8th International Scientific Conference
"Business and Management 2014"
May 15–16, 2014, Vilnius, LITHUANIA
Section: Higher Education Mangement
http://www.bm.vgtu.lt

ISSN print 2029-4441/ ISSN online 2029-929X
ISBN print 978-609-457-652-2/ ISBN online 978-609-457-651-5
Article number: bm.2014.087
http://dx.doi.org/10.3846/bm.2014.087

DOES BIOLOGY MATTER? ON SATISFACTION FROM E-LEARNING IN IT AND MANAGEMENT STUDENTS

Jacek Woźniak

University for Finance and Management, Department of Management,
Pawia 55, 01-030 Warsaw, Poland
Email: jkwozniak@tlen.pl

Abstract. The issue of whether traits that are difficult to change affect certain careers or activities in a positive manner has been discussed for many years. S.Baron-Cohen has proposed the AQ coefficient as a measure of individual differences more basic in nature than Sternberg's cognitive styles, which is considered to identify people with an aptitude for the sciences. The goal of this text is to ascertain whether an AQ coefficient questionnaire (Baron-Cohen *et al.* 2001) differentiates Humanities and IT students similarly to the English study as well as satisfaction from e-learning experience by questionnaire study. Hypotheses concerning relationships between the AQ coefficient and it's subscales, Style II from Sternberg's typology and satisfaction derived from e-learning were also verified. Results show some of the expected relationships, however they are statistically insignificant.

Keywords: e-learning, IT specialists, autism, Sternberg profile, Baron-Cohen's AQ.

JEL classification: M12, M53, M15, J24, I21.

1. Introduction

The issue of whether traits that are under our control shape careers – and if so, which – has been the object of discussion for years. This has included traits significant for choosing the profession of IT specialist, and for choosing e-learning as a method of tuition. In their extreme manifestations, these discussions have crossed the borders of political correctness, advising whether someone can function in their professional role – with due care not taken to back suggestions with sound empirical foundations.

Frequently, such suggestions concern gender. Iszkowski and Tadeusiewicz (2011) suggest, for example, that women are weakly predisposed to become IT programmers, basing their suggestion on colloquial knowledge and everyday experience. A number of statistical studies have also shown that women – as compared with men – leave this profession three times more frequently, choose it far less often, and far more frequently resign from an educational path which will prepare them for a profession in IT (Ahuja 2007; Trauth, Quesenberry, Huang 2009). This phenomenon, however, is more often explained by referring to culture. Specific conditions that developed by accident in the IT setting (meritocratic competitiveness, continual comparative appraisals, a "male cloakroom" atmosphere, long working hours making it difficult to reconcile work and personal life – cf.: Łubieńska, Woźniak 2012), push women out of this profession and cause the people who work in it to resemble the stereotypical geek.

The turn of the XXI century brought data concerning an additional factor which makes it easier for certain groups to work in the profession. Researchers from S.Baron-Cohen's team observed that mathematicians and students of the sciences differ from the general population on two cognitive dimensions – empathizing and systematizing. Several empirical studies have attempted to place the source of these differences in biological factors. However, even as a personality difference, i.e. as a fairly permanent feature whose etiology is unclear, these factors help explain in a politically correct and comprehensible way the likelihood that certain types of persons will have of attaining success in different professions (if intelligence, effort, work devoted or even "talent", understood as a universal problem-solving skill, are evened out). This research shows that mathematicians are characterized by a higher tendency to analyze systems, as opposed to cooperating with others. People who enjoy learning with the help of e-learning tools are sometimes described as featuring a low need for interaction with colleagues (Nadelko 2008). It may therefore be interesting to check whether increases in the AQ factor (the measure used to describe Baron-Cohen's phenomenon), characteristic of mathematicians and programmers, also ensure success in e-learning.

The problem if the people who gain high satisfaction from e-learning are different is important scientific and practical problem. Baron-Cohen's AQ, which measure the autistic feature can be corelated with the satifaction gained from e-learning. The purpose of the research descirbed in the paper is to check this statement by a questionnaire study.

The author is not aware of any research using AQ tools outside Western Europe and the US. The goal of this article is therefore twofold. Firstly, it intends to verify whether persons who enjoy e-learning also feature qualities analogous to the ones mentioned above. Secondly, it attempts to replicate the English study on young Polish professionals, seeking to answer whether the AQ factor differentiates representatives of the humanities and IT professionals in other cultures as well.

The text is organized as follows. First, it describes some of the Baron-Cohen group's findings concerning the specific cognitive styles characteristic of High-Functioning Autistics, persons with Asperger syndrome, IT specialists and men. The next section presents a summary of findings concerning the specifics of persons who learn effectively with the use of e-tuition tools. The next part discusses cognitive styles, comparing the Baron-Cohen approach and a typology of cognitive styles proposed by Sternberg. The fourth part presents the methodology used in the empirical study and the fifth – its results. First version of part 3, 5 and partly 6 of this article was published in Polish in (Woźniak 2013a).

To start with, we should note that the study described is of an introductory nature, as its goal was primarily to verify tools and check whether the differences described by Baron-Cohen's group appear analogously in the group of Polish extramural students. This character of the study justifies the use of a relatively small (120 subject) sample. The publication of these introductory findings is an invitation to conduct broader research.

2. The autism spectrum and differences between people

Medical practitioners use the term "autism spectrum" to describe the range of differences between different types of persons with social and communication disorders, who also exhibit strong limitations in a variety of areas of interest and (frequently) compulsory repetitive behavioural patterns. The ASD (Autism Spectrum Disorder) includes – grading the scale of difficulties experienced in everyday social life – among others:

– Autism,
– Asperger syndrome (AS),
– HFA (High-FunctioningAutism),
– and others – cf.: Austism Spectrum Disorder Fact Sheet)

"Autism is defined as a disorder of social development and communication, characterised by compulsory-repetitive behaviours and a limited imagination" (Baron–Cohen *et al.* 2001). The most serious disorder in the ASD is considered to be (childhood) autism, which makes itself apparent before a child is three years old and consists of disorders of behaviour and perception. In Asperger's syndrome, the disorders are similar, but the child does not exhibit delays in speech development or cognitive skills, and speech disorders are far weaker than in autistics. Both disorders have three common features, which form the basis for diagnosis:

1.deficitsin social development;
2.deficits in communicationdevelopment;
3.very strong but limited interests and compulsory-repetitive behaviour.

The next category (HFA) in the autism spectrum classifies persons whose social deficits are lesser, due mainly to a higher level of cognitive skills. In Poland, HFA is treated as an informal category and applied to persons with a not lower than average IQ. When referring to autism and the Autism Spectrum Disorder (ASD) in our text, unless otherwise stated, we will mean the above category, i.e. HFA.

Boys feature ASD four times more frequently than girls. Persons with disorders from the spectrum – other than autism – as a rule function well and have highly developed cognitive skills, though these may be limited to chosen fields, so ASs or HFAs may attain excellent results at work.

It should be noted that contemporary biological science considers the autism spectrum to be no more than the extreme end of a dimension of social functioning (Guidice *et al.* 2010; Auyeung *et al.* 2009) – hence people who function in a socially appropriate way may also feature traits characteristic of the autism spectrum. The dimensions of this similarity are variously described, but from the perspective of this text we are interested in two cognitive dimensions, i.e. empathising and systematizing.

Empathising is understood here as recognizing on the cognitive level and reacting emotionally in an adequate way to feelings shown by other people. Systematizing is the tendency to analyse and construct systems, understood as "attempts to discover rules governing a system, to be able to predict how the system will behave" (Auyeung *et al.* 2009). An analogous differentiation studied in this field of research concerns the differences between focus on mechanical cognitive activities

(among others: good spatial orientation, distinguishing cause-effect relationships) and mental cognitive activities (among others: communication skills, empathy or understanding social situations) (Guidice *et al.* 2010).

Most people evince a moderate level of one or both these kinds of features, while "individuals of the autism spectrum are characterized by impairment in empathizing alongside intact, or even superior systematizing. Adults with AS [Asperger's syndrome] are more likely to have a brain of extreme type S [systematizing] and are distinguished by their high SQ-EQ [difference between systematizing level and empathizing level] difference score" (Baron-Cohen *et al.* 2005).

To diagnose these factors, the Baron-Cohen group developed a questionnaire tool measuring the so-called AQ coefficient, which is a measure of this difference. Attempts have been made to interpret the results by turning to biology and hormonal factors, which may result in a changed formation of synapses in the prenatal period (Baron-Cohen *et al.* 2005). Such an explanation however does not seem to be commonly accepted (Guidice *et al.* 2010).

High systematizing skills may explain the so-called autism paradox, which is manifested in the fact that some autistics have high or even extremely high intellectual skills in certain areas (e.g. mathematics), while they are extremely deficient in others. In certain cases the tendency to focus obsessively on chosen issues, linked with high analytical skills, may be of help in finding work related to the subject of the obsessive focus. This work is frequently of a technical nature or in IT.

Currently, such "obsessive" behaviours frequently revolve around computers. As a result, Asperger's syndrome is sometimes called the "geek syndrome", or in other words the computer maniac disorder.

Computers were developed to store and process information, which is a favourite activity for persons with this syndrome. The effectiveness of persons with high AQ measures has found a place for itself in business. In various countries borderline autistics are employed as programmers and testers. According to gazeta.pl, company SAP has been employing autistics in its research and development centres in India and Ireland since 2011, and by 2020 wants 1% of its employees to be autistics. According to data available on the Internet, the first enterprise to employ autistics for testing computer programs was the Danish company Specialisterne, created in 2005 by Thorkil Sonne. Specialisterne does not have any special funding or tax relief for this purpose – it functions in a market economy, as autistics have turned out to be excellent testers of computer programs.

Businesses usually employ persons with a light form of autism (HFA), most frequently with Asperger's syndrome, who are able to function normally but react negatively to new surroundings, unexpected situations and the company of people they do not know. For this reason they frequently drop out of the mainstream education system, which requires passing stressful exams.

The gradual de-labelling of the autism spectrum may also be helped by research showing that further steps in this spectrum are represented by groups of persons who function in a socially appropriate way – namely students of the sciences (from mathematicians and IT professionals, to engineers), and men. Research has shown, though the samples were not large, that the discrepancy between systematizing and empathizing skills in men – as compared with women – is high (Baron-Cohen *et al.* 2005). This effect is stronger yet for students of mathematics and (weaker than for mathematicians but stronger than for men) the sciences, as compared to students of the humanities and social sciences (Baron-Cohen *et al.* 2001).

For the purposes of this text, it needs to be emphasized that a relatively high disparity between systematizing and empathizing styles becomes an indirect index of dysfunctions on the autism spectrum only after a well-defined level of discrepancy is crossed. Measures of this disparity in persons who function effectively in everyday life can only be a gauge for understanding their talents or interests in certain areas. Well-known studies of professional interests (such as Holland's typology, cf. e.g. Woźniak 2013b) are based on the similarity between declared interests and the interests of people who work in the given profession. In contrast, systematizing and empathizing indices diagnose chosen cognitive skills (i.e. "hard" personality features), even if the diagnosis is conducted using questionnaires measuring preferences for types of social situations.

It should also be mentioned that all the differences described here characterize groups and say nothing of individual differences, i.e. they do not for instance diagnose whether a specific woman will be a good or not-so-good IT specialist (Baron-Cohen *et al.* 2005).

3. The specifics of people who learn efficiently with the use of e-learning tools

Tuition with the use of e-learning tools is currently an important segment of the educational industry, both general education as that carried out by the business sector. Research conducted by ASTD

shows that about 1/3 of the time devoted to training in American businesses is done through e-learning channels (Woźniak 2009). Naturally, the question whether everyone can learn with the use of these methods is gaining theoretical as well as practical weight.

A good e-student is defined in this text as someone for whom learning the appropriate content with the use of e-learning methods comes with ease, and who derives satisfaction from doing so. We do not enter into discussions – either on a general level, or to compare ease of learning with traditional methods – whether all educational content can be taught with the use of e-learning tools. We simply accept that good e-students are able to take better advantage of an e-course than average students, both as concerns learning effectiveness as their satisfaction. A measure of educational effectiveness which puts together indices from Kirkpatrick's levels 1 and 2 is natural for practical purposes, as research suggests that both these factors independently affect implementation of training content by the trainee (Alliger *et al.* 1997; Woźniak 2010). This section of the article analyses research into the characteristics of good e-learners, with the aim of distinguishing such traits that are practically unalterable (so called personality traits), which favour becoming a good e-student.

Research on the specifics of good e-learners is conducted within two different frameworks. The first looks at psychological features which incline a person to reach for new technologies, and bases on the Technology Acceptance Model (TAM – Davis *et al.* 1989). This model postulates that the intention to use a new technology (specifically in this case: an e-learning course) is completely determined by two psychological states: perceived ease and perceived utility. The model has been criticized on multiple occasions for not taking into consideration situational factors of different kinds, which obviously have an influence on the intention to use new technologies (Woźniak 2009). For instance, if my previous experiences with this technology were good, this fact may directly influence the intention to use a new technology (and not only indirectly via perceived ease of use) – (ibid).

At the time of writing, a third version of this model, the TAM3 (Brown, Charlier 2013), additionally examines the effects both of preceding variables, as of variables which act independently of the two fundamental TAM variables. The value of TAM-based studies is continually being discussed, as several allegations go beyond the obvious limitations of this model. Specifically:

– The relationship between intention to use and de-facto implementation is unclear – Zang *et al.* (2008) show that the model they propose explains over 70% variability in the intention to use, as opposed to only 13% in the implementation of an e-learning course (Woźniak 2009). In the opinion of some, TAM3 explains about 40% of the variability in the intention to use (Brown, Charlier 2013).
– The intention to use cannot be treated as a prognostic for implementation, as such usage would disregard organizational factors (such as coercion and incentives on the part of the institution, pressure from superiors, colleagues and clients, tasks engaged in, etc.) that have de facto influence on workplace behaviour (Brown, Charlier 2013). It has long been proven for instance, that being overworked is a good (negative) prognostic for time spent on e-learning (Woźniak 2009).
– e-learning has ceased to be a new technology. Contemporary students have been living in a computerized world for years and the number of e-natives relative to those who just use new technologies is constantly growing. In this sense data that intention to use explains ca. 1/3 of the variability of implementation (Liao, Lu 2008) should be treated at the most as a historical fact, or at least as one unrelated to the newness of the technology.

Although the TAM is still an important focal point for e-learning research (Brown, Charlier 2013), it should be noted that in models of this kind, students' cognitive or biological specifics have no explanatory significance, as only psychological factors (or TAM 3's situational or organizational factors) are taken into consideration.

A second, completely different and fairly atheoretical approach studies the specific features which make e-learning easier. Although the conclusions from this research suggest that motivational factors have a dominant significance (Maurer *et al.* 2008; Brown, Charlier 2013), some of the variables go beyond the psychological factors characteristic of TAM research. For example, among variables describing students' attitudes, the following are of significance for success in e-learning: readiness to use e-literature and ICTs (Nadelko 2008), learning orientation as opposed to success-orientation (Swan 2004). These variables are to a certain extent situational, operationalized as answers to specific questions, and their relationship to an individual's permanent traits is unclear.

Permanent features have included: self-discipline (Nadelko 2008), visual (as opposed auditory or kinesthetic) learning style and finally preference for reflective observation and abstract

conceptualization over the remaining two of David Kolb's learning styles (Swan 2004). It has also been shown that success in e-learning is favoured by a low need for interaction with colleagues (Nadelko 2008) and belonging to groups which are: maturer, independent and risk-taking (cf. literature cited in Woźniak 2009: 43).

Such personality features as conscientiousness and openness to new experiences have been shown to indirectly favour high levels of motivation to learn (and so also e-learn), through goal orientation (Maurer, Lippstreu, Judge 2008). This is consistent with the common knowledge view that e-learning is easier for goal-oriented and disciplined persons.

It has also been shown that – from a certain level – cognitive skills have no significance for self-developmental activities, and (apart from motivational factors) satisfaction with e-learning is directly related to previous experience with this tool (Maurer *et al.* 2008; Woźniak 2009; Brown, Charlier 2013). It has only recently been shown that e-trainings raise cognitive requirements (are more demanding cognitively) placed on learners (Lin *et al.* 2013), which seems to suggest that persons with higher cognitive skills may deal better with e-learning. However, the research did not specify the kind of cognitive skills involved.

Basing on these results as our current state of knowledge, it seems that the self-discipline, time management skills, maturity and strong goal-orientation of "good students" (Woźniak 2009) are factors that favour a high motivation to learn, rather than being independent factors affecting ease in e-learning. As motivation to learn may be influenced by changing organizational factors (Woźniak 2009), we do not currently know whether any specific cognitive factors are related to e-learning ability, readiness to learn this way or satisfaction with doing so. This would mean that independent of AQ level, groups should not differ in their reactions to e-learning.

We should also draw attention to medical studies which show the appropriateness of e-learning for persons diagnosed with autism disorders. Research emphasizes that "interacting with a computer is treated by [autistic persons] as a 'safe' and 'enjoyable' experience". This may be explained by the fact that when interacting with a computer one is not faced with threatening expectations or evaluation, in opposition to social situations" (Konstantinidis *et al.* 2009).

Research into e-learning systems adapted to persons with cognitive dysfunctions (and this includes HFAs) has not been widely conducted (Wachowiak *et al.* 2010), although such adjusted e-learning systems have been recommended especially for HFAs (ibid). It should also be noted that e-learning tools for developing social skills have been constructed for persons with AS (Baron-Cohen 2009).

To summarize, research on the autism spectrum suggests that persons with these dysfunctions have a greater capacity to study using e-learning tools than traditional ones. The theoretical reasoning behind this research – that social interaction induced stress levels are decreased in e-learning situations – allows us to assume that this suggestion will also apply to persons who function effectively but who have an "IT (or ASD) profile", i.e. higher systematization levels as compared with empathizing levels. Such a "good e-student" profile, which has not as yet been the object of e-learning research, will be the focus of our study, described below.

4. A good e-learner – an issue of personality, or cognitive styles?

Psychology defines personality as a set of fairly permanent features or psychological dispositions which differentiate the individual from others (Strelau 2006). Personality theories are divided into two groups, depending on whether the source of repetitive patterns of behaviour is seen to lie in a hidden set of traits, or the individual's specific manner of perceiving the world. One trend focuses on studying individual differences and features of the personality, the other on cognitive styles (Strelau 2006).

The roots of the first of these – which claims that psychophysical processes are organized by sets of hidden traits – lie in typologies of character developed in antiquity among others by Aristotle; in modern times they base on Gordon Allport's model from the 1960s (Strelau 2006). Personality theory sees individual differences to lie in biological factors and considers these to be responsible for the difficulties an individual experiences in modifying his or her behaviour. The last chapter pointed out that studies on e-learning have not uncovered many personality traits to be indicative of being a good e-learner.

Cognitive approaches to personality seek to describe the ways in which individuals organize their perception of internal and external reality through construing comprehensible categories – contained e.g. in self-image – which in turn drive standard behavioural reactions. Several personal constructs which control an individual's activity – such as learned helplessness, locus of control, self-image value and self-efficacy – determine an individual's unique response to situational challenges. An individual's reactions are regulated not only by

his or her skill level or IQ, but also by cognitive style, understood as "a preferred style of cognitive functioning, related to the individual's needs" (Matczak 2006). Cognitive styles function as an intermediary level between the situation and an individual's behaviour, and though they have nothing in common with cognitive abilities and skills, they affect how an individual uses his or her abilities in a given situation.

These cognitive styles constitute an element of personality in the sense that they develop fairly early (in childhood), however they are determined not biologically, but culturally and through socialization. Depending on their cognitive style, an individual will find it harder or easier to deal with a given type of task. However, no style rules out implementing any task, as long as the individual puts enough appropriate effort (associated above all with their motivation level or situational factors) into this (Matczak 2006). Just as the habit of writing with one's right hand makes it more difficult to write with the left, so cognitive style can limit the fluency, efficiency or pleasure an individual experiences when engaging in certain tasks – not ruling out that they can be completed despite the style (as long as the perceived utility of the task is sufficiently high).

Cognitive style theories are just as varied as personality trait theories, and there is no one, approved, all-encompassing standard systematizing theoretical analyses. Among those which are at present fashionable is Robert Sternberg's theory from 1994, which draws attention to the susceptibility of cognitive styles to the kind of tasks an individual met with in the course of socialization. This theory emphasizes the biographic variability of cognitive styles as well as an individual's tendency to use different styles depending on the situation. The elegance of this theory – which emphasizes the role of metacognitive control and decisional processes in regulating the work of other cognitive processes – is reflected in its referral to concepts traditionally related to typologies of political power.

Sternberg's theory of intellectual styles (a mind's styles of government) classifies people on five dimensions:

- function (there is a legislative style creating rules, an executive style which implements them and a judicial style which evaluates effects, analogously to the three aspects of government);
- forms, or the way in which cognitive resources are distributed for different tasks (a monarchic style focusing on one thing at a time, a hierarchic style which implements many priorities, an oligarchic style – when there are multiple, non-hierarchical tasks, and an anarchic style which is flexible in its approach to tasks);
- level of abstraction (a global style focused on the whole, and a local style – on particular details);
- scope (an internal or introvert style – which likes to work independently, and an external or extrovert style – which likes tasks in which relationships with others are built);
- learning, or openness to change (a liberal style which likes new and unclear tasks, and a conservative style which prefers to follow procedures and rules).

These cognitive styles describe an individual's preferred style of functioning, i.e. what one prefers and not how able one is. There is a similarity to Jung's classification, especially visible in the categories of scope, level of abstraction and form.
These styles (described above) are naturally not independent (at the most – and even this is not obvious – this can be said only of the dimensions). Sternberg's colleague, L.-F. Zhang emphasizes that these styles typology can be brought down to three types:

- type I – creative, more cognitively complex;
- type II – prefers procedures, lower level of cognitive complexity;
- type III – depending on the situation, takes on the features of type I or type II (Zhang 2008).

Research using Sternberg's 13-category typology has yielded results which suggest that persons preferring independent work (the internal style) and acting outside procedures (the liberal style) achieve better results when using e-learning tools for study, than persons on the opposite ends of the dimensions (Swan 2004).

According to Zhang's three-type categorization, the liberal style belongs to type I, while the internal style to type III. Hence we should expect that type II persons will be less effective in e-trainings. The author is not aware of any research which would verify these conclusions, so empirical verification of these statements is one of the goals of this text. It should be noted that these hypothesis are highly speculative – based on previous empirical research and correlations and not on theoretical reasoning.

5. Methods

The goal of the study was to verify whether a correlation exists between declared ease of e-learning and two factors describing an individual: the AQ coefficient measuring differences in empathizing and systematizing, and Sternberg's simplified type

II cognitive style. We also wanted to show that IT students on average evince higher AQ values than students of the arts, which would indicate that the difference between science- and arts-oriented minds also occurs in other cultural environments than those studied to date.

The study was conducted on a group of 120 extramural undergraduate students. 1st year management students, 3rd year management students, 1st year IT students and 3rd year IT students each comprised ¼ of the sample. Most of the students also worked professionally although they had just begun their careers (as shown by their age – between 22-30 years).

The choice of students, enrolled in a private Warsaw university, was dictated by the researchers' convenience and the fact that in both departments the same subject is studied in the form of a compulsory e-learning module. We could thus use the common experience of students from two different environments, who – it was to be expected – would manifest different cognitive profiles.

Research has usually treated e-learning trainings as a uniform kind of stimulus. It has not taken into account the fact that some e-learning courses (e.g. more richly interactive or with a broader range of teaching techniques) may cause different responses and be variously evaluated, not because students differ with respect to learning profiles, but because the quality of their learning experiences (the quality of the stimulus) is different. The choice of samples in our study puts a partial check on this difficulty.

Measurement scales were adapted from the English, and locally specific ad hoc ones were added. Due to the pilot nature of the study, the tools used were not standardized or localized.

The AQ variable (measuring difference between empathizing and systematizing) was tested using a Polish translation of the English scale from (Baron-Cohen *et al.* 2001).

A scale measuring satisfaction with e-learning was constructed basing on a five-point scale from (Maurer *et al.* 2003), with the addition of two questions: (i) "The *Academic skills* course gave sufficient information on this subject", and (ii) "I had no difficulty with completing the *Academic skills* course". These questions were phrased in this way for two reasons. Firstly, (Alliger *et al.* 1997) have shown that using questions concerning utility or the adequacy of content to assess satisfaction with a course has the highest correlation with application (i.e. satisfaction is the best measure for predicting training transfer). Secondly, the "*Academic skills*" course is considered to be a poor e-learning module, overloaded with presentations and lacking in more refined exercises or simulations. When informally questioned, students state it to be boring and not very useful – so any praise it earns was considered to be indicative of ease in the use of e-learning tools.

The third scale, which was developed for the purpose, measured orientation towards success, efficacy and preference for clear procedures. The index for success-orientation was the declared college average, and of efficacy – the answer to the questions "I can learn using any method" and "I'm not afraid of using computers". Sternberg's type II was diagnosed with the questions: "I like to adhere to clear and distinct rules" and "I know that I function well when I am given clear procedures to follow".

The study was conducted in April 2013, the basis for the empirical part of the MA thesis of Ms Joanna Homka, a 5th year student of The University of Finances and Management in Warsaw.
The study was to verify three hypotheses, operationalizing the concept of "good e-student" in different ways:

1.Humanists evince an average lower level of the AQ coefficient – measured using a Polish translated version of the questionnaire from (Baron-Cohen et al. 2001) – as compared with IT professionals.

2.Persons with a higher AQ index more frequently call themselves "a good e-learner".

Persons with a higher AQ index more rarely declare themselves as type II in Sternberg's modified typology.

6. Research results

The point of departure for further analyses of the hypotheses was verifying the adequacy of measuring the AQ coefficient with the help of the translated English questionnaire. A measure of the AQ's adequacy was taken to be differentiating between the two groups studied – humanists and IT students. The graph below shows how a higher AQ level differentiates the two groups. The horizontal axis illustrates the number of questions which give AQ answers (the maximum is 50 questions, indices over 31 are diagnostic for autism), while the vertical axis illustrates the number of persons in each group who gave AQ answers, in percentages. Curve k in Figure 1, represents the distribution of AQ in the general population in United Kingdom (from research conducted by Baron-Cohen *et al.* 2001).

The figure shows that the Polish questionnaire differentiates IT and management students as predicted, i.e. IT students frequently evince a higher level of the AQ index than humanists (represented here by students of management). The data collected also allows us state that the mean value of the AQ coefficient also reflects this interdepend-

ence, which is illustrated in Table 1 below. We may jokingly say that education brings effects – an increase in humanists' ability to systematize (statistically insignificant).

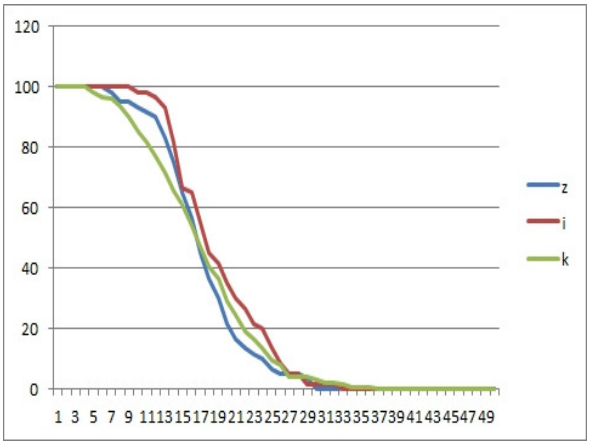

Fig. 1. Comparison between IT students (curve i) and management students (curve z) with the national population in England (curve k) (source: for curves z and i – own research; for curve k – on the basis of data from (Baron-Cohen *et al.*2001))

Table 1. Mean value of the AQ coefficient for student groups (Source: own research)

Level	Mean	N	Standard deviation
1st year of management	17,4333	30	5,01503
3rd year of management	17,6333	30	4,92344
1st year of IT	19,1333	30	4,85467
3rd year of IT	19,1333	30	5,24393
Total	18,3333	120	5,01315

Hypothesis 2, concerning the relationship between AQ coefficient level and being a good e-student, was not confirmed, although for most operationalizations of the term "good e-student" the trends were as predicted (though insignificant statistically). To verify the hypothesis, the subjects were divided into four groups of similar size, according to AQ coefficient levels.

Declarations of satisfaction with using e-learning tools for studying ("I like to e-learn") show that each of the four AQ coefficient levels gives fairly similar e-learning satisfaction levels, although in the two highest groups, 55% like e-learning while in the two lowest – 45%. Subjects declare slightly higher efficacy levels ("I can study using e-learning tools"), i.e. about 2/3 positive answers (and in the group with highest AQ levels 83%).

These levels are even higher when the question concerns a specific course ("I had no difficulty with completing the *Academic skills* course"). Although in this case the lowest efficacy was manifested in the group with the highest AQ. As should have been expected, ratings of the utility of a poor e-learning course were definitely lower than ratings of how easy it is. Even here, however, 2/3 of the ratings were positive (and the lower the AQ – the higher the ratings). The group with the lowest AQ rated the utility of the course higher than the remaining groups – both the percentage of highest ratings was greatest (the remaining AQ groups gave half as many), as average ratings ("rather yes").

The distribution of answers to questions concerning general declarations ("I usually prefer a good e-learning course to other ways of learning" and "there are topics which I prefer to get acquainted with through e-learning") did not show significant differences between the four AQ-level groups. It was found that subjects with the highest and second highest AQ levels preferred e-learning courses as opposed to subjects with medium and lower AQ, and those from the AC higher groups more frequently preferred e-courses for certain topics (1/3 "decidedly agreed" in comparison with 14%), but the sample was too small for the result to be significant statistically.

The third hypothesis, assuming that persons with lower AQ levels will give more positive answers to questions concerning preference for rules and procedures ("I like to adhere to clear and distinct rules" and "I know that I function well when I am given clear procedures to follow"), was only partially confirmed. In the first of these the answer "I decidedly agree" was found to be related to AQ intensity – among persons with the highest AQ, the smallest percentage chose this answer. The differences between the successive AQ levels were not great however (respectively starting from the highest AQ level: 28%, 41%, 38%, 54% persons chose "I decidedly agree"). The question concerning satisfaction therefore confirmed hypothesis 3. A very weak relationship was observed on the other hand with the question concerning effectiveness, as only a few people from the two highest AQ levels answered that they do not act efficiently when the procedure is clear. For both these questions, over 90% respondents from both groups gave positive answers (with the exception described above of the question concerning satisfaction in the highest AQ level).

7. Conclusions

From a management perspective, knowledge concerning preferences and talents of different individuals may be very useful. However, instructions concerning their development are frequently based on stereotypes with no scientific foundation. The goal of this text was to start verifying whether the

AQ coefficient may be a significant enough variable to recommend its use in planning development.

A sample of young professionals who simultaneously attend a private extramural university course in Warsaw has shown that the AQ coefficient does differentiate IT and management workers, as has been suggested by the English study.

However, no strong relationships were observed between AQ coefficient values and type II preferences form Sternberg's modified typology, or between AQ values and declared e-learning proficiency. This second result was unexpected, as several operationalizations of the category of "good e-student" – the measure used for declared proficiency and satisfaction derived from e-learning methods – were tested. This result suggests that the specific cognitive orientation responsible for choosing a sciences-oriented profession, at least one which the AQ scale measures, operationalized on 4 levels of intensity, does not have any significant effect on perceived value of tuition with the help of e-learning tools.

There are several limitations to generalizing our conclusions. Firstly, management directives concern activities to be implemented and not opinions about activities. Our study, however, concerned opinions and not activities, as proficiency in the role of a good e-student was evaluated using measures of responses in Kirkpatrick's typology. Some of the questions concerned satisfaction with real occurrences, but some were general declarations of satisfaction. Rather than being an indicator of attitude to e-learning, this made them resemble declarations of efficacy in some unclearly specified field of activity. Research shows that efficacy is a good prognostic for implementation, as long as it concerns a precisely defined group of activities which the respondent evaluates. Similarly – assessment of responses are the best, but still very weak, prognostic for implementation of guidelines taught during training.

Secondly, the respondents' declarations concerned a quite specific e-learning course and their general declarations may have been partially biased by reference to this course. "Academic skills" is a fairly static lecture on skills which are not particularly pertinent to students' immediate needs, so our results may simply demonstrate the lack of association between the AQ coefficient and low quality e-learning courses, which additionally do not address students' perceived needs. This kind of limitation in e-learning studies, where the kind and quality of courses are not differentiated between, requires further research. Just as assessment of self-efficacy differs depending on the specific challenge for which the efficacy is measured, opinions concerning e-learning efficacy should also differ depending on the kind of course the respondents have in mind when they formulate their opinions.

The data was analysed assuming a specific interpretation of AQ intensity. The theoretical model on which the AQ coefficient measure is based does not indicate convincingly how to assign respondents to the several AQ categories. The sample was too small to verify the hypotheses on more differentiated operationalizations of this variable. Similarly, we did not take into consideration that it is not so much the AQ coefficient as some of its constituent variables (the AQ scale consists of 5 partial scales) that are related to being a good e-student. Another of the Woźniak's texts (Woźniak 2014, in press) has shown that this is not the case either.

The fourth limitation is obvious. The sample was small, and its character – though adequate for an exploratory study – fairly accidental from the point of view of generalizing results. Hence we propose that more wide scale research into the relationship between an individual's more permanent features, their readiness to choose e-learning methods and evaluations of self-efficacy should be conducted.

It should be noted that studies of preferences for various tools of development are still infrequent. Their significance for management – as sources of advice on how to build efficient training procedures and increase the speed with which employee competencies are developed – is self-evident. This gap in scientific knowledge may be partially explained by a weakness of theories on which e-learning research is based, i.e. that they still treat e-learning from the perspective of applying new technologies. In the opinion of the Woźniak of this text, opening the "black box", which in the TAM theoretical model is an active person with traits, preferences and values, will be the most important input of the research project into understanding the determinants of efficiency in e-learning.

References

Ahuja, M. K. 2002. Women in the information technology profession: a literature review, synthesis and research agenda, *European Journal of Information Systems* 11: 20–30. http://dx.doi.org/10.1057/palgrave.ejis.3000417

Alliger, G. M.; Tannenbaum, S. I.; Bennettjr, W.; Traver, H.; Shotland, A. 1997. A Meta-analysis of the Relations Among Training Criteria, *Personnel Psychology* 50(2): 341–358. http://dx.doi.org/10.1111/j.1744-6570.1997.tb00911.x

APP. 2014 Austism Spectrum Disorder Fact Sheet American Psychiatric Publishing (APP) [online] [cited 1 January 2014]. Available from Internet:

http://www.dsm5.org/Documents/Autism%20Spectrum%20Disorder%20Fact%20Sheet.pdf

Auyeung, B.; Baron-Cohen, S.; Ashwin, E., Knickmeyer, R., Taylor, K., Hackett, G. 2009. Foetal Testosterone and Autistic Traits, *British Journal of Psychology* 100: 1–22. http://dx.doi.org/10.1348/000712608X311731

Baron-Cohen, S. 2009. Autism: The Empathizing–Systemizing (E-S) Theory, *The Year in Cognitive Neuroscience 2009: Annals of the New York Academy of Sciences* 1156: 68–80. http://dx.doi.org/10.1111/j.1749-6632.2009.04467.x

Baron-Cohen, S.; Knickmeyer, R. C.; Belmonte, M. K. 2005. Sex Differences in the Brain: Implications for Explaining Autism, *Science* 310: 819–822.

Baron-Cohen, S.; Wheelwright, S.; Skinner, R.; Martin, J.; Clubley, E. 2001. The Autism-Spectrum Quotient (AQ): Evidence from Asperger Syndrome/High-Functioning Autism, Males and Females, Scientists and Mathematicians, *Journal of Autism and Developmental Disorders* 31(1): 5–17. http://dx.doi.org/10.1023/A:1005653411471

Brown, K. G.; Charlier, S. D. 2013. An Integrative Model of e-Learning Use: Leveraging Theory to Understand and Increase Usage, *Human Resource Management Review* 23: 37–49. http://dx.doi.org/10.1016/j.hrmr.2012.06.004

Davis, F. D.; Bagozzi, R. P.; Warshaw, P. R. 1989. User Acceptance of Computer Technology: A Comparison of Two Theoretical Models, *Management Science* 35(8): 982–1002. http://dx.doi.org/10.1287/mnsc.35.8.982

Giudice, M.; del Angeleri, R.; Brizio, A.; Elena, M. R. 2010. The Evolution of Autistic-like and Schizotypal Traits: A Sexual Selection Hypothesis, *Frontiers in Psychology* 1: 1–18. http://dx.doi.org/10.3389/fpsyg.2010.00041

Iszkowski, W.; Tadeusiewicz, R. 2011. Czy istnieje specyficzny profil psychologiczny programistów, in *Informatyka i psychologia w społeczeństwie informacyjnym* [IT and psychology in information society], R.Tadeusiewicz, T. Rowiński (Ed.), Wyd. AGH, Kraków.

Konstantinidis, E. I.; Luneski, A.; Frantzidis, C. A.; Nikolaidou, M.; Hitoglou-Antoniadou, M.; Bamidis, P. D. 2009. Information and Communication Technologies (ICT) for Enhanced Education of Children with Autism Spectrum Disorders, *The Journal on Information Technology in Healthcare* 7(5): 284–292.

Liao, H.-L.; Lu, H.-P. 2008. The role of experience and innovation characteristics in the adoption and continued use of e-learning websites, *Computers & Education* 51(4): 1405–1416. http://dx.doi.org/10.1016/j.compedu.2007.11.006

Lin, C.-H.; Yang, S.-C.; Lai, C.-C. 2013. Support as a Mediator of the Impact Cognitive Load On Students' e-Portfolio Learning Outcomes, *Social Behavior and Personality* 41(1): 17–30. http://dx.doi.org/10.2224/sbp.2013.41.1.17

Łubieńska, K.; Woźniak, J. 2012. Managing IT Workers, *Journal of Business, Management and Education* 10(1): 77–90. http://dx.doi.org/10.3846/bme.2012.07

Maurer, T. J.; Lippstreu, M.; Judge, T.A. 2008. Structural Model of Employee Involvement in Skill Development Activity: The Role of Individual Differences, *Journal of Vocational Behavior* 72: 336–350. http://dx.doi.org/10.1016/j.jvb.2007.10.010

Maurer, T. J.; Weiss, E. M.; Barbeite, F. G. 2003. A Model of Involvement in Work-related Learning and Development Activity: The Effects of Individual, Situational, Motivational, and Age Variables, *Journal of Applied Psychology* 88(4): 707–724. http://dx.doi.org/10.1037/0021-9010.88.4.707

Matczak, A. 2006. *Style poznawcze*. in: Strelau J. (Ed.). *Psychologia. Podręcznik akademicki.* GWP, Gdańsk.

Nedelko, Z. 2008. Participants' Characteristics for E-Learning, in *Proccedings of E-leader Krakow 2008*, [online] [cited 17 November 2012]. Available from Internet: http://www.g-casa.com/PDF/Krakow%202008/krakow%20papers%20pdf/paper%20database%20krakow/Nedelko.pdf11

Strelau, J. (Ed.). 2006. *Psychologia. Podręcznik akademicki* [Psychology]. GWP, Gdańsk.

Swan, K. 2004. *Learning Online: Current Research on Issues of Interface*, Teaching Presence and Learner Characteristics. in: J. Bourne & J. C. Moore (Eds) Elements of Quality Online Education, Into the Mainstream. Needham, MA: Sloan Center for Online Education, 63-79.

Trauth, E. M.; Quesenberry, J. L.; Huang, H. 2009. Retaining Women in the U.S. IT Workforce: Theorizing the Influence of Organizational Factors, *European Journal of Information Systems* 18: 476–497. http://dx.doi.org/10.1057/ejis.2009.31

Wachowiak, M. P.; Wachowiak-Smolikova, R.; Fryia, G. D. 2010. Practical Considerations in Human-Computer Interaction for e-Learning Systems for People with Cognitive and Learning Disabilities, *International Journal of Information Studies* 2(1): 60–70.

Woźniak, J. 2014. Czy istnieje typ ludzi nadający się do informatyki i e-learningu. *eduakcja.* (in press).

Woźniak, J. 2013a. O specyfice osób mających preferencje do informatyki i e-learningu [in:] L.Banachowski Ed. Progress in e-education. Wyd.PJWSTK Warsaw, 169-188.

Woźniak, J. 2013b. *Rekrutacja – teoria i praktyka* [Recruitment and selection - theory and praxis]. WP PWN Warszawa.

Woźniak, J. 2012. *Współczesne systemy motywacyjne – teoria i praktyka* [Contemprorary motivational systems – theory and praxis]. WP PWN Warszawa.

Woźniak, J. 2010. O ocenianie e-szkoleń z perspektywy teorii Kirkpatricka i wiedzy naukowej na temat efektywności szkoleń [in:] L.Banachowski (Ed.), *Postępy e-edukacji* [*Progress in e-eduation*]. Wyd.PJWSTK Warszawa.

Woźniak, J. 2009. *e-Learning w edukacji i biznesie* [E-learning in business and education]. Wyd.Akademickie i Profesjonalne, Warszawa.

Zhang, L.-F. 2008. Thinking Styles and Identity Development Among Chinese University Students, *The American Journal of Psychology* 121(2): 255–271. http://dx.doi.org/10.2307/20445460

Zhang, S.; Zhao, J.; Tan, W. 2008. Extending TAM for online learning systems: an intrisic motivation perspective, *Tsinghua Science and Technology* 13(3): 312–317. http://dx.doi.org/10.1016/S1007-0214(08)70050-6