed to define assessment requirements for students to receive academic credits. After graduation, students obtain a Dual High School

Diploma that allows them to continue their education or certify their labor competencies via a standardized examination (Anonymized, 2014).

## MMDF's framework of collaboration

Four key stakeholders participate in the MMDF: the business-school relations manager, the person working in the school responsible for developing close ties and formal agreements between the commercial and education sectors; the tutor, a teacher overseeing the learning at school and the student's development at the workplace; the instructor, the tutor's counterpart at the workplace supervising and training the student; and the operator, who leads, promotes, and organizes the dual program in the workplace (Reyes Machado, 2014).

## The structure of the program

The total duration of the program is three years, divided into semesters. Students in the industrial fields of training start attending the workplace in year two, from three to four days per week. Careers in service industries, on the other hand, require only one year of training. During the remaining one or two days of the week, students either go to school or take classes online to continue their academic formation. For each technical career, a standardized curricular map guides the sequence of the student's study and training. Figure 1 shows the curricular map of the Information Technology Career.

**Curricular Map 2013**

Information Technology

| | Grade 10 - Semester 1 | hours | Grade 10 - Semester 2 | hours |
|---|---|---|---|---|
| Academic Formation | Communication in social spheres | 5 | Communication in academic and professional spheres | 3 |
| | Data processing | 5 | Digital apps | 3 |
| | Math | 5 | English | 3 |
| | Studying skills | 5 | Math | 4 |
| | Problem Solving | 5 | Chemistry | 4 |
| | Citizenship | 5 | Biology | 3 |
| | Personal and professional plan | 5 | | |
| | | **35** | | **20** |
| Technical formation | | | Programming techniques | 6 |
| | | | Discrete math | 4 |
| | | | Maintenance of computers | 5 |
| | | **0** | | **15** |
| | | **35** | | **35** |

| | Grade 11 - Semester 1 | hours | Grade 11 - Semester 2 | hours |
|---|---|---|---|---|
| Academic Formation | English | 3 | English | 3 |
| | Math | 4 | Math | 4 |
| | Physics | 4 | History | 3 |
| | | **11** | | **10** |
| Technical Formation | Basic programming | 7 | Object programming | 8 |
| | Digital documents | 8 | Databases | 7 |
| | Operating systems | 5 | Technical optative | 5 |
| | Cybersecurity | 4 | College optative | 5 |
| | | **24** | | **25** |
| | | **35** | | **35** |

| | Grade 12 - Semester 1 | hours | Grade 12 - Semester 2 | hours |
|---|---|---|---|---|
| Academic Formation | English | 3 | Philosophy | 3 |
| | Ethics | 3 | | |
| | | **6** | | **3** |
| Technical Formation | Professional formation | 4 | Technical English | 3 |
| | Local networks | 5 | Networks | 8 |
| | Databases and programming | 5 | Website design | 8 |
| | Administration | 5 | Norms in computer science | 3 |
| | Technical optative | 5 | Technical optative | 5 |
| | College optative | 5 | College optative | 5 |
| | | **29** | | **32** |
| | | **35** | | **35** |

**Figure 1. Curricular Map 2013. Translated and simplified**.

The training program is developed according to a Rotation Plan of Learning Stations related to the professional formation strand. The company's instructor determines the formation

plan by assigning time for the student to learn and master the required standard. Then, the tutor at the school validates if the instructor's training scheme aligns with the High School Common Curricular Framework (Marco Curricular Común) established by the National Education System.

Rotation Plans vary for every student, since the instructors based at the companies have limited resources. Table 2 is an example of a rotation plan for a student in the technical career of Electromechanics. Since there is a possibility that a rotation plan does not comply 100% with the professional formation strand for the Dual Institute careers, the business–school relations manager designs the Personal Formation Plan (Plan de Formación Personalizada) in coordination with school teachers to determine the specific strategies needed to complete the total number of modules.

| | | **ROTATION PLAN FOR ELECTROMECHANICS** | | | | |
|---|---|---|---|---|---|---|
| | **MODULE** | Install and give maintenance to electric installations and rotative electrical machines | | | Manufacturing mechanical parts in CNC machines | |
| | **LEARNING STANDARD** | Install and give maintenance to electric installations and rotative electrical machines | Draw electrical circuits | Give maintenance to domestic, commercial and industrial electrical installations | Manufacturing mechanical parts in CNC milling machines | Draw mechanical parts using CAD |
| **LEARNING STATIONS IN THE WORKPLACE** | Assembly of control stations | | | | | |
| | Design of gauges and cut and test leads | | | | | |
| | Assembly of equipment from a technical drawing | | | | | |
| | Road milling machine | | | | | |
| | Programming | | | | | |

**Table 2. Rotation Plan for Electromechanics (Anonymized, 2019).** ***Translated.***

## Conceptual Framework

Today, Mexican students graduating from secondary school face a variety of life choices: studying in a traditional high school program, enrolling in the Dual Program, or entering the job market. These events and the way adolescents anticipate and respond to them shape their futures. Because of the rapidly changing nature of social life, working conditions, job requirements, flexible arrangements and reflection on biographical events are needed. Self-socialization fosters biographical reflexivity and recognizes that the life course is a "biographical accomplishment which consists of a meaningful integration of events, pathways, transitions, memberships in organizations and networks across time" (Heinz, 2002).

The conceptual framework for this project rests on three important dimensions to help understand the student experience in the dual program:

- Characteristics of Effective Dual Apprenticeship Programs - based on the literature review, the following factors are considered critical in successful apprenticeships:
    - Personalized Learning Plan - the integration of the requirements of academic and working skills that meet the needs of the curriculum and the employer.
    - Rotational Plan of Learning Stations - the existence and monitoring of the Rotational Plan established by Dual Institute's MMDF.
    - Adequate training space - infrastructure in the work setting provided conditions to learn the skills.
    - Existence of a contract - the document that formally establishes basic legal conditions for both the employer and the apprentice.
    - Apprentice participation - the level of participation in work tasks for the student to practice the skills.

- Evaluation of the program - the clarity and monitoring of learning expectations by the instructor and schoolteacher.

- Work experience - the transitions between school and work and any breaks, interruptions or change in the person's career.
- Modes of biographical agency proposed by Heinz (1998).

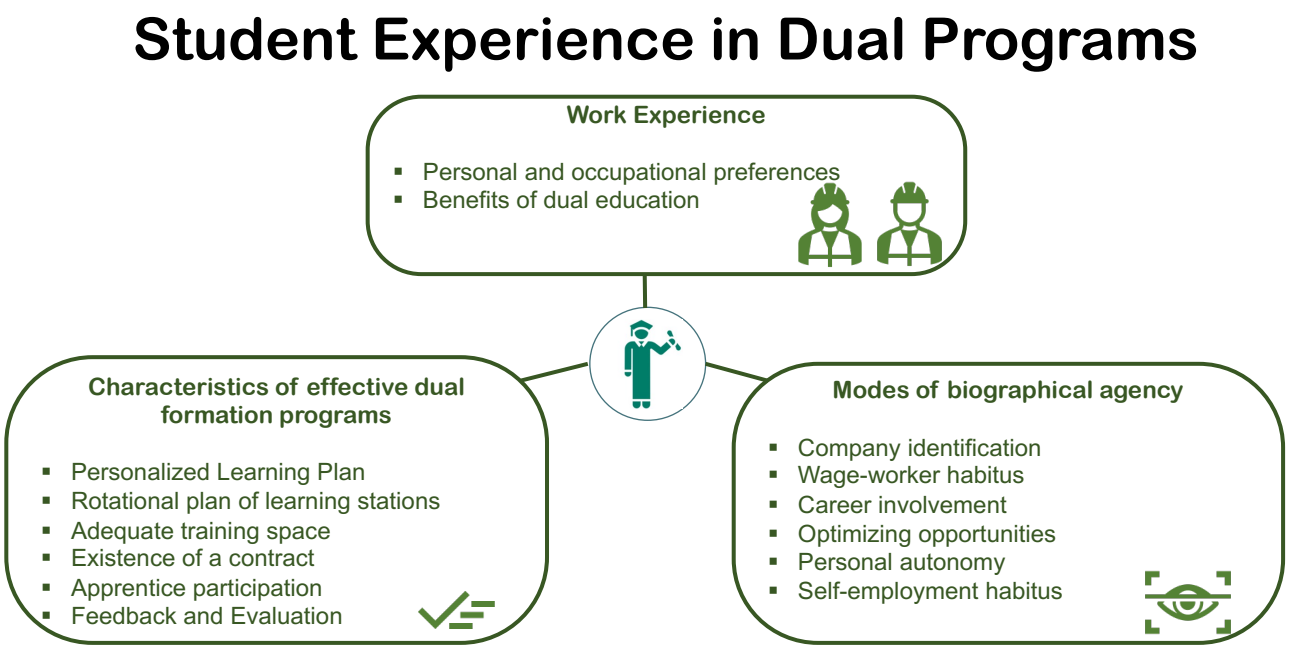



**Figure 2. Conceptual Framework.**

## Research Questions

The questions that will guide this project are:

1. Which program characteristics are related to graduates earning a higher income?
2. How do graduates from the Mexican Model of Dual Formation program see themselves in the workplace?
3. How do the graduates' work perspectives and their chosen program influence income?
4. Which elements of the Mexican Model of Dual Formation are the most useful for graduates from the program in the workplace?

# Project Design

## Data Collection

During the meetings with the Dual Institute's leadership in May 2021, the original plan was to get permission to use the information for the state of Nuevo Leon in the Dual Institute's federal database of graduate students. However, in October 2021, the new state government came into office, and a new leadership team was assigned on both federal and state levels. The new office restricted the use of the database due to data protection guidelines. The two sources of available data became those collected through the survey and the interview process. The following table shows the relationship between each research question, its reference to the conceptual framework, and data sources that map out the project design.

| **Research Question** | **Conceptual Framework Relationship** | **Survey and Interview Items** |
|---|---|---|
| Which program characteristics are related to graduates earning higher income? | Work Experience | Survey: 1-13<br>Interview: 1,2 |
| How do graduates from the Dual Formation program see themselves in the workplace? | Modes of Biographical Agency | Survey: 14,15,16<br>Interview: 10 -19 |
| How are the graduates' work perspectives and their chosen technical careers related to income levels? | Modes of Biographical Agency<br>Work Experience | Survey: 14-16 |
| Which elements of the Dual Formation programs are the most useful for current and graduate students in the workplace? | Effectiveness of Dual Apprenticeship | Survey: 17-26<br>Interview: 3-13 |

**Table 3. Mapping of survey and interview to research questions.**

## Survey

### Survey Design

Using the research questions and the literature review, I designed the 31-item survey (see Appendix A). The items are organized into the three main concepts from the framework: past work experience, modes of biographical agency, and the elements of effectiveness of dual programs.

First, the survey items for the working experience section were designed to understand research questions 1 and 3. Second, I wrote questions 14, 15, and 16 using research by Heinz (2002) to gain some insight into research question 2. Heinz's publications detail his interview questions and the codes he used in his qualitative analyses. I transformed his codes for each mode of biographical agency into answer choices for questions 14, 15, and 16. In each question, I included an open-ended option for participants to write their descriptions if the given choices were not compatible with their thoughts. The last section had items related to the different elements in the program, such as tutoring, evaluation, and feedback. These items were forced 4-point Likert scale questions to make the user form an opinion without a safe 'neutral' option and get specific responses.

In collaboration with the Dual Program director, I cognitively tested each question checking the proper use of terminology regarding the elements of the dual program and ensuring the data protection guidelines. Before sending the electronic form to the participants, three additional cognitive tests were performed on students enrolled in the program.

### Survey Participants

In Nuevo Leon, the Dual Institute offers the program in 17 locations across the state. Students choose from 14 technical courses available at each site. Their internship depends on each site's available arrangements with the local businesses. The sites are in similar urban

socioeconomic conditions with a low-income level. Out of the 17 locations, only ten schools sent the survey. The Dual Institute explained that the other seven schools did not have an updated alumni database. The estimated number of students who have graduated from the Dual Program in Nuevo Leon since 2016 is 400.

The ten participating schools sent out the email containing the survey link (see Appendix B) on my behalf to a total of 207 graduate students. Given that the program started in 2015, it makes sense that most of the responses are from graduates in 2020 and 2021 as shown in table 4. I received 93 responses (45% response rate), only one was incomplete and invalidated. The survey answers were anonymous and confidential, limited to one response per email address.

| Graduation Year | Responses |
|---|---|
| 2016 | 2 |
| 2017 | 4 |
| 2018 | 1 |
| 2019 | 12 |
| 2020 | 25 |
| 2021 | 43 |
| 2022 | 5 |

**Table 4. Responses by graduation year.**

From my conversations with the Dual Institute, I learned that most of the responses are from those years for two reasons. First, the former Director started to “strongly promote” this program in 2016. Because it is three years long, the Dual Institute’s effort was initially evident in 2019. Second, two of the on-site liaisons said it was easier to contact recent graduates than ex-students who are more than three years from their graduation. Unfortunately, the Dual Institute did not provide information on the number of graduates per year across the state, so this information only describes the survey.

Table 5 organizes the number of responses by technical career. Although the focus of this project is on industrial careers, Graphic Arts, Administrative Assistant, Accounting, and Transportation were also included in the analysis.

| Technical Career | Responses |
|---|---|
| Industrial Electromechanics | 30 |
| Technology Information | 7 |
| Machines | 18 |
| Mechatronics | 19 |
| Plastics | 5 |
| Industrial Productivity | 4 |
| Graphic Arts | 1 |
| Administrative Assistant | 3 |
| Accounting | 3 |
| Transportation | 2 |

**Table 5. Responses by technical careers.**

## Survey Procedure

The Director of the Dual Institute assigned a person to organize the survey and interviews within the organization. Within each school, there is a liaison between the companies, students, teachers, and external organizations. They sent out an email invitation to their contact list on behalf of the Dual Institute and me. The email included a brief introduction to this capstone project and the survey link. Daily, I would send the number of responses to my contact in the organization, and she would monitor and send reminders to locations lacking answers.

## Survey Analysis

The first step in the analysis was to clean up the data in a spreadsheet that contained all the responses. Since the survey was in Spanish, I first used Excel formulas to transform the file into the English version of the survey. Then, for questions whose answers were yes or no, I substituted the values for 1 and 0, respectively. The answers for the Likert scale questions were converted into numerical values: 4 – Strongly agree, 3 – Agree, 2 – Disagree, and 1 – Strongly disagree.

A key indicator of productivity to the state administration is monthly salary. In 2021, the average monthly wage in Nuevo Leon was $7,780. To understand the variation associated with income levels, I decided to classify the responses from question 9 in the survey into two groups: less than $10,000 and more than $10,001. There are three underlying reasons behind this grouping. One, students reported their income level in the following ranges: less than $2,500, $2,501 - $5,000, $5,001 - $10,000, $10,001 - $15,000, and $15,001 - $25,000. The Dual Institute recommended using these ranges as they commonly design their federal surveys with these in mind. Two, the $10,000 pesos mark is aligned with the state's objective of providing better opportunities to students to access higher-income jobs through the Dual Program. And three, only one response fell into the highest range ($15,001 - $25,000). By grouping the answers in these two income levels, I used cross-tabulation to describe the relationships between income and the different elements of the program.

For most items, I inserted pivot tables in excel to understand the frequency distribution for each question. For questions 14, 15, and 16, I created visualizations to describe the responses to answer research question 2.

To conduct inferential statistics, I used the chi-square test of independence. I could not use correlation or regression analysis because the income was reported by range rather than by a discrete amount. After the data was clean and ready, I tested each pair of variables with the chi-square statistic in SPSS. I explain the most relevant results and visualizations for each research question in the findings section.

## Interview

### Interview Protocol and Questions

I designed the interview protocol with two purposes in mind. One was to explore in more detail the experience of the students throughout the program and how they establish a biographically meaningful relationship to the constraints and opportunities of their situation. Interviewing graduate students with an income higher than $10,000 pesos can unveil the

individual perspectives and detect shared experiences. The second purpose was to bring forth information on the apprenticeship section of the program from the students' viewpoint. Questions 17 – 24 unpack their experience around the elements that relate to the effectiveness of the apprenticeship model according to the literature review and the conceptual framework: personalized learning plan, rotational plan of learning stations, adequate training space, existence of a formal agreement or contract, the level of apprentice participation, and evaluation and feedback.

## Interview Participants

Once the survey had received 60 responses, each school liaison initiated the invitation process for the interviews. The liaisons invited students with the following characteristics: current income above $10,000 pesos, currently employed or employed and studying, a graduate from the dual program, and living in Nuevo Leon. I interviewed ten people, and only one did not meet the above criteria; she was a full-time college student. The other nine participants had answered the survey before the interview, and they were from six different schools from Monterrey. Interviewees will be referred to by a letter to respect their anonymity.

## Interview Procedure

I created a shared calendar with the Dual Institute's organizer to coordinate interviewing slots. After the liaison confirmed, the participant received an email with the link. To start the meeting via Zoom or Google Meet, I greeted the person, introduced myself and the purpose of the study, its confidentiality and anonymity, and requested permission to record the interview. All participants agreed to be recorded. The interview was structured (see Appendix C) and the duration ranged from 27 to 45 minutes. Once I had completed the interview, I uploaded the video file to sonic.ai so the Spanish transcription would be ready for coding. In addition to the transcript, I took notes on printed interview protocols for each participant. No technical issues arose, and the interviews flowed nicely.

## Interview Analysis

To analyze the interviews qualitatively, I followed a two-step process to create a codebook. First, the tentative codes in table 6 were the product of the study by Heinz (2002). I first wrote the tentative codes in English; then, I translated them into Spanish. Then, re-watching the first two interviews, I developed codes using an inductive approach. The codebook (see Appendix D) was an essential resource for efficient analysis. I highlighted the codes in yellow in the transcript files, and next to each phrase, I typed the mode or concept in green brackets. Since the interviews were in Spanish, I asked an expert to translate the quotes in this written report.

| **Modes of biographical agency** | **Look for …** |
|---|---|
| Company identification | Phrases that indicate loyalty to the company and relationships with their boss, e.g., “this company helped me be who I am”, “I owe my growth to this company”, “my boss is like my mentor”, “close relationship with boss”, “my team is like my family” |
| Wage-worker habitus | Answers that reflect that work is a necessity, e.g., “the job is good money”, “I’m here because of the perks”, “I need this job to support myself and/or family”. |
| Career involvement | Comments that show interest in developing themselves with education and in their careers, e.g., “this is a stepping stone to my next job”, “I work and study”, “this job allows me to learn what I need for future positions” |
| Optimizing opportunities | Words or sentences that tell how work is an important domain in life, e.g., “this is one of the best jobs I’ve had”, “I look to work in places where I can grow/learn” |
| Personal autonomy | Words of personal interests, likes or needs, “I always liked ____”, “when I was a child, I used to (related to career)” |
| Self-employment habitus | Answers related to creating their own business, e.g., “own business”, “becoming my own boss” |

**Table 5. Tentative codes for modes of biographical agency during the interview.**

# Findings

This section is organized by research question with further elaboration of each finding.

## RQ1. Which program characteristics are related to graduates earning higher income?

### A personalized learning plan and a tutor who provides feedback and evaluation are indicators of a program that better prepares students to access higher income jobs.

To understand variation in income range, I analyzed the data using cross-tabulation with different variables. The first was the year of graduation. In table 6, I organized the responses by income range according to the graduation year. The few responses in the first three years restricts the possibility of identifying any pattern. However, 2019, 2020, and 2021 are years with enough data that show a reducing trend in the percent of students earning more than $10,000 pesos, which could be associated with the pandemic and the global labor market conditions. UNESCO (2019) stated that under economic crises, the companies with Dual Formation programs tend to make budgetary cuts in the training program and the recruitment of graduated students. This data supports the UNESCO report of 2019.

| | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** |
|---|---|---|---|---|---|---|---|
| More than 10,000 | 50% | 25% | 0% | 58% | 24% | 12% | 40% |
| Less than 10,001 | 50% | 75% | 100% | 42% | 76% | 88% | 60% |
| Number of responses | 2 | 4 | 1 | 12 | 25 | 43 | 5 |

**Table 6. Income level by graduating year.**

The second variable I cross-referenced with income level was the site. The 10 participating schools are found in four cities: Monterrey, Linares, Allende, and Ciénega de Flores. Although all the schools are in urban settings, the economic condition of each city

varies. The following table displays the notable difference between Monterrey and the three other cities in population and the gross domestic product per capita in 2020.

| City | Population 2020 | GDP per capita (in dollars) |
|---|---:|---:|
| Monterrey | 5,341,171 | $ 36,867 |
| Linares | 84,666 | $ 11,064 |
| Allende | 35,289 | $ 14,936 |
| Ciénega de Flores | 24,526 | $ 10,396 |

**Table 7. Cities by population and GDP in dollars, 2020 (INEGI).**

To examine the variation associated with the site's location, I ordered the sites by percentage of students in the higher income range and the number of responses in Table 8. In particular, it was important to identify whether the sites in Monterrey could be related to higher income ratios compared to those outside the capital city (sites C, E, and J).

| Site | City | Less than 10,001 | More than 10,000 | Number of responses |
|---|---|---:|---:|---|
| A | Monterrey | 50% | 50% | 6 |
| B | Monterrey | 50% | 50% | 2 |
| C | Allende | 50% | 50% | 2 |
| D | Monterrey | 67% | 33% | 18 |
| E | Ciénega de Flores | 75% | 25% | 4 |
| F | Monterrey | 81% | 19% | 21 |
| G | Monterrey | 81% | 19% | 16 |
| H | Monterrey | 82% | 18% | 11 |
| I | Monterrey | 90% | 10% | 10 |
| J | Linares | 100% | 0% | 2 |

**Table 8. Sites by income level.**

The schools outside Monterrey have different positions in the table ordered by decreasing percent of students earning more than 10,000. Additionally, sites C, E, and J have 2

or 4 responses each, which makes it difficult to state a valid observation. Among the sites located within Monterrey, Site A shows the highest percentage of graduates earning more than $10,000, but the number of responses in the second highest school (site D) is three times as in site A, which can influence the percent of higher incomes. Comparing site D to sites in Monterrey with similar responses (more than 10 answers), this is the school that provides students more opportunity to access higher-income jobs. From this data, I learned that the location of the program is not a characteristic related to higher income.

To continue exploring the relationship of the elements of effectiveness of the dual program and the income level, I conducted multiple chi-square tests of independence between income and the following variables: having a personalized learning plan, the number of revisions of their plan, number of semesters, and the existence of a contract. Statistically, there was no meaningful relationship between the variables (see Appendix E).

However, the cross-tabulations depict some notable patterns between having a personalized learning plan, having a tutor, the number of revisions, and income level. As shown in table 9, I found that analyzing whether students had a personalized learning plan that almost 80% of high earners did have a personalized learning plan, compared to only 65% of low earners who had a learning plan. Additionally, table 10 reveals that almost three-quarters of those in the higher income group had a tutor compared to 57% of those in the lower-income group. Table 11 indicates a significant difference between the two income levels in no revisions to the plan. Almost twice the percentage of students in the lower-income level reported they never checked their plan with their tutor. Finally, the existence of a contract was the same for both income levels, 80% of the students reported they knew about the formal agreement with the company. According to Valiente et. al. (2017), these elements in dual programs lead to successful development of skills for students to be better prepared when they enter the labor market.

| Did you have a personalized learning plan? | | |
|---|---|---|
| **Income Level** | **No** | **Yes** |
| Less than 10,001 | 34% | 65% |
| More than 10,000 | 22% | 77% |

**Table 9. Income level and personalized learning plan.**

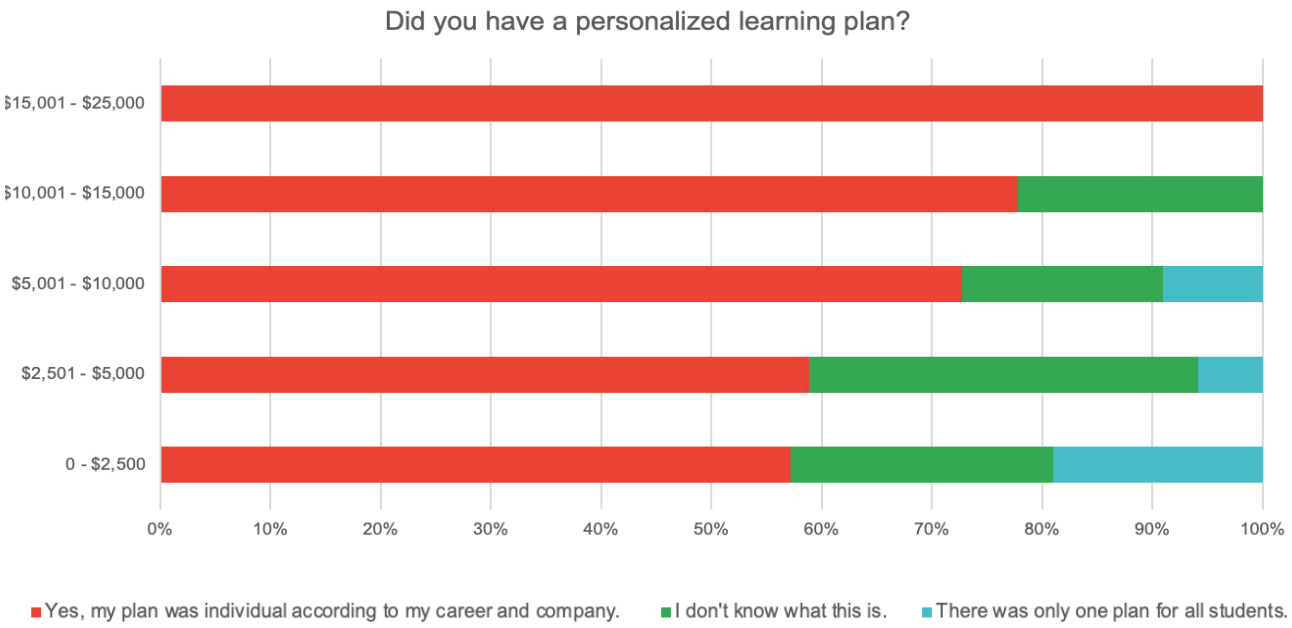
| Did you have a tutor? | | |
|---|---|---|
| **Income Level** | **No** | **Yes** |
| Less than 10,001 | 43% | 57% |
| More than 10,000 | 27% | 73% |

**Table 10. Income level and tutor.**

| How often did you check your personalized learning plan with your tutor? | | | | | |
|---|---|---|---|---|---|
| **Income Level** | **Never** | **Once per year** | **Twice per semester** | **Once per semester** | **Monthly** |
| Less than 10,001 | 41% | 1% | 6% | 9% | 43% |
| More than 10,000 | 23% | 0% | 8% | 14% | 55% |

**Table 11. Income level and number of personalized learning plan revisions.**

The following figure breaks down into smaller income ranges the survey question related to having a personalized learning plan. As income level increases, the percentage of students having a plan increases. From a descriptive perspective, this figure provides more evidence to support the finding for this research question.




The responses to two of the questions posed during each interview support the importance of having a tutor and the students' perception on the importance of feedback. One of the questions asked for examples of challenging situations or difficult procedures participants needed to learn. Although participants reported that their tutor was not always their boss, their answers indicated that an open communication existed with their tutors. The participants' responses illustrated the quality of their interactions with the tutors. For example, participant N said, "our communication was very good and daily." Moreover, I learned that workers that were not tutors showed disposition to teach and train students in the dual program. Participant J explained, "if it weren't for (person M) who taught me how to use the drill, I wouldn't have landed my very-well paid job and learning how to use a drill wasn't even part of my plan."

In relation to feedback and evaluation, I found a lot of variability in the experiences reported by the interviewees. The most salient form of feedback and evaluation was informal, and frequency varied across all the participants' answers. Three graduates mentioned that in addition to their daily or weekly meetings with their tutors, apprentices were expected to present their learning to the department once they were done with their plan in a particular learning station. Three graduates also explained that there was no formal evaluation, and the rest

commented that it varied across training stations. The Chi-test of independence between income and the quality of feedback and evaluation showed a significant relationship between income and feedback received by tutor in the company. Students who reported to receive feedback and evaluation from their tutor are more likely to earn more than 10,000, $\chi^2$ (3, N = 92) = 9.148, $p < .05$.

## RQ 2. How do graduates from the Dual Formation program see themselves in the workplace?

### Graduates see themselves as students and workers in companies with adequate working conditions and opportunities to learn and move forward in their careers.

Heinz (2002) developed the modes of biographical agency as a tool to understand the identity that students develop throughout the dual formation programs and after their graduation. As students advance in their schooling and work placement, they give meaning to their experiences with occupational selection, employment opportunities, and career options as biographical events that inform but do not determine future decision making (Heinz, 2000). In a dual program, becoming an apprentice is a biographical event in and of itself. Delving deeper into a graduate's work perspectives provides the foundation for answering research question 3.

One question from the survey sought the answer to this research question: Which of the following describes you best as a worker? The options for participants were designed to reflect each of the modes of biographical agency:

a. I am a team player, loyal to my company, and my colleagues and my boss are like a family (*Company identification*).
b. I work as a means of living (*Wage-worker habitus*).
c. I like learning new things that are useful for my work (*Career Involvement).*
d. I'm studying a new degree to advance my career (*Optimizing opportunities*).
e. I love what I do (*Personal autonomy*).

f. I like having my own business (*Self-employment habitus)*.

g. Other:

Figure 2 summarizes the responses by modes of biographical agency. There were no open-ended responses to this question, and this figure shows 92 answers. Students did not choose the responses related to personal autonomy and self-employment habitus. This does not necessarily mean they did not see themselves as liking what they did or as wanting to own their own business, but at the time of the survey they did not describe themselves in these two ways.

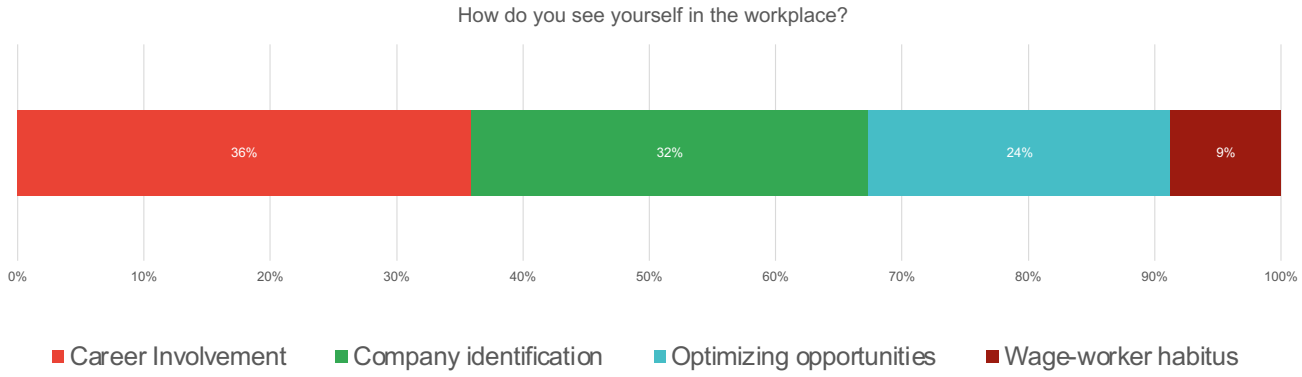



**Figure 2. Self-description by modes of biographical agency.**

The two most repeated answers were c and a: career involvement, and company identification. From a work perspective, people choosing career involvement indicates a mode of biographical agency that describes them to understand the dual program as a signal of future progress in the labor market to advance in their careers. In other words, people who selected career involvement consider their professional advancement a priority. The second most common answer relates to company identification, which suggests that participants highly value the working environment in a company, its reputation, and the benefits the organization offers its employees. Almost a quarter, 24%, of the participants selected option d, which describes the optimizing opportunities mode. People in this mode see themselves in a transitional stage, where they are both students and workers.

Graduates see themselves as people engaged with their careers and education. They will consider working for a company with attractive benefits and opportunities to continue learning in formal or informal programs. The data from the survey illustrates this further: 17% of the participants are full-time students and 26% of the survey participants work and study at college while 50% are full-time workers.

A different survey question illustrated the program graduates' perspective when applying for a job.

The options were aligned to the modes of biographical agency according to Heinz's work:

a. I like the company and the work environment is very important for me (*Company identification*).
b. It provides higher income and benefits than the rest (*Wage-worker habitus*).
c. They provide training and certification opportunities (*Career Involvement*).
d. The company is a place where I can grow as a worker, both in what I learn and how much I earn (*Optimizing opportunities*).
e. The company and its products are related to what I really like doing (*Personal autonomy*).
f. I like having my own business (*Self-employment habitus*).
g. Other:

Although the modes of biographical agency appear in a different order compared to the previous question, figure 3 illustrates that the most common perspectives are the same: career involvement, optimizing opportunities, and company identify. Knowing the program graduates' perspective for the Dual Institute is relevant in selecting companies and students to optimize results and opportunities.

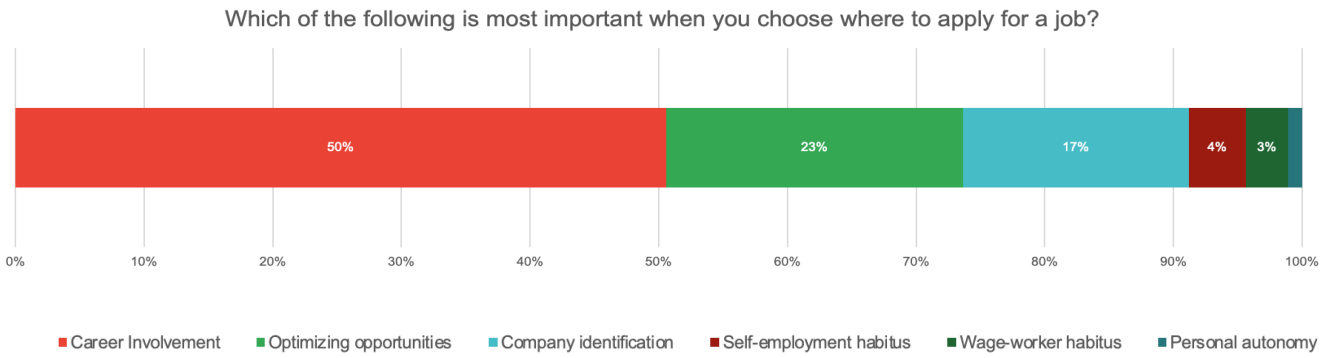



**Figure 3. Reasons for applying for a job by mode of biographical agency.**

## RQ 3. How are the graduates' work perspectives and their chosen technical careers related to income levels?

### Higher earning graduates are more oriented towards advancing their careers and education. The three careers that provide the most opportunities to access higher-income jobs are Plastics, Machines and Mechatronics.

#### Work perspectives

To compare the variation of work perspectives across the two income levels, I regrouped the answers from figure 2 and noticed two considerable differences between participants' perspectives from both income groups. First, figure 4 shows that 68% of the higher-income participants chose career involvement as a work perspective, whereas only 26% students in the lower income group perceive themselves in that way. People who are involved in advancing their career are typically intrinsically motivated, which can lead them to be more involved, learn faster, and advance their careers more rapidly. This may explain their higher-income jobs.

Second, the priorities for the lower-income participants are different. I found that company identification is the most frequent perspective (36%), which means that for these participants job security and social relations in the workplace are essential. The next most common work perspective is optimizing opportunities reflecting a transitional perspective that combines working and studying. In third place is career involvement.

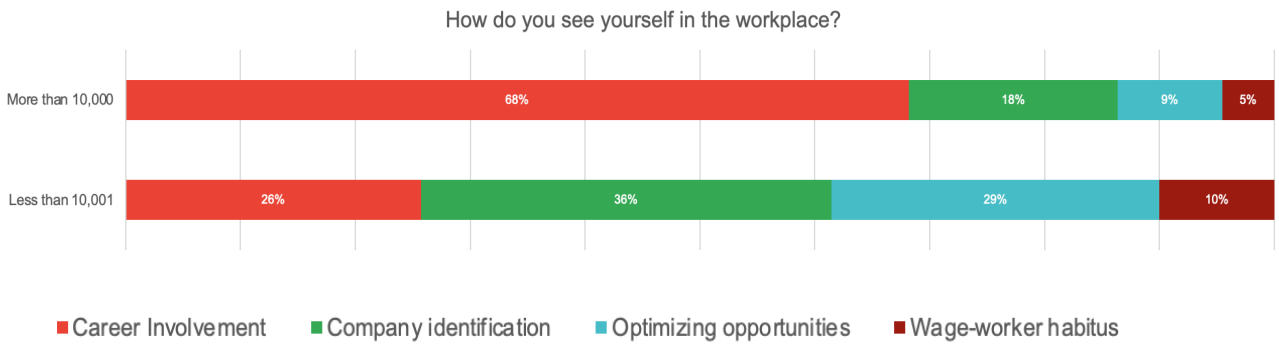



**Figure 4. Self-description by modes of biographical agency and income level.**

This data suggests that career involvement as a perspective can be a leading indicator of higher-income jobs. Surprisingly, survey participants did not choose the options related with the wage-worker or the self-employment habitus. Heinz (2002) explains that early in the adolescence and young adulthood, students from dual programs tend to focus in completing their degree (technical or college) to advance their careers.

Additionally, participants answered the reasons they considered critical in their decision-making process when applying for a new job. I classified the answers by modes of biographical agency. The difference in the two most common responses—career involvement and optimizing opportunities—between these income groups is not significant. However, figure 5 supports the previous finding that career involvement and optimizing opportunities are present in the higher-income group.

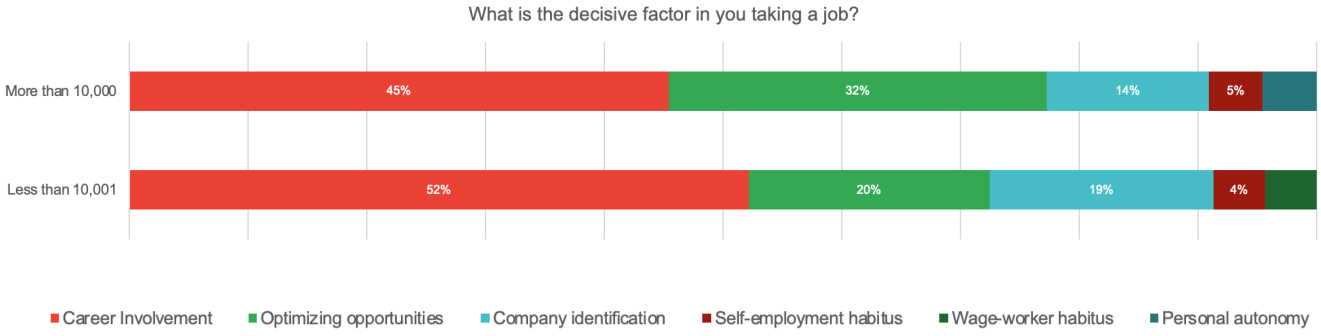



**Figure 5. Reasons for applying for a job by mode of biographical agency.**

Unexpectedly, a minor percentage of students report making their decision related to wages and benefits. In the higher-income group, no student reports wages and benefits as a

factor to take a job. I contribute this finding to the age of the participants (19–22 years old) and the personal responsibilities at this stage in life.

### Reasons for enrollment

I was interested in asking students for the reasons to enroll in the program because this information can reflect their initial mode of biographical agency. I classified the responses in the item into different modes. The results show a prominent difference between students in both income groups. Most students in both income groups selected the program to advance their careers (career involvement). However, 36% of the students in the higher-income group enrolled in the program to achieve occupational success and advancement and to shape their work history (optimizing opportunities). Compared to their fellow graduates with lower paying jobs, only 20% enrolled in the dual program for similar reasons. Figure 6 shows that 19% of the students in the lower-income group decide to enroll for material compensation and employment (wage-worker habitus). Very few students in the higher-income group decided for this reason. The data from this question in the survey signals the drivers for the high-income group to be more oriented towards their careers and education.

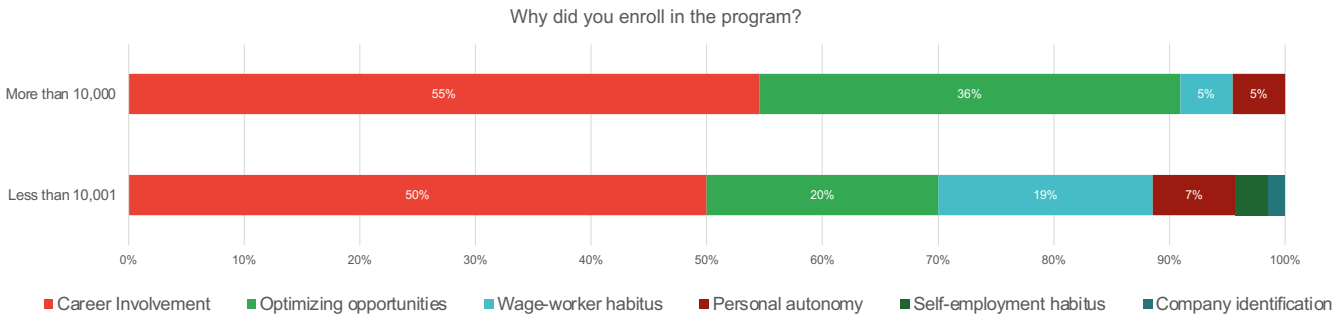



**Figure 6. Reasons for enrollment by modes of biographical agency.**

### Technical career

To analyze how the chosen technical career influenced income, I organized responses by income group and technical career (see table 12). Given that the focus of this project is on

industrial careers, I did not include the data from administrative-related or service-oriented careers. The technical career with the highest percent of higher-income students is Plastics with 60%. However, only 5 participants reported following this career. Mechatronics and Machines had 19 and 18 responses, respectively, and students in the higher income group is 28% and 32%. From the data, Mechatronics and Machines are the careers that provide better chances to access to higher-income jobs.

| Income Group | Plastics | Mechatronics | Machines | Productivity | Electromechanics | Information Technology |
|---|---|---|---|---|---|---|
| Less than 10,001 | 40% | 68% | 72% | 75% | 83% | 86% |
| More than 10,000 | 60% | 32% | 28% | 25% | 17% | 14% |
| Responses | 5 | 19 | 18 | 4 | 30 | 7 |

**Table 12. Technical careers by income groups.**

The survey included a question that asked participants about the business activity of their internship: industry, service, or commerce. I computed the ratio of students in the higher-income group who did their apprenticeship in an industry-related company to students in the same group in a service- or commerce-oriented organization. Students who did their internship in an industry-related company are 2.6 times more likely to have a higher-income job.

## RQ 4. Which elements of the Dual Formation are the most useful for graduate students in the workplace?

### Working experience and real-life skills in the workplace are the two main benefits of graduating from the dual program.

From the survey, 68% of the participants recommend the program for two reasons. First, in the program, students are able to learn skills for their career. Second, it allows students to continue studying college and working. Some students also mention that the program enables students to find a well-paid job because it adds work experience to their resume.

The interviewees uncovered the benefits in a more detailed way. As a result, three skills were the common thread in the experiences reported by the participants. “The dual program is an opportunity to solve real-life problems,” said participant N. Many examples were given: learning complex procedures and finding a simpler way to learn the 50-step process, manipulating expensive machines not available in school, and even learning how to apply for a job.

Interviewees mentioned that one of the most valuable opportunities during their apprenticeship was learning how to communicate professionally with others in the workplace. Participant A said, “talking to external suppliers in the company was hard at the beginning, but it has been super helpful in my current job.” Many responses supported that learning how to interact with people in different roles and positions in the organization was something students can’t learn in classroom environment. Burt (2001) claimed that real and meaningful labor relations are part of socialization and personality development for young apprentices.

At least three interviewees mentioned the selection process for the dual program as something relevant in their learning. This is significant as a real-life skill because they commented on how that piece of the program prepared them in searching for a job and properly interviewing for a position. Participant I commented on that regard that “the selection process for the dual program is a learning experience.”

Additionally, some participants mentioned that the Dual Program was an experience that had broadened their perspective on life. Participant J explained that his boss in the program was German and his interaction with him not only helped him learn how to communicate with foreigners, but also it helped him widen his perspective on life and the world. In a different interview, the participant's knowledge of how to use the milling machine helped him qualify to an international competition taking place in Japan in the fall of 2022. He will participate to represent the company he currently works for and he is learning Japanese. Also, Participant V described herself opening her mind as she entered a predominantly male-oriented career. She commented, "my family insisted I not study Plastics, but I really liked it, especially because I thought it was only for men, but then I saw some female workers, and I said to myself, if men can do this, I can."

I had not planned on asking interviewees how they learned about the dual program. Interestingly, they repeatedly answered that they had been invited by their school. Before that invitation, they did not know the program existed. The closing question in the interview asked students if they would recommend the program, and all of them answered most definitely and explained their reasons supporting their recommendation. However, I did notice a pattern in which participants suggested that more promotion is needed, because the program would benefit many students if they knew about it.

# Recommendations

## Recommendation 1. Standardize the feedback and evaluation process as an integral part of students' personal training development.

Following the footsteps of European countries with a long tradition in dual education, standardizing feedback, evaluation and accreditation is a process that the Dual Institute in collaboration with external departments can collaborate. The Department of Education, the Chamber of Commerce and the Department of Labor can participate in establishing the

minimum requirements of feedback and evaluation during the apprenticeship in any company. Given that there is ample variability across the students' experience in relation to feedback and evaluation, I also recommend integrating the companies with frequent participation in the dual program in this revision process. Vormfelde (2017) argues that inexistent policies that strengthen the dual program puts at risk the sustainability of the program.

### Recommendation 2. Keep fostering apprentice participation and the positive relationship between tutors and students.

Burt (2001) confirms that high quality dual programs offer participants opportunities to learn the dynamics of the workplace and to establish social and professional ties. A vast majority of the participants in this project developed positive relationships with their tutors. In some cases, those professional and personal connections are maintained even if the students no longer work in their apprenticeship organization. This project brought evidence forth that positive tie are formed between students and the people in the companies. An open communication between the companies and the Dual Institute's liaisons is critical to meet the conditions to attract employers and students to the program.

### Recommendation 3. Understand the current student work perspective to better orient them into a personal plan for their career advancement.

As shown in the findings, students who are more oriented to make decisions based on advancing their careers are more likely to have higher-earning jobs. Knowing the students' work perspective since the beginning of their involvement in the program would help the Dual Institute design actions to guide students toward a more career-driven mindset. The Dual Institute can use this information in two ways. First, the Dual Institute can choose students who already have the career involvement mindset to participate in the Dual Program. Alternatively, they can plan for different initiatives that can motivate students who aren't in that mode of biographical agency to focus their attention on their career advancement. Some questions from this project's survey and interview can contribute to identifying the student's mode of biographical agency.

## Recommendation 4. Increase social media presence and introduce the dual program to all students in their first semester.

The surveys and interviews indicate that graduates highly recommend the program, but some suggest better promotion and induction could be beneficial to attracting and welcoming newcomers, respectively. There is no literature on promoting dual programs to attract students from different social backgrounds to the program. However, many participants showed a willingness to talk to future students about their experience. Participant V mentioned, “short video clips of graduate dual students talking about our experiences and what we learned could attract so many young people connected online and I know the benefits many students will have by participating.” Additionally, the promotion should address how the dual program meets the high standards of quality in training for the competitive labor market and the academic requirements to continue in higher education.

By introducing the program to all students in the traditional high school program across locations in the Dual Institute, the opportunities that students are more involved in their careers since the beginning of high school increase. As this study showed, having a career involvement mindset increases the likelihood of accessing higher income jobs. This initiative can also motivate more students to participate in the program and meet the criteria, grades, behavior, attendance, and more.

## Recommendation 5. Design a study to understand the company perspective to increase local business participation in the dual program.

To increase the number of partnerships with companies that are leading the industry, I recommend designing a study that helps the Dual Institute the variables that the literature suggests attracting employers to participate in the program. Acemoglu, Pischke, Valiente et. al. (1998, 2017) list the following as essential elements to sustain effective dual programs:

- Cost of training an apprentice versus the cost of selected well-trained candidates in the labor market

- Involvement of selecting and recruiting learners
- Size of the firm
- Relevance of curriculum in high school as a strategy to reduce in-company training course
- Needs of employers met by the program
- Student profile

Understanding the perspective of the employers can contribute to triangulate the needs of the company and the characteristics of the students and the program to increase effectiveness and invite more companies to participate. As a result of increase business participation, more students can have opportunities to learn cutting-edge technical skills and improve chances of accessing higher-income jobs.

## Limitations

I designed this study in April 2021, conducted the interviews in December 2021 and January 2022 and I closed the survey in January 2022. The participants in the study graduated in different years starting in 2018, some of them finished the program during the pandemic lockdown in 2020 and others could not complete their rotational plan due to the adjustments in the companies during the pandemic. Although no student reported major changes in the dual program due to the pandemic, this study does not compare the dual program before and during the pandemic.

During the initial design, I collaborated with a federal employee of the Dual Institute. By October 2021, that person was no longer working in the Dual Institute. Additionally, a new state government entered office in October, so the established contacts with the state Dual Institute changed too. The current government put in place new data protection guidelines, so the survey link was sent by the Dual Institute. An identification number was assigned for each respondent,

but there was no email address that validated the person answering the questions. In relation to the interviews, the Dual Institute contacted the alumni.

## Conclusions

I designed this project to understand the Dual Program's characteristics from the students' viewpoint. Additionally, I investigated the students' way of seeing themselves in the workplace. However, a critical component in the program's collaborative framework is the private sector, in other words, the participating companies. It is essential to explore their experience with students, the program's limitations, and the public policies that restrict obtaining a real benefit from participating in the program.

Through the interviews and the surveys, we can confidently declare that students highly recommend the Dual Program to improve their learning, their life perspective, and their work experience. On that note, the Dual Institute offers a high-quality program to improve students' lives and the productivity of their community.

Although this project's scope was based on Nuevo Leon, other states can benefit from this study's findings toward improving their programs. Additionally, the survey and interview protocol serve as a base to research dual program graduates' work perspectives and experience in dual programs.

The Dual Program is an opportunity for communities across the globe to educate their youthful population, improve this population's prospects of a higher quality of life while also increasing the community's productivity. This program is a testament to creative and meaningful learning, and it reminds us—as educators, policy-makers and entrepreneurs—that education needs to be authentic, experiential, and meaningful to learners.

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# Appendices

## Email invitation

Dear _____,

Invitation to Participate in Research Study

(Date)

*Study Title:* Understanding the MMDF (Mexican Model of Dual Formation) experience from the student's perspective to access better employment

Principal Investigator: Federico Brull, Doctoral Candidate, Vanderbilt University

Dear Potential Study Participant,

I am inviting you to participate in a qualitative study examining the factors that contribute to higher earnings after graduating from the Mexican Model of Dual Formation. To participate in this study, you must be a graduate from the MMDF in any of the following careers: Industrial Maintenance, Mechatronics, Electromechanics, or Robotics.

Your participation in this study is voluntary. Furthermore, your participation is confidential.

*Study's Purpose:* The purpose of this study is to identify factors in the MMDF program that contribute to access to higher-income jobs in the automotive, computer components, and electronics industries after graduating.

*Research Questions:* The following research questions will guide the study:

1. What are the characteristics of effective training/apprenticeship programs for successful students with higher earnings?
2. Which mode of biographical agency favors higher earnings in the automotive, electronics, and manufacturing sectors?
3. What elements in the MMDF are the most useful for students in the workplace in the automotive, electronics, and manufacturing sectors?

*Procedures:* People who meet the criteria will be selected based on their career path. An invitational post will be created by the researcher on teacher Facebook group platforms and through email listserves. A secure link will be sent to those that confirm they meet the criteria

and are interested in participating.  Afterwards, some of the participants will be chosen for a 40-minute interview.

*Confidentiality:* Confidentiality of all participants will be protected in compliance. Names of the participants will not be identified through the study.

*Compensation:* No monetary or non-monetary compensation will be provided for your time or responses.  Your contribution to this study will help improve the design of the MMDF and it also informs the current research on the study of vocational and educational training in Mexico.

*Questions:* If you have any questions or concerns regarding this study and your participation, please do not hesitate to contact me, the researcher, via email at federico.e.brull.gonzalez@vanderbilt.edu, or via phone at (52) 8118-014491.

Thank you for your valuable time and willingness to participate in this research study.

The survey will take approximately 15 minutes to complete. Click on the link below to start the consent and survey.

## Survey

**Complete Name:** **Personal Email address:** **Mobile phone:**

**GENERAL INFORMATION**

h. When did you graduate from the MMDF?

i. What school did you go to?

j. What city and state do you currently live in?

k. What technical career did you choose?

   a. Industrial Maintenance

   b. Mechatronics

   c. Electromechanics

   d. Robotics

   e. Other:

l. In what company did you do your apprenticeship?

m. What do you do now?

   a. Going to college

   b. Working in a company

   c. Work and study

   d. Neither

***If answer is a, then***

6A If you're going to college, are you enrolled in a career path related to your apprenticeship?

   a. Yes

   b. No

**WORKING INFORMATION (Work history)**

n. If you are currently working, how long did it take you to find a job after graduating?

   a. I'm not currently working

   b. I graduated with a job

   c. Less than 1 month

   d. 1 – 3 months

   e. 4 – 6 months

   f. 6 months to a year

g. More than a year

o. Do you currently work in the field of your apprenticeship?
    a. Yes
    b. No
p. What is your monthly income?
    a. 0-2,500
    b. 2,501-5,000
    c. 5,001-10,000
    d. 10,001-15,000
    e. 15,001 – 25,000
q. How many formal jobs have you had since you graduated?
    a. None
    b. 1
    c. 2
    d. 3
    e. More than 4
r. Are you currently working in the company where you did your apprenticeship?
    a. Yes
    b. No
s. Did you receive an offer in the company of your apprenticeship?
    a. Yes
    b. No
t. If you're not in the company of your apprenticeship, would you return to work there?
    a. Yes
    b. No
    c. Maybe

**MODES OF BIOGRAPHICAL AGENCY**

u. Why did you choose to enroll in the MMDF program?

a. Company identification: The apprenticeship companies are popular for their working environment.
b. Wage-worker habitus: It is an opportunity to find a job quicker and better paid than the traditional high school programs.
c. Career Involvement: Studying and working is a combination I like.
d. Optimizing opportunities: To work and study so I could have my high school diploma, have work experience and be able to continue studying a degree.
e. Personal autonomy: I always wanted to study my chosen career.
f. Self-employment habitus: I wanted to learn skills to manage my family business or start my own.

v. Which of the following is most important when you choose where to apply for a job?
    a. Company identification: I like the company and the work environment is very important for me.
    b. Wage-worker habitus: It provides higher income and benefits than the rest.
    c. Career Involvement: They provide training and certification opportunities.
    d. Optimizing opportunities: The company is a place where I can grow as a worker, both in responsibility and income.
    e. Personal autonomy: The company and its products are related to what I really like doing.
    f. Self-employment habitus: I like having my own business.

w. Which describes you the best as a worker?
    a. Company identification: I am a team player, loyal to my company, and my colleagues and my boss are like a family.
    b. Wage-worker habitus: I work as a means of living.
    c. Career Involvement: I like learning new things that are useful for my work.
    d. Optimizing opportunities: I'm studying a new degree to advance my career.
    e. Personal autonomy: I love what I do.
    f. Self-employment habitus: I like having my own business.

**ACADEMIC**

**MMDF** -APPRENTICESHIP EXPERIENCE

x. Did you have a personalized learning plan?
    a. Yes, my learning plan was different to all others according to the company of our apprenticeship and our career path.
    b. No, everyone in my school studying the career had the same plan regardless if we were doing our apprenticeship in different places.
    c. I don't know what that is.

***If answer is Yes to question 17.***

17A. Who checked your personalized learning plan in school?

a. Tutor

b. Principal

c. No one

17.B How often was your personalized learning plan checked?

a. Every month
b. Twice every semester
c. Once every semester
d. Once every year
e. Never

17C. How did having a personalized learning plan help you perform better in school?

17D. How did having a personalized learning plan help you perform better in your apprenticeship?

***If answer is No to question 17.***

17E. Do you feel you needed a personalized learning plan?

a. Yes

b. No,

In both cases, Why?

17F. To your knowledge, is there a reason you didn't have personalized learning plan?

a. Nobody in my school had one.
b. I wasn't assigned a tutor.
c. My tutor was never available.
d. Other:

y. How many semesters did you go to the company for your apprenticeship?
   a. None
   b. 1
   c. 2
   d. 3
   e. 4
z. In how many companies did you do your apprenticeship?
   a. 1
   b. 2
   c. 3
   d. 4 or more

***If answer is different than a, go to question 19A.***

19A. What is the reason you changed company?

a. The company closed the apprenticeship program for everybody.
b. Most classmates complete their apprenticeship program in more than 1 company.
c. Personal problems with my mentor in the company.

d. I don't know, I just got noticed of the change.

e. Other:

aa. Did you have a formal contract between you and the company (companies) you did with the apprenticeship?

a. Yes

b. No

bb. In your training stations or rotations, which would describe the best.

| | Totally Agree | Somewhat Agree | Somewhat disagree | Totally disagree |
|---|---|---|---|---|
| a. I felt safe and was provided with safety equipment in my stations or training areas. | | | | |
| b. I was assigned to stations or training areas to learn the tasks. | | | | |
| c. After I was taught or explained the task, I participated doing the task gradually until I could do it on my own. | | | | |
| d. I had a mentor at the company that knew what I had to learn. | | | | |
| e. I received feedback and evaluation from my mentor at the company. | | | | |
| f. The feedback from my mentor was useful so I could do my task at the station. | | | | |

**MMDF**

cc. On a scale of 1 to 5, 5 being extremely recommendable, would you recommend the Dual Program to others?

dd. Why would you recommend the MMDF?

a. After you graduate, it is very likely you get a well-paid job.
b. After you graduate, you can continue to study in a university.
c. The school subjects are very useful in the workplace.
d. The apprenticeship program teaches you how to do something practical.
e. Other:

ee. Why would you NOT recommend the MMDF?

a. After graduating, getting a well-paid job is hard.
b. After graduating, it is hard to get into university.
c. School subjects
d. The apprenticeship program lacks structure and organization and its hard to learn something practical.
e. Other:

ff. What did you learn in the MMDF that is most useful in your workplace? (open-ended)

gg. Would you be willing to schedule a meeting with the researcher to talk more about your experience as an apprenticeship?

a. Yes
b. No

***If answer is yes,***

26A. What time is the best for an interview?

a. Morning (7 – 11 am)
b. Afternoon (12 – 5 pm)
c. Evening ( 6 pm – 9 pm)

26B. Which day ?

a. Monday
b. Tuesday
c. Wednesday

d. Thursday
e. Friday
f. Weekend

26C. Could you do the interview online?

a. Yes
b. No

**Thank you for your participation! I'll get in touch soon!**

***If answer is No,***

**Thank you for your participation!**

## Interview

**MMDF (benefits of the Dual program)**

1. What was the main reason you decided to study the MMDF?
2. How is the MMDF different from a traditional program?
3. What are your most meaningful experiences in the MMDF?
4. What are the most important advantages of graduating from the MMDF?

**EFFECTIVENESS OF APPRENTICESHIP PROGRAM**

5. How would you describe your apprenticeship?
6. How was your relationship with your mentor? (how often did you meet and what were those meetings about? (mentoring)
7. If there was a conflict in the workplace or, who did you go to find a solution? Can you think of an example. (mentoring)
8. Describe your rotational plan and how your instructor went about it. (mentoring, rotational plan of learning stations)
9. Describe a situation in which something was difficult to learn and how did your instructor interact with you (rotational plan of learning stations).
10. Did you feel your rotational plan was fulfilled? (Rotational plan of learning stations)
11. How did instructors and schoolteachers evaluate your progress? (Evaluation)
12. Who did you interact with in the company during your apprenticeship?
13. How and where did you interact with other employers in the company? (Training space, participation)

**MODES OF BIOGRAPHICAL AGENCY**

14. How did you choose your technical career path? (personal and occupational preferences, modes of biographical agency)
15. Do you currently work in that field? Why? (modes of biographical agency)
16. How many jobs have you had so far in your career?
17. Explain the motivation when you change jobs. Note: ask about the last two career changes.

18. Think of the perfect job. What does it look like? (modes of biographical agency)
19. Have you had a job offer where they allow schedule flexibility for you to continue your education? On a scale for 1 to 5, 5 being extremely important, how important it is for you? (career involvement)
20. For students who are working in their apprenticeship company. How long do you plan to work here? Why? What would make you change jobs? (company identification)
21. Would you ever consider working independently? Opening your workshop, for example? Why or why not? (self-employment habitus)
22. From your experience, what do you think is important to be successful in the workplace? (modes of biographical agency)
23. Would you recommend the Dual Program? Why or why not?