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# **AI-based services to help Italian high school students in their post-high school transition**

Research Proposal

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## **1. Purpose and importance**

For several years now, the Italian educational system has been in conditions that do not live up to the expectations of such an influential state on a global and European level, being a member of G7 and G20, with a great cultural history behind it. In fact, Italy is one of the European states with the worst performance indicators for tertiary schools, with a dropout rate that is more than 50%, which is far above from the average of the Organization for Economic Co-operation and Development (OECD), which amounts at 31% (Aina, et al., 2018). Moreover, analysing in detail conditions and opportunities for young students, Italy has the worst percentage of degrees young people from 25 to 35, with only 28.86%, when the average of the countries belonging to the OECD is 45% (OECD, 2021), and also the percentage of not in education, employment and training (NEET) students from 15 to 29 years old is the second worst in Europe, and amounts to 27.1% (OECD, 2021). This serious situation in the Italian educational system is the result of some decisions taken in the past, and the reforms to increase the supply of universities implemented in the early 1990s are the main cause, which aim was to increase the territorial capillarity of universities. In this way, the government wanted to give equal opportunity to the lower and middle classes of society to enrol in universities, decreasing the direct and indirect cost of mobility for students (Bratti, et al., 2008). These reforms have led to an increase in enrolment, but also to an increase in dropout after the first year and to the lengthening of the time it takes to graduate (Carrieri, et al., 2015), also because students are allowed to repeat the exams how many time they want without limitation and they can enrol in university for an unlimited number of year. All this characteristic foments the "parking lot" hypothesis (Bratti, et al., 2008), in which young people enrol in university more for the status of student than for the desire to achieve a better job, thus decreasing the efficiency of the Italian educational system. The aim of the study is to understand if it is possible to develop AI based services to give more awareness to the Italian student about their possible future path. In addition, this research seeks to identify the data base structure necessary to receive as input the student data. This data is needed to develop a student profile in order to be able to tailor services to their interests. Thus, the purpose of the research is to create a win-win-win situation where all stakeholders involved can benefit. The greatest benefit is definitely for the students, who would gain a greater awareness of their capabilities and their possible contribution within society. The school system would also benefit, as by optimizing post-high school choice, universities would have

more motivated students who are more interested in their subjects of study, improving the quality of services and lessons. Finally, the government would be able to reverse the trends of economic and social decline of recent decades. These benefits can be noticed through to a decrease in the percentage of NEETs and dropout in universities.

## **2. Framework**

In order to understand in detail how high school seniors decision-making process of university or career path takes place, it is necessary to make a brief introduction to the Italian school system, the orientation projects and a literature review.

### **2.1 Italian school system**

Education in Italy is regulated by the Ministry of Education, University and Research (MIUR), it starts from a non-compulsory integrated system from zero to six years old. According to what is reported on the website of the MIUR (MIUR, s.d.), it is composed of educational services for infants and is managed by local authorities, other public bodies or private individuals, which take in children between the ages of three and thirty-six months, and of preschools, which may be managed by the State, local authorities, other public bodies or private individuals, which take in children between the ages of three and six years. Once the student has completed preschool, compulsory schooling begins, which is 10 years in length. It is characterized by a first cycle of education, which is the same for all students and is divided into elementary school, for a duration of 5 years, and first-degree secondary school, for a duration of 3 years. At the end of the eighth year of compulsory school, the student, before beginning the second cycle of education, must face the first major choice within their tracking school. In fact, at this stage the student can choose between two alternatives: second-degree secondary school or vocational education and training paths. The second-degree secondary school is divided into three typologies of high schools, all with a duration of 5 years: technical institutes (*"Istituti Tecnici"*), characterized by a solid cultural base of scientific and technological character in line with the indications of the European Union, with the aim of making students acquire knowledge and skills necessary for a rapid entry into the world of work and for access to university (Italy, s.d.), in relation to the exercise of technical professions with an organic connection between the school and the companies of the surrounding area through internships, apprenticeships and the *"alternanza scuola-lavoro"* project ( "alternation school-work") (Galli, 2012), now called *"Percorsi per*

*le competenze trasversali e per l'orientamento*” (PCTO, which means education and training in soft life skills and students’ orientation) (Ministry of Education, 2021); professional institutes (“*Istituti Professionali*”), characterized by a solid base of general and technical-professional education, which allows students to develop knowledge and skills necessary to meet the training needs of the productive sector of reference, for a rapid entry into the world of work and for access to university (Italy, s.d.), through laboratory activities, internships, apprenticeships and the PCTO project (Ministry of Education, 2021); gymnasium (“*Licei*”), characterized by a less technical basis than the two previous typologies and more theoretical, with the aim of providing students with cultural and methodological tools for a thorough understanding of reality, and to learn knowledge, skills and competencies consistent with personal skills and appropriate to the continuation of higher education (Italy, s.d.). The vocational education and training paths are managed by the regions, and have a duration of three or four years, whose purpose is to provide the skills and technical knowledge such as to be able to easily insert students in the job world, thanks to the relationship between the region and the local industrial realities. In addition, students who undertake the latter tracking school can also enter in the universities, integrating the knowledge gap at private or state institutions that provide specialized programs for this type of student. At the end of the second cycle of education, the student must decide his or her future based on the skills and knowledge developed during the years of education and based on the information available to him or her, provided by the student orientation projects (which will be discussed in chapter 1.2.3). At this decision-making stage, the student can continue his or her studies by enrolling in a Bachelor's degree program at a university, in "*Alta Formazione Artistica, Musica e Coreutica*" (AFAM, if the student is inclined towards music), or in a course offered by "*Istituti Tecnici Superiori*" (ITS, to professionalize a student in a specific job) (MIUR, s.d.).

## **2.2 PCTO project**

The introduction of work within the education of students is a debate that in recent years is involving many European states, also thanks to the European Alliance for Apprenticeships (EAA), which want to improve the on the job learning for the European students through the alternance school-work (Gentili, 2016). Indeed, Work-Based Learning (WBL) and Work-Related Learning experiences allow students to apply the theory learned in school and develop new hard skills and soft skills, useful for students' careers (Sicurello, 2016). Italy joined EAA in July 2015, with the so-called "Buona Scuola" law (law 107/2015), thanks to

which compulsory alternation school-work was introduced in all second-degree secondary schools. With this law, students at technical and professional institutes are obliged to complete 400 hours of internship over the last three years, and in gymnasium there is an obligation of 200 hours, again spread over the last three years (Gentili, 2016). With the 2019 budget law, the school-to-work alternation project changed its name to "*Percorsi per le competenze trasversali e per l'orientamento*", also known as PCTO, changing the amount of hours dedicated to this project for each institution: 90 hours in the final three years for gymnasium, 150 hours for technical institutes and 210 hours for professional institutes (Ministry of Education, 2021). PCTO has led to many changes, especially from the organizational point of view, as the school has the duty to establish a direct relationship with the various companies in the area. Furthermore, there is the need to appoint a person responsible for the project within the school and another person responsible on the company side, who acts as a tutor for the student, with the task of integrating, teaching and making the final report on what was learned during the internship, filling a survey provided by the school tutor.

### **2.3 University Orientation**

University orientation is a critical service for high school students to provide the information they need for the decision-making process on which path to take once they finish high school. As is reported in the report (MIUR, 2021), orientation is a set of activities that enables teens to identify their interests, skills, and competencies so that they can make more informed educational and vocational decisions. In Italy, orientation is entrusted directly to the schools, which have the task of orienting their students, creating an internal organizational structure that deals with establishing and maintaining relations with universities and local businesses, with the aim of providing information on the local economic situation. The orientation activities reported within the document (MIUR, 2021) are: the formative orientation or didactic orientation and the activity of accompaniment and orientation consulting. The first activity consists of disciplinary learning, aimed at the acquisition of basic knowledge, cognitive, logical, and methodological skills. The second activity is carried out by high school teachers, who have the task of assessing the students, informing them about the possible professional outlets and training paths, also based on what the labour market requires. Therefore, for the accompanying activities, the presence of an orientation tutor within the school staff is necessary, capable of coordinating the orientation activities and

interfacing continuously with external parties to be involved in these activities. In addition, this figure will need to participate in orientation training and keep update, to be able to offer adequate support to students. Moreover, high school students senior, who are interested in pursuing their studies in tertiary school, can search general information about the university faculties on the website (MIUR, 2021). Also, MIUR offers a web portal (MIUR, 2021) to provide university's general information to students and their parents, in order to satisfy their requests and to have more consciousness about which kind of university path could take. Furthermore, the students can find some psycho-aptitude and cultural tests online (UniCusano, 2021) (Studenti.it, 2021) (Università.it, 2021), which scope is to provide them some suggestions about their possible academic path, based on the result of the test.

### **2.3 Literature review**

As a result of the exponential technological growth of the last two decades, the educational systems of different countries have also had to renew themselves. To face the digital change, the Council of European Union decided to implement a new strategic framework for European cooperation in education and training for the period 2021-2030 (Achievement, 2021). The aim of this new strategy framework is to help young people to become active, responsible, and open-minded members of the society, through some priorities that refines the European Education Area (Achievement, 2021). This case study research meets some of the objectives set by the Council of European Union including improving quality, equity, inclusion, and success for all in education and training; enhancing competences and motivation in the education profession; supporting the digital transitions in and through education and training (Achievement, 2021). In particular, the administrative digitalization of the Italian school is more difficult process, mainly due to technological backwardness. This is highlighted by the fact that the saturation level of paper archives in Italian schools is already at 80%, the 68% of the Italian schools don't have an IT system for document management and at least the 80% of Italian schools don't have an electronic storage in accordance with the law (MIUR, 2015). The process of digital change involves not only Italian schools, but also all stakeholders. For this reason, in the innovation strategy of the Italian school system there is the will to create a Stakeholder Club for the Digital School, a permanent partnership that makes Italian school capable of supporting change and innovation (MIUR, 2015). Moreover, the students need more information about university, labour market, and skills to improve quality, equity, inclusion, and success for the post-high

school decision (Frauke & Vaishali, 2017) (Nicolas, 2017). Regarding the implementation of AI in education, the literature review showed its use mainly for personalization of lessons for each student (Acemoglu, 2021). This implementation of AI could improve teacher productivity, adapting their material to the needs and attitudes of diverse student, also through the Interest-Driving Creator (IDC) theory of learning design. This theory will develop students' twenty-first century competencies and bring a focus to the learning process rather than the learning outcomes (Pierre, et al., 2019). One issue to realize the implementation of AI in the educational system is definitely that of student assessment. The Digitally Based Assessments (DBAs) could be a solution, since it has resulted in improvements in the International Large-Scale Assessments (ILSA) scope, efficiency, and data quality.

### **3. Research design**

The main research question of the master thesis is “How can AI-based services help Italian high school seniors in their post high-school transition?”. To answer the main research question, three research questions are found, dividing the macro topic into three subtopics:

The first research question is “How is the current situation of the Italian educational system?”. It is analysed by other four sub question, using a PEST analysis to give a background of the current situation. The first sub question is “What policy choices have impacted the Italian educational system?”, to analyse the politic side. The second sub question is “What are the economic consequences of Italian educational system?”, to analyse the economic side. The third sub question is “What impacts does the education system have on society?”, to analyse the social side. The fourth sub question is “What is the technology applied in the Italian educational system?”, to analyse the technology side. To answer these four sub-questions useful information from scientific articles, scientific journals and official statistics of the Italian state are used to carry out the pest analysis.

The second research question is “How is student data stored in the current Italian educational system?”. It is analysed through other three sub questions: “What student data is kept in the current Italian educational system?”, “Where student data is stored in the current Italian educational system?”, “What student data is needed for the predictive algorithm?”. To answer this second research question, secondary research is done on the state of the art of student data storage and interviews are conducted with Italian student's data manager, high



school administrators, and ministers of Italian Education system or ministers of Italian Innovation.

The third research question is “How can implementation AI-based services improve the decision-making process of the post-high school transition?”. It is analysed through other three sub question: “What are the main issues in the post-high school transition for the Italian students?”, “What are the main issues in the PCTO project, both students’ and professors’ side?”. To answer the third research question, interviews are conducted with Italian high school professors, high school students, university students, and AI technology experts.

### **3.1 Sampling**

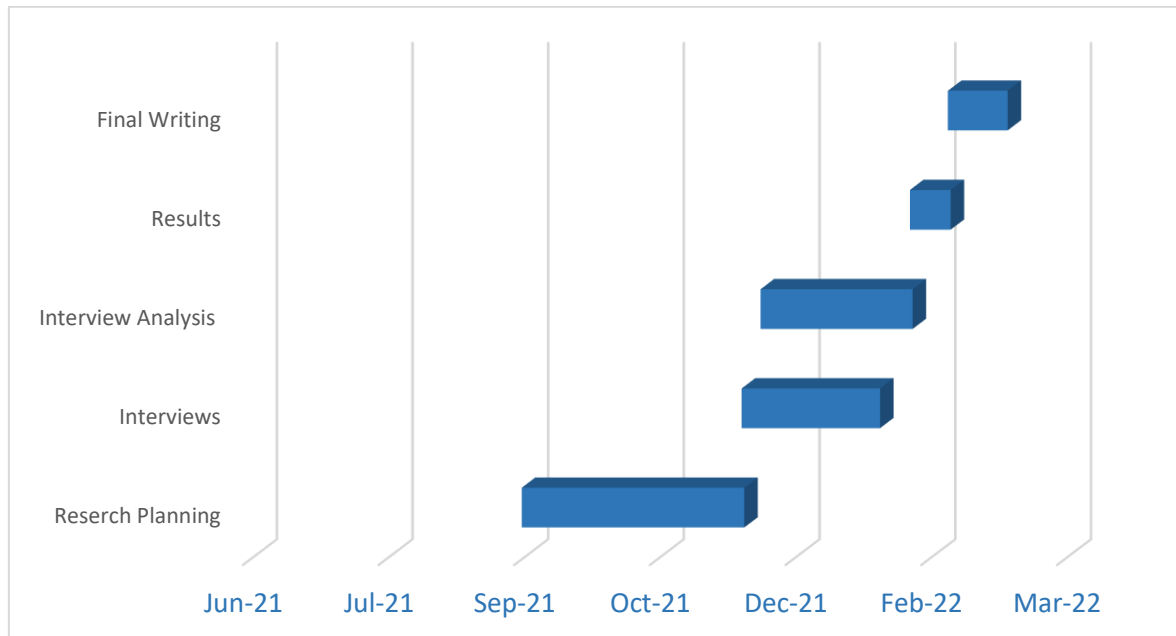
The sampling technique that is used in this research is the convenience sampling, which is studied during Innovation Management and Product Development course at Polytechnic of Turin during the Innovation Management Engineering master. This sampling technique consists of selecting an easy-to-reach sample through the existing network. Moreover, the snowball sampling is used to expand the number of people, asking to the respondents to involve other respondents.

### **3.2 Data recording and analysis**

The data will be collected through primary and secondary research. The data from the secondary research is monitored by an excel spreadsheet, dividing the sources of information for each different topic and keeping track of the results and useful information for the research work. This helps to relate the various theories and data found on different sources, making the final drafting easier. For the primary research side, the interviews are conducted through video-conferencing software such as Zoom, Microsoft Teams, Google Meet or Skype. Moreover, interviews could be recorded if the respondent permits, but in any case, notes are taken of responses, and they are analyzed with the InVivo Coding. This type of coding is based on two steps: the first consists of encoding the text of the interview into words that summarize the meaning of the answer. The second step consists in identifying themes into which the codes identified in the previous step can be grouped. The results of this analysis lead to inferences that are intended to answer the sub questions formulated above. For example, you can get a sense of what could be improved in the PCTO project

from student and faculty interviews or understand the students' needs that are not solved in the current post-high school transition.

#### 4. Research timeline



Above is the Gantt chart of the thesis research which consists of 5 phases. The first phase is the Research Planning, which involves not only designing the master thesis, but also developing sufficient knowledge of the topic through scientific articles, seminar, webinar and lectures at Tallinn University of Technology. This phase is quite long it takes more than two and a half months, from September 10<sup>th</sup> until the end of November, considering that there is very little knowledge in e-governance. After that there are the other two activities, which are essential for the success of the thesis: the interviews and the interview analysis. Before conducting the interviews, it is necessary to think about the questions to be asked and begin contacting students, AI experts, high school teachers, and school administrators. A week was allotted for this phase of initializing the interviews, also considering the response time of the stakeholders. Once the interviews have begun, the interview analysis phase can be continued in parallel, beginning the analysis work immediately after the stakeholder interview. These two activities last about a month and a half, to be able to collect as much data as possible and analyze it through the InVivo Coding methodology. The analysis obviously ends after the end of the interviews and continues until the end of January, twelve days more than the end of the interviews. Next, there is the discussion phase of the results obtained from the analysis phase, which will last

for weeks. In this phase you compare what you got from the research phase with the initial goals you set and use the results to answer the research questions. Finally, there is the last phase of the master thesis, which involves the final writing of the thesis. This phase consists of making the elaborate coherent and consistent in its entirety, while respecting the format of the institute.

## **5. Ethical issues and commitments**

Given the serious conditions of the Italian educational system, it needs new solutions to be able to have more human capital, capable of relaunching the country's future growth. Italy has a very high dropout rate and a very low percentage of graduates (the worst in Europe), and most of dropouts occur during the first year of the university (Grilli, et al., 2016). In fact, students often do not have the necessary information to decide which path is best for their future and this usually leads to making a suboptimal decision and thus to a change of university or termination of studies (Kerr, et al., 2014). Also, the parents of the student have strong influences in this senior high school students' decision making process, both because they want the best for the future of their children and because they will be paying for the university, so they would like to spend their money in an efficient way (Castleman & Page, 2017). Artificial intelligence-based services can help providing useful information that can optimize the student's choice of path to take. First, this typology of services can be critical for the student's assessment, a very difficult problem to solve and that cannot be solved only by high school senior performance data, as is common (Foote, et al., 2015). For this reason, it is very interesting to understand if it is possible to develop a personal profile of the student using artificial intelligence. Important issues are for sure the data privacy and data protection because the students' involved in this project are underage or recently of age. In Italy, the age for expressing consent to the processing of data for services offered online is fourteen, following a derogation from the law at the European level that imposes an age of sixteen (Republic, 2018). So, this could be an advantage point in favour of the case study, being able to use in input the data of students from the age of fourteen years, following their consent. With this input data, artificial intelligence may be able to understand in more detail what the possible pathways might be, as it would be able to process more information than a person can. To be able to realize such services, it is necessary to make a detailed analysis of how and where student data is stored, to be able to guarantee them protection and privacy of their data. These data are stored in the servers that the electronic records companies offer to Italian

schools, and therefore it will be necessary to make an analysis at the level of basic architecture. It allows to understand how to create an infrastructure that allows the different servers to communicate together, to be able to access the data of the students necessary for the artificial intelligence to develop the student profile. Moreover, the access to the data of the labour market is very important, to gain insight into what hard skills, soft skills, and competencies companies need now and in the future.

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