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Career Path Choices of Vocational School Students in the Context of Their Entrepreneurial Abilities, General Aptitude, and Hope for Success

ABSTRACT

The right choice of a career path for young people deciding to attend vocational school can prove to be an important factor not only for future educational success, but also for a successful transition from education to work. It is, on the one hand, a key developmental challenge for young people entering adulthood and, on the other, an expectation and concern for local authorities shaping education policy in the context of the needs of the local economy. The problem of a successful transition from education to work is, then, an interdisciplinary issue, related to both psychology (individual differences) (and the management of local development oriented towards providing the local economy with the necessary competences for work. Therefore, it is also (and actually first and foremost) an important challenge for career counselling and for young people. The article presents an empirical study of 3,577 vocational and technical school students, covering 1,080 female and 2,497 male students, conducted in 19 schools in Poznań in 27 fields of study using questionnaires and psychological tests to determine entrepreneurial abilities (KUP), hope for success (KNS) and general aptitude (APIS). Our analyses of the research results led us to claim that there is a relationship between entrepreneurial abilities, general aptitude and hope for

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success and the career path choices of vocational school students. It was shown, with the use of artificial intelligence, that on the basis of the results of questionnaires measuring these student characteristics, a prediction can be made about the choice of further career or educational direction. The results of the analysis using AI can support career counselling for vocational students and the development of a career counselling system at this and earlier stages of education.

KEYWORDS: entrepreneurial abilities; hope for success; general aptitude; career paths of vocational school students; artificial intelligence.

1. INTRODUCTION

Choosing one's educational path at the end of primary school is one of the most important stages of the career path, largely determining the education related to a future occupation. In the Polish system of education, this stage of building or designing career paths has a lot of relevance for students choosing a vocational school, as the choice of a school (and the course of study in particular) implies in fact choosing an occupation. In the case of Polish comprehensive school (*liceum ogólnokształcące*), the class educational profile (humanities, mathematical-physical, biological-chemical, etc.) does not determine the future career but only the choice of major school subjects, whereas the decision about a career is made, by and large, when a university and a course of study are chosen. In this connection, we can say by and large that the choice of a career is postponed by several years in comparison with primary students selecting a vocational school.

For young people who decide to attend vocational school, choosing an appropriate educational path may turn out to be a significant predictor of not only future educational success but also a successful transition from education to work. An advantageous transition from being at school to being an employee is, on the one hand, a major developmental challenge for young people entering adult life (Bańka, 2007); on the other hand, it is expected

and aided by units of self-government, which shape the educational policy with respect to the needs of the local economy. The issue of a successful transition from education to work is therefore an interdisciplinary problem pertaining to both psychology in terms of individual differences and local growth management geared towards providing the essential job competences to local economy. Understanding and describing the conditions of a successful transition will be of value to both participants in educational systems (students and their parents in the process of deciding about education or a career, as well as counsellors supporting this process) and self-government units that fund and design this system (school principals and school governing authorities, who determine the educational offer and teaching methods) in response to the needs of the economy, as well as the educational aspirations of local inhabitants.

This is why it is so important to support young youth planning their future career in the vocational education system and to discuss support methods that go beyond the typical career guidance instruments associated with early career orientation. Is a teenager who fills in interest surveys in fact choosing a career based on his or her aptitude and abilities, or are they designing their future treating interest surveys and tests as a kind of declaration concerning their future or a (more or less daring) manifestation of their self-image? This may imply that the choice is based not on the actual assessment of their aptitudes but rather on the choice of those interests and items in questionnaires that best match this vision of the future. It should be expected that career counsellors who support students at this stage expect to produce a decent profile showing strengths and weaknesses. However, how much do teenagers know about their strengths in terms of a career that they have not experienced yet, knowing it only from literature, the media or accounts of adults (parents, counsellors or other authority figures)?

With this in mind, we should reflect on the utility of popular career preference questionnaires, whose structure and the overt diagnostic (advisory) purpose may impose a student's declarative narrative in the process of their assessment, distorting or rendering impossible an assessment of the traits or variables underlying the further choice (matching) of a career. What can replace popular personality questionnaires in the process of supporting teenagers in their career choices?

This article discusses the influence of entrepreneurial abilities, general aptitude, and hope for success on the choice of a future career path and, in particular, the possibility of predicting a career through an analysis of those variables. The statistical analyses carried out here are also connected with the determination of expected career choices made by those students who have not openly declared their choices, as well as a verification of how accurate was the choice of those who declared a specific occupation. The validity of the proposed method of choice estimation could be determined by relating career choices to the course of study followed by the student if we could approve the hypothesis that the choice of the course of study in vocational school is accurate. Such a hypothesis, however, would necessitate additional research and analyses that are not addressed here; therefore, we applied an AI-enhanced statistical analysis to draw conclusions based on the above-mentioned predictors.

2. CAREER CHOICES

When a primary school student is choosing a vocational school, this choice (decision) is crucial for a career path. The decision is pivotal in this particular moment and cannot be put off as it happens among students who are choosing a comprehensive school (*liceum ogólnokształcące*). Nevertheless, the career path at vocational school is not restricted to this stage, and it can be modified

by choosing qualifications necessary for technical occupations, thus profiling the specialization of a career. Another likely decision defining the career path is the one to continue education at second-stage vocational school (and, in fact, obtain a technician diploma) or a decision to start studies by technical school students who are taking *matura* exams. However, these decisions in fact concern the level of professionalisation of a career chosen earlier, which implies that the actual career choice determining the career path is made when first-stage vocational school or technical school (*technikum*) is chosen and the educational profile in this establishment. This choice is made by a teenager at 13–14 years, so it is implicit that this choice is not autonomous. Well, what can influence this choice?

Reliable career guidance, aiming at the greatest possible independence and autonomy of choice, assumes that the choice of a career should rely on a proper self-evaluation as well as thorough and complete career information, which makes it possible to match a student to a career. Knowing oneself (abilities, aptitudes, interests) and the future work (requirements, conditions, type of tasks) should underlie the choice of a career. Unfortunately, both factors are connected with many problems and barriers. As mentioned at the beginning, a young person's self-evaluation is not easy, particularly when it is done in respect of the future (values and expectations, one's own and those imposed by upbringing and the socio-economic circumstances). In the same way, it is not easy to collect and convey reliable career information for its enormous scope and variability, both due to technological and social progress. But even this defective, out-of-date or incomplete career information is filtered in some way, with priority given to the first factor, which is the interests and expectations of the student. This means that the actual choice is made using incomplete or wrong data, and this is done every year by hundreds of thousands of children in Poland. Consequently, we are led to think that this choice depends on additional factors as career guidance is not

capable of providing all necessary data for a logical and methodological decision to be made. What then, impacts the decisions of children choosing a vocational school?

This question can be answered based on the results of the research underlying this article. It makes use of questionnaires and psychological tests determining entrepreneurial abilities, vocational interests, hope for success and general aptitude, as well as – thanks to a unique original survey – additional factors, such as the family situation, e.g., parents' education or occupation, or the environment, e.g., authority figures, institutions and values taken into account when choosing a career. All students were asked questions like: "What do you think is the most important thing when choosing a career?"; "What made you choose this school?"; "Who would you turn to for help in choosing a career or a school?" For each question, the respondents were asked to choose 2 from 6 possible responses.

For instance, when asked "What do you think is the most important thing when choosing a career?", 71% of the students surveyed chose "interests, passions, hobbies", 50% pointed to "abilities, aptitudes, qualities of character", but 6% indicated "good advice of trusted persons" as one of the two answers, which means that to those students this factor seemed more important than self-assessment – that is, one of the first two indicated answers (abilities and interests). A similar revision was made by 33% of the students, who pointed to "material reasons and the salary" as more important than self-evaluation, or 30% of the respondents who indicated the "possibility of finding a job". Interestingly, only 5 students of the 3,588 surveyed indicated "prestige, social recognition of the profession", and among them were four male students of secondary technical schools.

The question "What made you choose this school?" was answered by only 77% of the respondents with "job I want to do in the future"; only 40% indicated "required level of learning", and merely 14% chose "subjects taken at the exam." Simultaneously,

as many as 30% of the respondents indicated "closeness to where I live, transfer to school", and as many as 14% chose "where my friends are going to learn", and 7% of the surveyed students pointed to: "where my parents or siblings used to learn" – factors not associated with self-evaluation, i.e., aptitudes and abilities of the student.

Finally, the question "Who would you turn to for help in choosing a career or a school?" was answered with "career counsellor" by (as many as) 44% of the respondents; 17% indicated "school pedagogue/psychologist", 5% pointed to "teacher", and barely 4% to "class tutor". Simultaneously, as many as 71% of the surveyed students answered "parents" and 45% pointed to "friend, brother or sister", which also in this case demonstrates a weak association with factors related to self-assessment and the assumptions of career guidance.

The presented results of the research prove that the choice of a career path by vocational schools students is slightly – or less than it might be expected – depends on the student's self-evaluation, which is crucial for the support provided by a career counsellor. Therefore, it seems justified to ask about alternative, additional tools supporting the self-assessment (or perhaps assessment, too) of the student when choosing a career path.

2.1 ENTREPRENEURIAL ABILITIES OF VOCATIONAL SCHOOL STUDENTS

Entrepreneurial abilities are but one example of supporting the process of the student's self-assessment, which may resolve the problem related to the declarative and projective nature of the results obtained with questionnaires surveying interests or vocational personality relating directly to a career. As mentioned earlier, when doing popular questionnaires, students can manipulate the results by choosing responses, activities or career behaviours that are in line with their own career choices; these, as demonstrated above, may depend on many external factors

of a social nature – influence of the family, friends, or economic and pragmatic considerations – often leading to wrong choices of a vocational school. Entrepreneurial abilities, in contrast, reflect the general functioning of the student, in family or social settings, masking – as it were – the advisory purpose of the assessment of such abilities.

The Entrepreneurial Aptitude Questionnaire (*Kwestionariusz Uzdolnień Przedsiębiorczych*, KUP) by Noworol (2016) is based on theories of cognitive styles (Nosal, 1990). These theories describe the principal mental activities of the human being. They refer to processes of information reception, learning and thinking, as well as complex activities such as decision-making or intellectual and emotional control. When diagnosing aptitude, career success or abilities, one takes into account only those styles which are relevant for the type of work or career path planning. In addition to theories of cognitive styles, the construction of the KUP factors in the works of entrepreneurship theorists (Cromie, 2000; Drucker, 1992, 2004; McClellend, 1965; Richter & Kemter, 2000; Rotter, 1966), which contrast the early studies of entrepreneurs arguing that those are people who possess exceptional qualities associated with qualitatively outstanding abilities with the contemporary viewpoint that entrepreneurial abilities, just as managerial or leadership abilities, can be acquired in a sense. The KUP has a high theoretical validity. It relies on the well-known theories of cognitive styles and works of researchers of entrepreneurship, which add current relevance to the dimensions of entrepreneurial abilities. The theoretical validity of the questionnaire was confirmed by its factorial validity. Five factors were obtained and the factor loadings reached statistically significant values ($p < 0.001$). The isolated factors were identified as: need for success; A-type behaviour style; practical, creative abilities (*I can*); locus of control; and stability as a pivotal dimension of emotional intelligence. On the basis of validity and the compliance of the

dimensions with our theoretical assumptions, we distinguished five scales for the questionnaire.

- The Energy for Work scale is related to the psychological kind of behaviours, so-called type A referring to persons who motivate themselves to act, to take up ever more challenges, thus achieving career success. Many entrepreneurs and managers are characterised by precisely this type of behaviours.
- The Success scale is related to one of the fundamental needs manifested in the behaviours of successful people, especially entrepreneurs: need for personal achievement. This need is a driving force of action and an extremely strong motivator in many people. High scores on this scale identify individuals whose commitment to a constant struggle for a better tomorrow results from their desire of success and reaching the top. For many, material success can be the central idea of their lives and attaining it can be their main goal and motivation. Reaching this goal becomes more important than the home, family, recreation, leisure, and many other things.
- The Practical Competences scale identifies persons who can find their way through any circumstances and cope where others see only insurmountable obstacles, who can not only endure but also stimulate changes in the environment, seeing in hardships opportunities for growth. People like that are practical, and it is generally believed that they can be useful as employees in any position. They can handle different and sometimes very complicated circumstances. They are thought to be multi-talented and irreplaceable.
- The Self-Control scale is related to emotional intelligence and constitutes one of its pivotal dimensions associated with the ability to control one's emotions, self-insight, knowledge of one's personality, intuition, understanding of feelings or compassion; it plays a pivotal role in personal and work life, determining largely success or failure in entrepreneurial activity.

- The Self-Directedness scale is associated with the trait of locus of control, which is a person's real control over situations and the strength of their conviction about the degree to which they control their life. High scores on this scale point to a strong internal locus of control and identify optimists who believe they can handle every situation and overcome all adversities.

The scales described above demonstrate that entrepreneurial aptitude, as measured by the KUP, can impact the choice of one's career path not only thanks to having abilities to do specific occupations, but also at the stage when a concrete career decision is made. In a nutshell, entrepreneurial aptitude not only shapes vocational identity, but it can also be a tool for making decisions; it can be decisive for a choice itself, determining its autonomy (independence and internality of a decision), even aspirations or validity of a choice made, which is conditional upon self-control and the need for success.

Considering the fact, as indicated above, that the choice of a career largely depends on external factors, entrepreneurial abilities can considerably influence the validity and quality (autonomy) of this choice.

2.2 GENERAL APTITUDE (INTELLIGENCE)

Assessment of a student with respect to his or her general aptitude, i.e., their intelligence, is not carried out in the context of the world of work; nor does it trigger a projection of the career choice already made (the student's imagined future occupation, expectations of the student and the environment), thus facilitating, to some extent, the choice of a further career path. In this case, the APIS-P(R) aptitude test is a particularly useful tool, chiefly because it leaves no room for the respondent's declaration or opinions. APIS-P(R) is multidimensional test battery by Ciechanowicz, Jaworowska, Matczak, and Szustrowa (1995) for measuring general intelligence. The APIS-P(R) is a modified version of APIS-

P published in 1995, but both editions are based on common premises concerning the hierarchical structure of intellect: the human being possesses general aptitude which constitutes the foundation of all intellectual activities and accounts for their differentiation. The APIS measures crystallized intelligence. Here, a distinction is assumed between fluid intelligence (biologically conditioned mental capabilities, which are utilized to solve problems in any area, regardless of their content) and crystallized intelligence (the ability to handle content-specific problems by using culturally relevant skills and knowledge), which results from experience and is formed on the basis of fluid intelligence as a result of being invested in various kinds of activity, undertaken in a specific socio-cultural context. The APIS battery, just like all classic intelligence tests, measures the efficiency of convergent thinking; therefore, APIS tests are "power" tests rather than "speed" tests, which implies that what matters is differences in capability, not in work speed. The APIS-P(R) contains eight tests: Behaviours, Squares, Synonyms, Classification, Number Transformations, New Words, Blocks, and Stories – representing four types of ability (two tests for every type of ability). Five tests consist of 15 items, and three feature 10 items. The items in two tests have a forced-choice format, and the others are open-ended. The reliability of the test testifies to a very high internal consistency of the total score and a slightly lower consistency for the individual tests. Research has confirmed the validity of the APIS-P(R) test battery as a tool for measuring general intelligence. The best indicator of intelligence measured with the battery is the total score. Its scores also correlate closely with school marks. The component tests are saturated mainly with the general factor, but they also have their own specific profiles, as proved by the factor analysis results. The APIS is a multidimensional test battery because it is designed to measure crystallised intelligence. The developers of the battery took into account four types of abilities:

- Abstract-logical abilities are associated with operations of logical reasoning focused on abstract material and using deduction and induction. The Classification test contains closed-ended tasks involving the completion of verbal classes. Each class is represented by three words (nouns), and the subject is to find the fourth, missing class element (out of five provided). The Number Transformations test elicits reasoning by analogy using numerical input. In each task, the subject is presented with two pairs of numbers linked with each other by the same formula, as well as a number that needs to be complemented with another one; in this way a third pair is created, based on the same formula as the first two.
- Verbal abilities are associated with speech comprehension and the active use of speech in terms of meanings, memory of words and grammatical rules. The Synonyms test examines the knowledge of words, commonly regarded as an essential indicator of both verbal abilities and general intelligence. Each task features a word and the first letter of a synonym with dots representing the missing letters. Based on such information, tasks consisting in adding synonyms have a convergent nature, and the subject is expected to supply a specific word. The New Words test measures primarily verbal fluency. The subject is to create a four-letter word based on three initial letters given.
- Visual-spatial abilities are related to operations that are mental representations of physical transformations. The Squares test examines the ability to do imaginary rotation and manipulation of figure elements. The tasks involve finding ways to divide geometrical figures into two parts that can make up a square after being properly rotated on a plane. The Blocks test requires orientation in space (i.e., three-dimensionality) and contains tasks providing input in the form of perspective drawings showing 3D constructions made with identical, cuboid blocks.

- Social abilities related to comprehension of social relations, human behaviours, and planning behaviours in social interaction. The Behaviours test relies on verbal material and is intended to test the knowledge of social rules, regarded as an important component of social intelligence. The Stories test is based on perceptual material, and the tasks make use of picture stories. The test is designed to measure the ability to accurately perceive interpersonal relationships and understand social situations. It contains open-ended tasks that require the subject to arrange the randomly presented in chronological order.

Again, the test scales indicate that abilities measured with the APIS(R) can influence one's choice of a career path, similarly as in the case of the KUP, in terms of abilities required for specific occupations (abstract-logical, verbal, visual-spatial, or social); when a career choice is being made, the scales can serve as a cognitive and intellectual tool that determines the quality and validity of the choice based on the quality of cognitive processes, that is, intelligence. Further analysis considers general intelligence, which is of key importance for the career choice itself (assuming that the above-mentioned types of abilities can be treated as an aptitude for specific occupations, activities or occupational tasks, and can prove useful for an in-depth and detailed analysis of the validity of such choices). The adoption of the general intelligence scale for further analysis rests on the premise that general intelligence is not only a statistical operation of adding up the scores obtained on individual tests or scales, but it reflects a real being, a real characteristic of learning (Jensen, 1987).

2.3 HOPE FOR SUCCESS

The third area of self-evaluation considered in the statistical analysis was the question of students' hopefulness and expectations of success when choosing an occupation and career paths. It can be reasonably assumed that when hope for success is considerable,

the choices will be more ambitious and more independent; in other words, based on the self-evaluation of own agency or own assessment of chances.

This area can be usefully examined with the Hope for Success Questionnaire (Kwestionariusz Nadziei na Sukcess, KNS) by Łaguna, Trzebiński, & Zięba (2005), based on the concept of hope construed as the belief that one has the competences to succeed. This concept is based on the hope theory formulated by Snyder, for whom hope is a state of motivation resulting from two interlinked beliefs: one about the possibility of carrying one's plans through (i.e., agentic thoughts), and one about oneself as a resourceful and efficacious individual, possessing the necessary knowledge and competency to realise one's will (Snyder, Cheavens, & Sympson, 1997; Snyder, Sympson, Michael, & Cheavens, 2000). In the course of years-long research, a considerable amount of data was collected proving that the power of hope thus understood impacts the effectiveness of people's behaviours, the way they overcome obstacles and their endurance, the level of life adaptation, and a great many parameters of emotional and physiological functioning. At the same time, hope for success was found to be relatively independent of related constructs such as optimism (Seligman, 1993). Significantly, as regards the career choice made by students, Snyder defines hope for success also as a thought and cognitive process accompanying a specific decision and the associated action. It can be said that hope and the above-mentioned beliefs are activated as thinking that accompanies the person's action oriented towards a specific goal (hopeful thinking), which refers to itself, since she is pursuing a goal in accordance with her will, being capable of overcoming obstacles along the way to that goal (Snyder, 2002). Such a perception of hope for success makes it a potentially very significant factor in one's choice of an occupation, especially when choosing a career path in which future action and coping with difficulties are vital for achieving a set goal.

The validity of the test was demonstrated by the fact that the KNS scores correlate positively with personality variables pointing to good adaptation, including the basic hope, optimism, belief about self-efficacy and general self-esteem, as well as extroversion and conscientiousness; in contrast, they correlate negatively with the traits of anxiety, depression, and neuroticism. The factor analysis of the questionnaire revealed – in keeping with our theoretical assumptions – two factors: the first relating to beliefs about strong willpower, and the other to beliefs about one's capacity for finding solutions. The test finds its application chiefly in scientific research and individual diagnosis (e.g., in career counselling, staff training, the initial stages of training intended to boost personal competences, as well as in psychotherapy) and serves to predict how easily one adapts to the environment and new challenges.

A higher level of hope is associated with better adaptation. Hope for success is inversely correlated with negative emotions, and positively with positive emotions; experimental manipulations aimed at increasing hope raise positive mood and lower negative mood. People with a great deal of hope for success overcome recurring barriers flexibly and can find an alternative goal. People with little hope think they have got stuck and tend to conjure up virtually magical solutions. When encountering stressors, individuals with a high level of hope can turn to their families, friends, or generally those they feel attached to; they manifest better social adaptation in contacts with friends and the family.

The results of the research done among students of various schools indicate that hope is positively correlated with school performance. It is linked to higher scores on achievement tests, higher averages attained by students, and higher semester and exam grades. Hope for success, measured with the KNS, is related to how strongly a person expects her actions to bring positive results, and it is comprised of two components:

– a conviction about having a will – awareness of one's own efficacy manifested in initiating and maintaining the pursuit of a goal, and
– a conviction about being able to find solutions – awareness of one's knowledge and intellectual competences, manifested in situations that require one to invent or find new ways to achieve a goal.

As it can be seen also in this case, the student's expectations of the effects of his or her own actions and real influence on these actions can have a considerable impact on their choice of a career, especially their autonomy and independence, as well as the level of aspirations manifested in such decisions, thus taking into account the effect of the above-mentioned abilities.

For this reason, statistical analysis considers the results of all three questionnaires in order to determine their combined effect on students' educational choices and the possibility of predicting student's choices based on those questionnaires.

3. RESEARCH AND ANALYSIS

In 2009–2010, the co-author led a study of 3,588 in 19 vocational schools in Poznań, in 27 courses of study, using questionnaires and psychological tests to determine entrepreneurial abilities (KUP), vocational interests, hope for success (KNS), and general aptitude (APIS(R)). The goal was to support career guidance for students of vocational schools and the development of the career guidance system at this stage of education; therefore, the research was supplemented with a survey identifying factors of educational and career choices made by the students of the schools participating in the project. The counselling and developmental project, addressed to vocational schools and their students, and especially the anonymous results of questionnaires and tests utilized in career counselling, provide an opportunity for exploring

the impact of specific areas of assessment on career choices of the subjects and, in the long run, for assessing the influence of the students' traits and abilities on the accuracy of those choices and the quality of transition from education to work, also through longitudinal studies of the career paths (employment) of the respondents 10 years after graduation. This aspect is addressed in a different dissertation of the co-author of the present article.

For the purposes of this study, in order to explore the impact of entrepreneurial abilities, general aptitude and hope for a successful career choice on a successful career choice, the scores of the three above-mentioned questionnaires are considered, excluding those related to the parents' education and occupation, and the student's place of residence or interests. The results of the three questionnaires are analysed in respect of the student's gender and selected occupation (declared in a survey and/or determined by the course of study run by the technical or vocational school, represented by a 3-letter occupation code, according to Holland (Noworol, 2013).

3.1 SAMPLE

We analysed the results of 3,577 surveys (1,080 female and 2,497 male students took part). In the sample, 767 respondents were attending vocational school (304 female and 463 male), and 2,810 were attending technical school (776 female and 2,034 male). 228 of the surveyed students did not indicate "a chosen career" (23 female and 205 male). For those 228 respondents, we will attempt to predict the "chosen career" based on the results obtained from three questionnaires.

3.2 RESEARCH TOOLS

The KUP consists of 52 items assessed by means of a 6-point frequency scale, ranging from 0 (*never*) to 5 (*always*). The KUP measures five abilities:

– Energy for Work (*energia do pracy*, EP), a scale related to the personality types A and B;

– Success (*sukces*, SC), a scale related to the need for achievement;

– Practical Competences (*kompetencje praktyczne*, KP), a scale related to practical abilities (technical and creative) – *I can*;

– Self-Control (*opanowanie*, OP), a scale related to stability as the axial dimension of emotional intelligence;

– Self-Directedness (*sterowność*, ST), a scale related to locus of control.

General aptitude is measured with the APIS (R), consisting of eight tests: Behaviours, Squares, Synonyms, Classification, Number Transformations, New Words, Blocks, and Stories – representing four types of ability (two tests for every type of ability): Abstract-Logical Abilities, Verbal Abilities, Visual-Spatial Abilities, and Social Abilities. Five tests consist of 15 items, and three feature 10 items. The items in two tests have a forced-choice format, and the others are open-ended. The APIS is a multidimensional test battery because it is intended to measure crystallised intelligence, or General Aptitude. The questionnaire was used in its original paper version consisting of 105 items. In our analysis, we took into account the total score of General Aptitude.

Hope for Success was measured with the KNS questionnaire. It was used in the survey based on the original paper version comprising 12 questions, yielding scores that are interpreted as Hope for Success, with two components: Conviction About Having Will and Conviction About Ability to Find Solutions. In our analysis, we took into account the total score of Hope for Success.

KUP scores, intelligence reflected by the APIS general aptitude score, KNS Hope for Success scores were converted to a uniform 100-percent scale using S-transformation (Noworol, 2013, p. 30, Template 1.11).

Interpretation of the scales after scores conversion:

$X < 25$ = does not occur

$25 < X \leq 40$ = occurs to a very small degree

$40 < X \leq 50$ = occurs to a small degree
$50 < X \leq 60$ = occurs to a moderate degree
$60 < X \leq 70$ = occurs to a more than moderate degree
$70 < X \leq 85$ = occurs to a high degree
$X > 85$ = occurs to a very high degree.

The KUP, which was developed as a research tool for adults, was subjected to a confirmatory factor analysis (CFA) to test its relevance for school students, controlling for gender. The CFA showed that all factor loadings were significant ($p < 0.001$). Table 1 contains sample data for the first three loadings on each KUP scale.

Table 1. Sample CFA factor loadings for selected KUP positions on individual scales.

KUP*	Female students			Male students		
	Factor loadings	*SE*	*T*	Factor loadings	*SE*	*T*
(EP)-1->[KUP3]	0.766	0.035	21.893	0.818	0.025	32.377
(EP)-2->[KUP10]	0.921	0.034	26.990	0.872	0.025	34.521
(EP)-3->[KUP16]	0.743	0.034	22.007	0.753	0.024	31.579
(SC)-9->[KUP4]	0.763	0.036	20.933	0.783	0.024	33.161
(SC)-10->[KUP9]	0.932	0.033	27.909	0.917	0.023	39.426
(SC)-11->[KUP15]	0.434	0.032	13.696	0.510	0.023	22.463
(KP)-17->[KUP1]	0.901	0.028	32.132	0.903	0.019	47.793
(KP)-18->[KUP6]	0.547	0.033	16.486	0.602	0.024	24.622
(KP)-19->[KUP12]	0.747	0.043	17.265	0.691	0.033	20.732
(OP)-26->[KUP5]	–0.621	0.040	–15.588	–0.527	0.025	–21.451
(OP)-27->[KUP7]	–0.661	0.039	–16.871	–0.629	0.028	–22.638
(OP)-28->[KUP8]	–0.680	0.035	–19.342	–0.661	0.024	–27.422
(ST)-42->[KUP2]	–0.951	0.030	–32.112	–0.889	0.020	–44.444
(ST)-43->[KUP11]	0.799	0.033	24.466	0.749	0.023	32.790
(ST)-44->[KUP17]	–0.563	0.036	–15.821	–0.555	0.025	–22.062

* EP = Energy for Work, SC = Success, KP = Practical Competences, OP = Self-Control, ST = Self-Directedness.

The CFA factor loadings are high and statistically significant. *t*-Student values are highly statistically significant, $p < 0.001$ (Table 1).

3.3 RESEARCH HYPOTHESES

H1: The Entrepreneurial Aptitude Questionnaire (KUP) is fully applicable to school youth.

H2: The KUP scales, intelligence as a dimension of general aptitude and hope for success are good predictors of career paths of vocational school students who are planning their career.

H3: Vocational school students choose career paths in keeping with their entrepreneurial abilities, intelligence and hope for success.

H4: There is a lack of adequate career guidance in primary and vocational schools, which is manifested in the career choices made by vocational school students.

3.4 RESULTS

KUP, general aptitude and hope for success

In the first instance it was tested if there were differences among KUP scales, APIS general aptitude, and KNS hope for success (Table 2).

As can be seen from Table 2, the EP and ST scales are not differentiated by gender. Energy for Work ranks above average, which is a very good result for vocational students. Such a result implies that the respondents' willingness to learn an occupation was above average, and their personal traits were slightly biased towards type A (SC scale). The average score on the ST scale means that the respondents are both externally directed and self-directed, which is also a positive quality.

Table 2. Gender differences among KUP scales and in intelligence, indicated by general aptitude (APIS) and hope for success (KNS) (1 = female students, 2 = male students).

	Mean 1	Mean 2	*t*	*df*	*p*
EP	67.25105	68.06192	–1.20673	3575	0.227615
SC	63.67612	69.16608	–8.21716	3575	0.000001
KP	63.46876	68.60183	–8.42842	3575	0.000001
OP	65.09502	67.13149	–5.08740	3575	0.000001
ST	51.95290	51.71020	0.70074	3575	0.483513
APIS general aptitude	40.61497	53.96433	–14.1043	3226	0.000001
KNS hope for success	79.62282	81.29123	–3.2986	3390	0.000982

The other three scales (SC, KP, and OP) show significantly higher scores for male than female students (Table 2). This implies that young students are more ambitious, more achievement-oriented, they strive for higher professional skills, and are more self-controlled than female students.

Similar results were obtained for intelligence measured with the APIS general score and for success measured with the KNS. Higher scores for general aptitude in male students imply that they will fare better at vocational school (given the school types researched) than girl students. The scores achieved by boys are average, while girls show low general aptitude (Table 2). This may be due to educational choices made by female students that are inconsistent with their abilities, as evidenced by the lack of career guidance in primary schools. The higher scores on the Hope for Success scale achieved by the boys can be explained in a similar way. However, both boys and girls reach high scores here, which means that the students of the researched vocational schools, regardless of their gender, have high hopes of achieving job market success.

Occupation codes as chosen by students

In order to examine which occupations will be chosen by students entering the labour market, their choices were analysed by gender. Tables 3 and 4 present the frequencies of career choice codes. 3-letter codes developed by Holland correspond to occupations, in line with the Polish classification of occupations and specialities (Noworol, 2013). The codes are: I = Institution, K = Culture, N = Science, P = Entrepreneurship, S = Art, T = Technology.

Table 3. The frequency of occupation codes chosen by female students.

Codes	Count	%
0*	23	2.12963
INP	15	1.38889
IPN	163	15.09259
ISP	12	1.11111
KNS	1	0.09259
KPI	24	2.22222
KPT	6	0.55556
NIT	4	0.37037
NTS	1	0.09259
PIK	279	25.83333
PIT	23	2.12963
PSK	1	0.09259
PSN	1	0.09259
PTI	1	0.09259
PTN	4	0.37037
SKT	1	0.09259
SNI	4	0.37037
TIN	51	4.72222
TIP	22	2.03704
TNI	14	1.29630
TPN	1	0.09259
TSI	119	11.01852
TSP	310	28.70370

* 0 = no code.

As it can be seen from Table 3, only 11 codes were more frequent than 10, so they were considered for further analysis. It can be seen that 23 female students were unable to specify their future career path (2.13%).

Table 4. The frequency of occupation codes chosen by male students.

Codes	Count	%
0*	205	8.20985
INP	4	0.16019
IPK	5	0.20024
IPN	451	18.06167
ISP	43	1.72207
ITP	22	0.88106
KPI	4	0.16019
KPT	6	0.24029
NIT	2	0.08010
NTK	1	0.04005
PIK	107	4.28514
PIN	1	0.04005
PIT	13	0.52062
PKI	8	0.32038
PTI	1	0.04005
PTK	1	0.04005
PTN	1	0.04005
PTS	1	0.04005
SNI	9	0.36043
SPK	1	0.04005
SPN	1	0.04005
SPT	1	0.04005
TIN	616	24.66960
TIP	486	19.46336
TIS	16	0.64077
TNI	118	4.72567
TNP	64	2.56308
TPK	2	0.08010

Codes	Count	%
TPN	1	0.04005
TPS	1	0.04005
TSI	260	10.41249
TSP	45	1.80216
Total	2,497	100

* 0 = no code.

The male students chose occupations whose codes with a count of more than 10 times were considered for further analysis. It can be seen that 205 male students were unable to specify their future career path (8.21%) (see Table 4). The codes with a count of over 10, controlled for gender, are presented in Table 5.

Table 5. Frequency of occupation codes (> 10) chosen by students, by gender.

Codes	Female students	Male students	Missing	Row totals
0*	23	205	10	238
INP	15	4	0	19
IPN	163	451	0	614
ISP	12	43	0	55
ITP	0	22	0	22
KPI	24	4	0	28
PIK	279	107	0	386
PIT	23	13	0	36
TIN	51	616	0	667
TIP	22	486	0	508
TIS	0	16	0	16
TNI	14	118	1	133
TNP	0	64	0	64
TSI	119	260	0	379
TSP	310	45	0	355

* 0 = no code.

Only nine codes plus "0" were considered for further analysis (Table 5). Then, the Classification and Regression Trees (C&RT; by Breiman, Friedman, Olshen, & Stone, 1984) analysis was conducted (using AI methods), and on the basis of scores for KUP entrepreneurial abilities, APIS intelligence, and KNS hope for success all codes chosen by the students were predicted; in other words, it was estimated which occupation code was suitable for every student (Table 6).

Table 6. Prediction of occupation codes, based on C&RT analysis, for all students; 0 denotes lack of career choice.

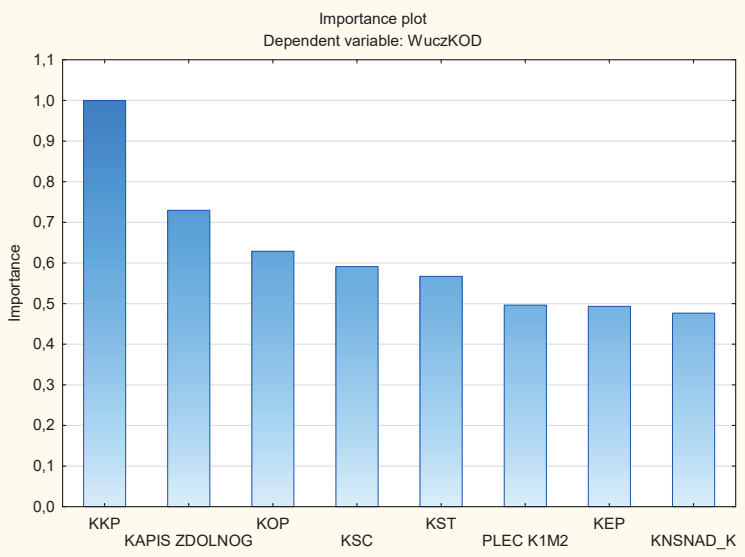
Observed value	Predicted value	Frequency	Total	Observed value	Predicted value	Frequency	Total
0	PIK	8		TIN	TSP	22	
0	TSP	12	187	TIN	TIN	545	585
0	TIN	167		TIN	PIK	18	
IPN	PIK	70		TIP	TSP	15	
IPN	TSP	75	569	TIP	TIN	443	465
IPN	TIN	424		TIP	PIK	7	
ISP	TIN	41		TNI	TIN	105	
ISP	TSP	8	53	TNI	TSP	8	119
ISP	PIK	4		TNI	PIK	6	
PIK	PIK	113		TSI	TSP	65	
PIK	TSP	103	304	TSI	PIK	33	307
PIK	TIN	88		TSI	TIN	209	
PIT	PIK	7		TSP	TIN	41	
PIT	TIN	12	34	TSP	PIK	53	314
PIT	TSP	15		TSP	TSP	220	

It can be seen that the students' scores for entrepreneurial aptitude (KUP), intelligence reflected by the APIS general score, and hope for success measured with the KNS, made it possible to predict codes that describe optimal career path choices regardless of gender. These results showed that the majority of students

should choose occupations described by the code TIN (Technology/Technologies, Institution, Science); this group included 167 students of those who were unable to specify their planned career path unassisted. The second code that students should choose is TSP, including 12 who were unable to independently specify their planned career path. The third code of predicted choices is PIK, also for 8 students who marked 0.

Further, the validity of individual exogenous variables was also analysed. It emerged that Practical Competences (KP) play the crucial role (Figure 1), which can be interpreted as influenced by a quite natural predictor, because the research involved students of both vocational and technical schools.

Fig. 1. Analysis of the importance of exogenous variables: KKP = Practical Competences, KAPIS ZDOLNOG = intelligence measured with APIS, KOP = Self-Control, KSC = Success, KST = Self-Directedness, PLEC K1M2 = Gender, KEP = Energy for Work, KNSNAD_K = Hope for Success.



Other important predictors are Intelligence, Self-Control, Need for Success, and Locus of Control. In contrast, Gender, Energy for Work, and Hope turned out to be less important but significant predictors (Figure 1) – their importance is close to 0.5.

4. DISCUSSION AND CONCLUSIONS

Our analysis of the research allowed us to conclude that there is a relationship between entrepreneurial abilities, general aptitude and hope for success and further career path choices made by vocational students. With the help of artificial AI, it was demonstrated that based on the results of questionnaires assessing the above qualities in school students, one can predict his or her choice of a career and a school course of study. This means that the proposed approach can prove useful for students who, for various reasons, do not indicate a "chosen occupation" when transiting from primary to secondary education – in other words, at the beginning of their career path. This situation may be due to diverse reasons. In some cases, a student is unable to make a choice because he or she has not received at this educational stage (from the imperfect career guidance system) the proper data to make a decision, related to reliable self-evaluation or evaluation of their aptitude and abilities plus a complete and up-to-date vocational information.

In isolated cases, however, when the student does have such data, without adequate guidance, his or her age and data analysis abilities will not enable them to make a right choice of a career based on those complex data. In other cases, when choosing a career, the student is influenced by many environmental and social factors, which – as shown in this article – are very frequently unrelated to their predisposition and abilities, so that the potential choice of occupation is no longer the student's own choice, tailored to his or her needs. In such cases, when no choice has

been made, a C&RT analysis can be proposed to suggest to the parents, the guidance counsellor, the teacher, or the student himself, the most likely choice we could expect given the respondent's entrepreneurial abilities, general aptitude and hope for success.

This means that career counsellors can foster educational and vocational choices of students in a tangible way, diagnosing their entrepreneurship, intelligence and hope for success, using the above-proposed questionnaires. This begs an obvious question. If we have to use questionnaires and tests to support the student's educational and occupational choice using the proposed method, isn't it easier to use one of the popular questionnaires on vocational interests and personalities yielding a specific occupation or a group of occupations than use the proposed AI career prediction analysis to predict what occupation the student will pick? Answering this question depends on our assessment of the validity of questionnaires used in career counselling, namely, interest and preference questionnaires based on the student's declarations directly related to work and career. As we have shown, students make their career choices typically under the influence of their parents, friends, economic, cultural factors, or images of working life and career circulated in the environment and the media – having no personal experience in this regard. It can be expected that while answering questions what they want to be and what they would like to do, they are largely projecting their future idea of themselves, expectations of close ones or current trends on the job market, rather than making a reliable self-assessment, which is the purpose of such tools after all. This means that the context of the questions that the subject is answering regarding such an important sphere of his or her life can considerably reduce the reliability of their declarations and the validity of the survey itself. Hence the proposal or necessity of asking questions in a roundabout way using the proposed questionnaires. The questions do not directly concern careers; additionally, the questionnaires contain practical tasks, reducing

the share of the student's declarations, opinions and assessments, shifting the weight from his or her self-evaluation to assessment. In this case, a career choice is based on a set of reliable data and the effective – as demonstrated here – method of C&RT analysis.

The advancement of statistical and data analysis methods in other sectors, particularly in marketing, as well as consumer needs analysis, can encourage career counsellors to seek alternative methods to support students' educational and vocational choices, who are subjected to many, non-personal, factors affecting decision-making. Since asking adult respondents "Do you like going to the theatre?" or "Do you read books?" will not provide us with a reliable knowledge of their preferences or aptitude because answers to such questions always have a social bias, it is perhaps inappropriate to ask young students what they would like to be, especially that we can expect a different answer depending on who is asking: the father, the mother, a teacher, or a peer member of an informal school group. Now, just like in the first case, it was considered that it is better to analyse thousands of other choices, opinions or behaviours unrelated to theatre or literature, to decide whether it makes sense to address to them theatre or book offerings; the same, perhaps, should be done with young people facing their first choice of career path.

In this case, a career counsellor need not (fortunately) follow the social media of their clients or make use of costly big data tools. It is enough to utilize the less typical questionnaires proposed here in the diagnosis of students' occupational preferences and run a C&RT analysis of the results thus obtained, predicting a student's career choice.

These predictions of codes of career path choices point out the obvious lack of career guidance at schools or that career guidance there is insufficient. Only 18.6% of students chose TIN, which was consistent with the prediction. 7.5% of the respondents chose TSP and 3.8% chose PIK, as predicted.

The statistical analyses permitted a verification of the formulated hypotheses. Hypothesis 1 was confirmed *in extenso*, so the Entrepreneurial Aptitude Questionnaire (KUP) is fully applicable in testing school youth. Hypothesis 2 was also positively confirmed. The C&RT analysis using AI showed that the KUP scales, intelligence as a dimension of general aptitude and hope for success are good predictors of career paths of vocational students who are planning their career. However, it should be noted here that not all predictors were equally valid. It turned out that four of the five KUP scales had greater predictive power (importance) together with intelligence as measured by APIS (Figure 1) than gender, Energy for Work (KUP), and Hope for Success (KNS). Hypothesis 3 turned out to be partly wrong, because it was shown that only 29.9% of the subjects were able to specify their planned career paths on their own, in line with their scores on entrepreneurial abilities (KUP), intelligence indicated by Total Score (APIS), and Hope for Success (KNS).

Hypothesis 4 was fully supported, because as many as 70% of vocational students do not choose a career path in keeping with their aptitude measured with five dimensions of entrepreneurial abilities, intelligence and hope for success. This result clearly demonstrates that career guidance is not adequate at primary and vocational schools.

It also emerged that the surveyed students should choose career paths connected with the use of traditional and modern technologies used within the Industry 4.0 and Craft 4.0 sectors, as well as innovations and entrepreneurship. Those students who chose a compatible TIN code and perhaps many of those whose results indicate this code as well have an aptitude for further education, as the TIN code is characteristic of technicians and engineers in various fields, as well as operators of different machinery and equipment (Noworol, 2013).

Another important conclusion indicating some limitation of code prediction is that the profiles of vocational schools, father's

and mother's occupation, and other predictors were not factored in. Nonetheless, the results obtained with the use of artificial intelligence seem adequate for this type of analysis and suggest a potential for further applications that can have not only a cognitive but also a utility value. They can be very useful for developing modern career counselling 4.0.

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