ISSN 1803-1617

2011 ERIES JOURNAL

Journal on Efficiency and Responsibility in Education and Science

Table of Contents

An international peer-reviewed journal published by
Faculty of Economics and Management
Czech University of Life Sciences Prague

contact: editor@eriesjournal.com
www.eriesjournal.com

ISSUE 2

ERIES Journal

JOURNAL ON EFFICIENCY AND RESPONSIBILITY IN EDUCATION AND SCIENCE

Aims and Scope

The Journal on Efficiency and Responsibility in Education and Science aims to publish perspectives of authors dealing with issues of efficiency and/or responsibility in education and related scientific disciplines. The focus is on topics such as:

- theory and methodology of pedagogy and education;
- theory and methodology of science;
- human resources and human relations management;
- knowledge management and knowledge engineering;
- systems engineering and information engineering;
- quantitative methods.

The journal accepts quantitative, qualitative and experience-based full research papers, short communications or review studies. Applications and case studies introducing and describing impacts of new theoretical approaches in real conditions of practical case are also accepted.

All papers passed a double-blind peer review process.

Published by the Faculty of Economics and Management, Czech University of Life Sciences Prague

ISSN 1803-1617 (electronic version)

Journal on Efficiency and Responsibility in Education and Science
ISSN: 1803-1617

FIELD OF STUDY AS A FACTOR INFLUENCING THE MODEL OF VALUE-ADDED ASSESSMENT

Radek Krpec, Michal Burda

University of Ostrava
radek.krpec@osu.cz

ARTICLE INFO

Article type
Full research paper

Article history
Received: May 15, 2011
Received in revised form: June 28, 2011
Accepted: June 29, 2011
Available on-line: June 30, 2011

Abstract

This contribution deals with the possibilities of schools' results evaluation and unbiased assessment of the so called education value-added. Value-added models in education express school contribution to the progress of a pupil in relation to predetermined educational goals. The article is a comparison of two methods of the value-added assessment: method of relative shift and relative gain of knowledge method. The focus is laid on the school's field of study as a factor which could, to a considerable extent, affect the measurement results. Both methods are used for relatively wide range of data drawn from results of secondary school pupils value-added assessments and are compared in respect to the schools' classification according to their field of study. The results show that the field of study is a significant factor influencing the value-added assessment outcomes and have to be taken into account.

Key Words

value-added model, relative gain of knowledge, on-line educational testing, socio-economic facor

Introduction

Value-added assessment and relative gain of knowledge

In present times of changes in the educational system and regarding the pressure put on elementary and secondary school students' progress in the level of education, the necessity of schools' results evaluation is relevant.

One of the possible measurement forms is the value-added assessment based on finding out what part a certain school plays in pupil's progress (Lissitz, 2005; Malach, Malcik, 2010). Here, results from two different time segments at given school are compared. In this respect, test results from separate key phases of the education process may serve to determine the value-added level. Although it is clear that even the value-added assessment does not take into account the whole spectrum of factors affecting pupils' outcomes, and thus it will not solve the problems in measuring a particular contribution of the given school to the pupil's progress, it is still notable improvement against using mere test results.

The OECD definition by Educational policy institute (2008): "Value-added models in education express school contribution to the progress of a pupil in relation to predetermined educational goals. Contribution is a value rid of the other factors instrumental to progress in pupil's education." The value-added assessment models could be divided in two basic groups:

- Simple – assessment is realized in two different time segments
- Contextual – takes into account also factors not influenced by the school

The value-added score of a school is affected by information of contextual character on three levels.

1. Students enrolling at school have been prepared variously in the tested subjects along with other contextual characteristics as socioeconomic status, Income Deprivation Affecting Children Index (IDACI), special educational needs, and so on.
2. The information on their contextual situation is presented during the whole period of school attendance in terms of improvement possibilities.
3. Schools have their educational programmes built up variously regarding the study plans and curricula.

Since the only contextual information available was the field of study, we could not have applied the multiple regression method for the relative shift calculation. One of the possibilities then was to calculate the relative shift, in accordance with so called fields, when each secondary school class partaking in these tests was assigned one of the nine fields of study according to a unified dial. Separate fields were then assigned to "similar" schools with similar educational programme frames and their value-added score is to a certain extent comparable. We have distinguished the following fields: 1. Grammar schools, 2. Lyceum schools, 3. Technical schools, 4. Scientific schools, 5. Economic schools, 6. Services, 7. Pedagogical, social and health-care oriented schools, 8. Social science oriented schools, and 9. Art schools.

Main goal of the article is to compare how the results differ in the sequence of schools with regard to the both methods mentioned – "Total relative shift" and "Total relative gain". Fields of study as a socio-economic factor and it's impact to the value-added school results is also investigated.

Material and Methods

Relative gain of knowledge

One of the models used in practice is the model of relative gain of knowledge (Malčík and Krpec, 2010). For obtaining the student's value-added score, we need to know to what extent the student's outcomes worsened or improved compared with possible presuppositions. By "possible presuppositions" are meant results coincident with results of similar students from different schools. The similarity of students should be considered from the viewpoint of previous results as the best presupposition for the results in future (Malčík, 2007).

For calculation of the relative gain of knowledge we use a linear regression model based on pupil's knowledge measurement in two different time segments between input and output results, see e.g. (McCaffrey, Lockwood, Koretz and Louis, 2004; Liu, 2011; Sanders and Horn, 1994). Figure 1 illustrates the process of delimiting the value-added score in two subjects. The horizontal axis demonstrates input results; output results are illustrated by the vertical axis. The field with pupils' results data is represented by regressive line which is, after subjects and fields of study, calculated using the equation:

$$y_{ij(2)} = a_0 + a_1 y_{ij(1)} + \varepsilon_{ij},$$

while

i – a label of pupil in terms of j-th school,

$y_{ij(2)}$ – final test result,

$y_{ij(1)}$ – previous testing results,

a_0, a_1 – regressive coefficient,

ε_{ij} – accidental error normally divided, independent and with identical variance for each student.

The regressive line roughly interprets average outcomes of students who were placed at a certain point of the input information axis by their previous results.

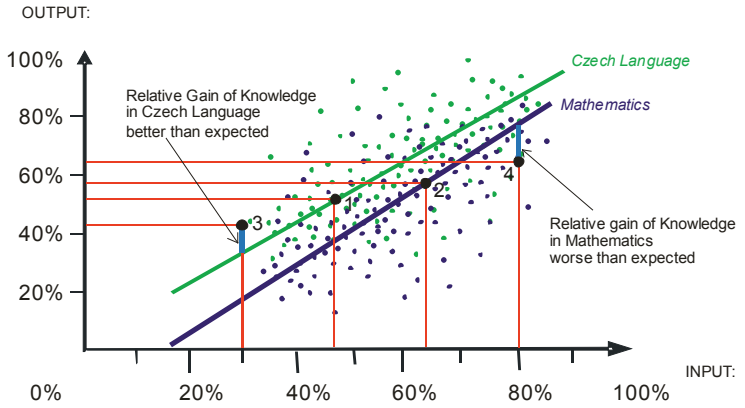


Figure 1 – Method of calculating the Relative gain of knowledge

The Figure 1 shows that student **2**, entering with a success rate of 64%, will probably have an output result reaching 54% in mathematics. This rate is the presumed success rate of the student.

Provided the student will reach better than the presumed results – and in fact half the students always reach better than the presumed results – the student has a "positive residue". Residue is defined as difference between the actually reached success rate and the success rate presumed on the basis of regression line. If the student obtains worse mark than has been presumed, then he or she has a "negative residue", as student **4** in Figure1 has in mathematics. Residues are often referred to as benchmarks of the value-added score. Yet, it will be certainly more accurate if we refer to them as a *relative* value-added. Some

of the students reached higher value-added score than others, as suggested by their residues.

Relative shift

Another way to measure the level of education among pupils is to evaluate the so called Relative shift of a pupil (Vector Module 3). It is a ratio expressing the extent of progress or downgrade in a certain test. It is a rate of progress (downgrade) of a pupil against his or her maximum possible progress (downgrade).

Calculation of relative shift for progress:

$$\frac{output\ \ percentile - input\ \ percentile}{100 - input\ \ percentile}\%.$$

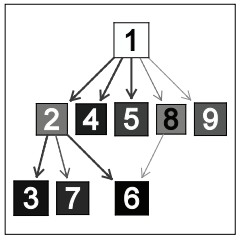
Calculation of relative shift for downgrade:

$$\frac{output\ \ percentile - input\ \ percentile}{input\ \ percentile}\%.$$

Percentile may be interpreted as a ratio of those outperformed by the participant (Chráska, 2007, pp. 202-204). The input percentile is then the one reached by pupil in the input test, the output percentile the one reached in the output test.

Hasse diagrams

The numbered hubs represent individual fields of study, while the direction of arrows signals statistically significant divergence between the given subjects (i.e. rejection of the zero hypothesis of congruity of mean values). The arrows are directed from the fields with higher mean value to those with lower mean value. Hubs not connected with an arrow are incommensurable (i.e. the zero hypothesis was not rejected). Boldness of an arrow represents an extent of significance to which the zero hypothesis was rejected (thin line for the level of 0.05, then 0.01, 0.005 and the thickest line for the level of 0.001). Colour (shades of grey) of the hub also represents relative information on the mean value of the given subject and the hub size represents variance of values.



Description of a tested set

For the comparison we have made use of a set of results from testing which excluded pupils who had results of input or output test between 2007 and 2010 years from some of the three subjects either missing or the result was zero. This set comprised 4,714 pupils of the first year from 83 secondary schools in the Moravian-Silesian region who were examined in three subjects: Czech language (CL), mathematics (MA), English language (EL). The original tests also included the German language, but due to low participation of pupils from various fields of study it was decided only for the learners of English. Pupils' division into separate fields of study was as follows:

Field	No. of pupils
1	1,603
2	485
3	1,205
4	103
5	365
6	432
7	404
8	76
9	41
total	4,714

Table 1: Number of pupils divided into separate fields of study

Results

Comparison of outcomes of "Total relative gain" and "Total relative shift"

Firstly, we will have a look at a comparison of the averages of "Total relative gain" and "Total relative shift" in each individual field. We will see a list of individual fields ordered by the "Total relative gain" and "Total relative shift" in individual subjects.

The order of Czech language is identical in the first three positions, differences occur between the fourth and fifth position and between the sixth and seventh position. Since the differences in "Total relative shift" averages between the fourth and fifth position and also in "Total relative shift" between the sixth and seventh position are not statistically significant, the reversed order could have been coincidental. We may presume that the order shows no significant variances.

In the rest of subjects (mathematics, English language) the sequence of fields does not vary at all. Thus it can be presumed that there is no cardinal difference between both methods.

Field	Average "Total relative shift" in CL
1	0.10
8	0.01
2	-0.01
5	-0.07
9	-0.08
4	-0.09
7	-0.09
3	-0.12
6	-0.14

Field	Average "Total relative gain" in CL
1	4.23
8	0.33
2	0.08
9	-0.84
5	-1.64
7	-2.29
4	-2.62
3	-2.89
6	-3.53

Field	**Average "Total relative shift" in MA**
1	0.13
2	0.01
3	-0.05
5	-0.06
8	-0.08
4	-0.14
6	-0.18
7	-0.24
9	-0.31

Field	**Average "Total relative gain" in MA**
1	7.31
2	0.81
3	-1.58
5	-2.80
8	-5.27
4	-6.84
6	-8.06
7	-10.09
9	-12.62

Field	Average "Total relative shift" in EL
1	0.06
9	0.05
5	0.02
2	-0.01
3	-0.07
7	-0.10
8	-0.10
6	-0.13
4	-0.22

Field	**Average "Total relative gain" in EL**
1	3.12
9	1.97
5	0.22
2	-0.52
3	-1.73
7	-2.16
8	-2.47
6	-2.95
4	-4.78

Table 2 to 7: Total relative shift and total relative gain in Czech language, mathematics and English language

Let us see now how the results differ in the sequence of schools with regard to the both methods mentioned – "Total relative shift" and "Total relative gain". "Total relative shift" or "Total relative gain" of a given school is delimited as an average value of "Total relative shift" or "Total relative gain" of all pupils from the relevant school (Raudenbush and Willms, 1995). If we sequence individual schools in accordance with "Total relative shift" and "Total relative gain", we will find out that the differences are more remarkable. We will rank the first ten schools by the average of "Total relative gain" and associate them with general ranking according to the average of "Total relative shift" in tests from Czech language. We will proceed identically with the last ten schools according to "Total relative gain" in Czech language.

School	**Ranking by "Total relative gain" in CL**	**Ranking in "Total relative shift" in CL**
X	1	5
XXV	2	17
XXII	3	3
LXI	4	11
LXXX	5	41
LX	6	1
XII	7	10
III	8	9
XL	9	13
XLIX	10	12
.	.	.
.	.	.
.	.	.
XIX	74	26
XXX	75	81
XLIII	76	51
LXXV	77	78
LV	78	54
XV	79	60
XXXIII	80	71
VIII	81	56
L	82	61
XVII	83	82

Table 8: Variances in Total relative gain and Total relative shift

The table proves large variances. For example, school LXXX is, regarding the average of "Total relative gain", on the fifth place, while in terms of "Total relative shift" it is as far as on the 41st place. Similarly, school XIX is with its average of "Total relative

gain" back on 74th position, its average of "Total relative shift" is on 26th position. If we determine the difference between the averages of "Total relative gain" and "Total relative shift", we will find out that the most significant gap is 60 positions in the case of school on the 23th position in its average of "Total relative gain" and on 83th position, which is the last one, in its average of "Total relative shift".

The differences in ranking are not so significant in mathematics and English language tests, as they are in the case of Czech language. The largest ranking difference in mathematics between the averages of "Total relative gain" and "Total relative shift" is 14 positions and the same gap is 18 positions in the case of English language.

Let us now examine in what manner the school rankings correlate the averages of "Total relative gain" and "Total relative shift".

The Spearman's rank correlation coefficient between the school rankings in accordance to the averages of "Total relative gain" and "Total relative shift" in the case of Czech language is 0.604. The value of correlation coefficient proves that, even if some of the schools vary significantly in their ratings, the difference in total school rankings is not that remarkable. The correlation dependence in mathematics is very high. The Spearman's rank correlation coefficient between the school rankings in accordance to the averages of "Total relative gain" and "Total relative shift" in the subject of mathematics is 0.981, so the variation in rankings is minimal. And so is the coefficient between the school rankings in accordance to the averages of "Total relative gain" and "Total relative shift" in English language which is 0.975, thus the correlation dependence is again significant.

As the correlation analysis shows, in the subject of Czech language more remarkable variations occur. The variations in mathematics or English language are almost negligible.

Another way of confronting both methods is to compare the final ranking of individual pupils in "Total relative gain" and "Total relative shift" in the subject of Czech language. The largest gap in ratings is 2,012 positions. These considerable differences appear with pupils who had relatively high input ranking, so their relative shift is not very significant. Considering the first 15 pupils with the largest gaps in ranking, we find out that these pupils had excellent outcomes in both input and output tests. Their relative shift ranks them among the average, but in regard to their relative gain they rank among the best 500 out of the total of 4,714 pupils. No significant differences in pupil rankings occur in either method in tests from mathematics and English language.

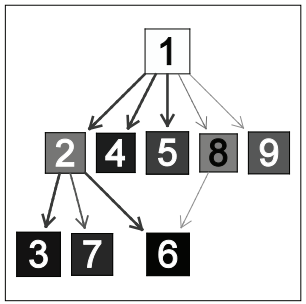
Analysis of value-added assessment outcomes variance among fields of study

We also carried out an analysis of variance in "Total relative gain" and "Total relative shift" of the fields of study. In all cases the statistic tests very strongly reject the zero hypothesis about non-existent differences among the fields of study (each with the p-value lower than 2.2×10^{-16}, see the table for values of the F-statistics).

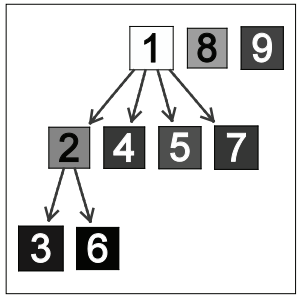
Subject	F-statistic value for	
	relative shift	relative gain
Czech language	30.307	61.702
Mathematics	43.025	76.910
English language	17.907	26.778

Table 9: F-statistic value for relative gain and relative shift

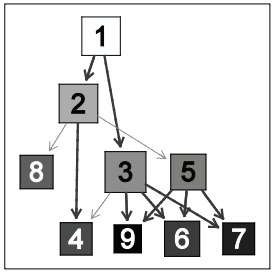
We calculated also a set of two selective Student t-tests (*non-pooled SD*) for each subject to prove statistically significant differences between individual field-of-study couples. To prevent the simultaneous statistic interference we have used the Holm's scheme. The results of this testing are demonstrated graphically using the Hasse diagrams (Burda, 2006).



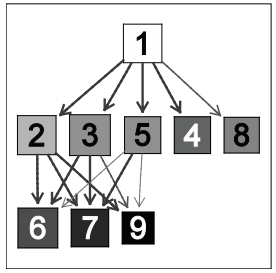
a) CL relative gain



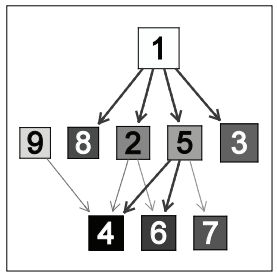
b) CL relative shift



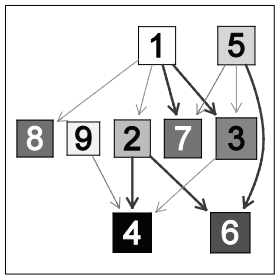
c) MA relative gain



d) MA relative shift



e) EL relative gain



f) EL relative shift

Drawing comparison between "Relative gain of the field of study" and "Relative shift of the field of study"

The analysis of variance in the previous part tells us that some fields differ significantly in their results. Pupils ordinarily select subjects which are suitable for them and which correspond with their skills and capabilities. This fact made us decide for the results comparison with the field of study as a factor affecting the value-added assessment to eliminate the pupils' input qualities and assess the value-added score only. We delimited the relative gain for each pupil calculated always under the terms of the field of study, hereafter as "Relative gain of the field of study", and we also delimited the relative shift calculated only under the terms of the field of study, hereafter as "Relative shift of the field of study".

Comparison of school rankings in "Total relative gain" and "Relative gain of the field of study" in each subject will be dealt with in the next chapter. Now we will have a look at a comparison of school rankings in "Relative gain of the field of study" and "Relative shift of the field of study" in individual subjects.

Considering the model where "field" means a factor affecting the value-added score, no significant differences can be found between the two methods. Even in the subject of Czech language the Spearman's ranking correlation coefficient is 0.928, i.e. very high correlation dependence in ranking. The largest gap is 32 positions. Sources of such differences are suggestion for further research and they will not be covered more in this article.

Regarding the school rankings in accordance to "Relative gain of the field of study" and "Relative shift of the field of study" in mathematics, the Spearman's rank correlation coefficient is 0.942. The following chart shows that differences between both models are comparatively small in the first ten places.

School	**Ranking by "Relative gain of the field of study" in MA**	**Ranking by "Relative shift of the field of study" in MA**
XXVIII	1	1
X	2	2
LXVIII	3	3
LXVII	4	4
LIII	5	11
XIV	6	9
LVII	7	15
XLII	8	19
XIII	9	7
XXIV	10	6
.	.	.
.	.	.
.	.	.
IV	74	79
LX	75	77
LXXX	76	75
L	77	74
LXXV	78	76
LXX	79	82
LXVI	80	78
XLVII	81	80
XXXIII	82	81
LXXI	83	83

Table 10: Differences between both models

The Spearman's rank correlation coefficient in the English language is 0.902 between "Relative gain of the field of study" and "Relative shift of the field of study", thus it is quite high as well.

Interesting thing is that the Spearman's rank correlation coefficient between "Relative gain" and "Relative shift" in Czech language noticeably drew near 1by adding the field as a value-added influential factor, while in mathematics and English language this value slightly lowered.

If we compare rankings of individual pupils in "Relative gain of the field of study" and "Relative shift of the field of study" in Czech language, the Spearman's rank correlation coefficient is 0.915, i.e. high. The situation is similar in the case of mathematics with the Spearman's rank correlation coefficient of 0.910 and English language with 0.933, i.e. high in both cases.

For drawing any conclusion, a deeper analysis of data causing this divergence is necessary. At the moment we could state that both methods assess the value-added score in different ways, but taking into account the value-added influential factors, the differences in both methods' results are comparatively slight. On selecting the model, it is important to consider what we are really about to assess – whether we are interested in shift under

the terms of a group or gain against the presumed gain under the terms of a group of tested individuals.

Drawing comparison between "Total relative gain" and "Relative gain of the field of study"

In this part we will see what changes take part in the model of "Relative gain", provided we regard the "field" as an influential factor. That means we will divide all the tested individuals into 9 groups according to their field of study and we will delimit "Relative gains" only under the terms of a group.

If we compare the school rankings according to "Total relative gain" and "Relative gain of the field of study" in Czech language, we will logically deduce that shifts in ranking correspond with the Hasse diagrams created for the variance analysis of "Total relative gain" and "Total relative shift" of the fields of study. Some grammar schools met downgrade in school rankings, while schools with the fields of study no. 3, 6 and 7 reached quite considerable progress. The deepest fall is 50 positions, from the 21st place to the 71st place. The highest leap is 37 positions from the 44th place to the 7th place. As for the schools at the top or in the end of the chart, no significant divergence occurred as was presumed (see following figures). Negative figures mean a shift upwards in ranking, i.e. progress, and positive figures signal a shift downwards in ranking, i.e. downgrade, taking into account the field of study as an influential factor.

School	Change in ranking	Field of study
LVII	-37	6
XIV	-33	3
LIII	-28	3,9
VII	-28	3
LII	-27	6
LXVII	-24	3
LXXIII	-22	6
XXVIII	-20	2,3
LXXII	-20	3,6,7
XLV	-19	6

School	Change in ranking	Field of study
XLVII	50	1
XXIII	47	1
I	46	1
II	39	1
LXXIX	33	1
IX	32	1,8
XXIV	29	1
XXXIX	28	1
XI	27	1
LXVI	27	1

Table 11 and 12: School rankings according to "Total relative gain" and "Relative gain of the field of study" in Czech language

The situation in mathematics is similar. The highest progress can be seen in schools with the fields of study no. 6, 7, 9, and 4. The deepest downgrade occurs in schools with the field of study no. 1 which, again, corresponds with our variance analysis.

School	Change in ranking	Field of study
LVII	-45	6
LXXVI	-44	9
LXXIII	-38	6

VIII	-37	6
XLIII	-33	6
XLII	-31	4
LII	-30	6
XX	-27	7
LXXVIII	-26	2,7
XXXVI	-24	3,6,7

School	Change in ranking	Field of study
II	39	1
LIX	38	1
LXXXIII	38	1
XI	36	1
LX	35	1
LXXX	35	1
XXIII	33	1
XXV	31	1
LXVI	29	1
LXXXII	29	1,2

Table 13 and 14: School rankings according to "Total relative gain" and "Relative gain of the field of study" in mathematics

Finally, we will have a look at changes in school ranking in the English language subject. Here we can also see progress in schools in accord with the above mentioned variance analysis. Downgrade in rating also mostly occurs in schools with the field of study no. 1.

School	Change in ranking	Field of study
XLII	-58	4
LVII	-43	6
XLIII	-37	6
LXXVII	-36	2,4
LXVII	-27	3
VII	-23	3
LXXIII	-23	6
XXXIV	-22	2,4
LII	-22	6
VIII	-21	6

School	Change in ranking	Field of study
LXXX	35	1
XXIII	34	1
XXXIX	34	1
XLVII	34	1
LXXXI	33	1
I	32	1
II	31	1
XXIV	31	1
LXXVI	31	9
XXV	29	1

Table 14 and 15: School rankings according to "Total relative gain" and "Relative gain of the field of study" in English language

The above figures and analysis of variance (see subsection 3.2) prove that it is more than appropriate for the model to regard the "field of study" a factor affecting the calculation of value-added score. There are undoubtedly other influential factors, but for a lack of relevant information their influence on the above mentioned models was not attestable.

Discussion

The paper claims that the field of study could be a significant factor influencing the value-added assessment models. However, the extent to which it influences the model is heavily determined by its definition. Our division of the schools into nine fields of study is based on an analysis of school educational programmes. It is also based on findings that socio-economic factors significantly determine which school student choose.

We have identified nine types of schools with similar study plans. As can be seen in the results presented in this paper, our distribution of schools into the fields of study works well in the Czech Republic – other countries with different educational programmes may need to develop their own distribution.

It is known that socio-economic factors could also significantly affect the value-added assessment models. However, such research is left for the future.

Conclusion

The article presents two important value-added assessment models: method of relative gain of knowledge and method of relative shift. Thanks to sufficiency of comparatively vast sets of data, it was possible to confront both models from the point of units' position in the set, ranked from the best to the worst. The final results could suggest that in sufficiently large sets there will be no larger differences in final ranking of results, but these differences are quite remarkable for some of the individuals. The article at the same time observes in what manner the values change when information on the field of study is taken into account. The analyses we carried out tell us that it is more than appropriate to regard the field of study as an influential factor for the value-added assessment. When regarding the field of study an influential factor for the value-added assessment, the differences in both models outcomes are mostly slight or comparable. We cannot decide which model is correct, since each of them has its use in certain situation and certain assessment.

In following research we will examine and compare further value-added assessment methods. As very appropriate we find the method of multiple regressions, using other socio-economic factors including the Rasch analysis. It is also advisable to explore more deeply what causes those more significant differences the positions of individuals in final ranking.

References

Burda, M. (2006) Visualization of cosymmetric association rules using Hasse diagrams and concept lattices. In: *Znalosti 2006*. pp. 175-182.

Chráska, M. (2007) *Metody pedagogického výzkumu: základy kvantitativního výzkumu*. Praha: Grada.

Liu, O. (2011) Value-added assessment in higher education: a comparison of two methods. *Higher Education*, vol. 61, no. 4, pp. 445-461. Netherlands: Springer Netherlands.

Lissitz, W. R. (2005) *Value Added Models in Education.* Maple Grove: JAM Press.

Malčík, M., Krpec, R. (2010) Monitoring přidané hodnoty ve vzdělávání v Moravskoslezském kraji. Ostravská univerzita v Ostravě. [2010-09-30].

Malčík, M. (2007) Electronic support of educational results measuring. In: Proceedings Information & Communication Technology in Education 2007, Rožnov pod Radhoštěm.

Malach, J., Malčík, M. (2010*) Value–added assessment in postsecondary schools. Theoretical approaches and research results in the Czech republic.* Kultura i Edukacja 2010 No. 5 (79).

McCaffrey, D., Lockwood, J., Koretz, D., Louis, T., Hamilton, L.,(2004) Models for Value-Added Modeling of Teacher Effects. *Journal of Educational and Behavioral Statistics*, vol. 29, no. 1, pp. 67-101. Washington: American Educational Research Association.

Raudenbush, S., W., Willms, J., D. (1995) The Estimation of School Effects. *Journal of Educational and Behavioral Statistics*, vol. 20, no. 4, pp. 307-335.

Sanders, W., L., Horn, S., P. (1994) The tennessee value-added assessment system (TVAAS): Mixed-model methodology in educational assessment. *Journal of Personnel Evaluation in Education*, vol 8., issue 3, pp. 299-311. Netherlands: Springer Netherlands.

SCIO (2008). Vektor Modul 3: Manuál. Praha.

Journal on Efficiency and Responsibility in Education and Science
ISSN: 1803-1617

PREFERENCES OF POTENTIAL APPLICANTS FOR UNIVERSITY EDUCATION AND THE "LEARNING ECONOMY"

Jakub Husák, Markéta Volkánová

Czech University of Life Sciences Prague
husak@pef.czu.cz

Abstract

In the current postmodern society, knowledge is still more important. Also corresponding with this fact are the development theories which have been developed from the theory of learning organisation, the theory of learning regions to the relatively new term "learning economy" used in some current publications (e.g. Lam, Lundvall, 2006). Knowledge, learning process and education become an integral part of personality development and also the development of the whole of society. The concept of the "learning economy" is based on the responsibility of each member of society for its education and individual knowledge dynamics and also is based on the responsibility of the whole of society for the collective knowledge dynamics as a prerequisite of its successful development. In this context, the paper is focused on the preferences and ideas of potential applicants for university education within the process of the choice of universities. The main factors which influence the decision-making process of potential applicants for university education are examined by using quantitative empirical research. The correspondence of these factors, preferences and ideas with the requirements of the "learning economy" is also analysed. Attention is also paid to the responsibility of potential applicants for university education for the creation of their knowledge and knowledge dynamics (mainly codified and scientific knowledge are the focus of this paper).

ARTICLE INFO

Article type
Full research paper

Article history
Received: April 5, 2011
Received in revised form: June 6, 2011
Accepted: June 12, 2011
Available on-line: June 30, 2011

Key Words

education, knowledge, learning economy, preferences, university

Introduction

Current society is often called a knowledge society and this results in the logical common effect which is possible to be described as a focus of society on human resources from the perspectives of knowledge, skills and qualifications. From these facts, the concept of knowledge emerges as the most strategic resource, with learning as the most important process (Lundvall 1995). Qualifications (qualifications of people living in a particular delimitated area, which consists not only of the educational structure, but also of the ability to be self-educated using more or less formalised methods and to use the knowledge and skills gained to increase the quality of life within the area) are therefore regarded as one of the main factors of development potential, not only from the individual aspect, but also from the regional and societal points of view.

Despite the fact that the learning process is not a complete guarantee of economic success, it still remains a universal cure for the problems of socio-spatial inequalities. Innovations and learning are important features in understanding why some firms or regions are economically successful and some are not (Hudson 1999b). Firms use quasi-rent, which results from the possibility of using the knowledge potential and skills of a locality or region (not only of the individuals living in the locality, but also the synergic effect of sharing knowledge). Firms are localised on the basis of the capacity of localities or regions, which is formed in particular by the infrastructure, natural resources, institutional endowment and knowledge available within the locality (Maskell, Malmberg 1999a). From these perspectives, knowledge becomes one of the most important locational and developmental factors. Murdoch (1995) claims that the type of available knowledge and information is less important than the significance which is attributed to particular institutional assets. However, other authors (e.g. R. Hudson, A. Malmberg, P. Maskell – see below) consider the type of available knowledge as a crucial developmental factor.

Knowledge is often classified as codified and tacit because there is a significant difference between these basic types. Codified knowledge is possible to be standardised and transferred by instructions, manuals, education, and it is possible to be sold as goods. Tacit knowledge (e.g. know-how, skills and competences) is possible to be acquired only directly by one's own experience and participation in a particular activity (Hudson 1999a). Knowledge is difficult to grasp. Knowledge assets provide valuable services and they have potential economic value. Compared to physical assets, it is possible to share knowledge without the loss of it by its owner. Knowledge sharing does not decrease the usefulness of knowledge, but it decreases its value. Shared knowledge loses its scarcity. In this context, it is possible to debate about the codification of tacit knowledge, because codified knowledge itself represents an instrument for the production of new knowledge (Maskell, Malmberg 1999b).

This concept of knowledge is typical of the individual, organisational and regional levels, but current conceptualisation is shifting away from these levels to the whole of society, by use of the term, "learning economy". Nielsen and Lundvall (2006) define the "learning economy" as one in which the ability to attain new competencies is crucial to the performance of individuals, firms, regions and countries. Recent decades have been characterised by an acceleration of both knowledge creation and knowledge destruction. Information and communication technology has made a lot of information more easily accessible to a lot of people, but it also has made many skills and competencies obsolete.

These facts result in the new typology of knowledge, using a combination of two criteria – individual or collective entity and explicit (codified) or tacit knowledge. On this basis, Lam and Lundvall (2006) create the typology of four different forms of knowledge – embrained, embodied, encoded and embedded. Embrained knowledge is possible to be characterised as individual and explicit (codified), which is dependent on the individual's conceptual skills and cognitive abilities. It is formal, abstract or theoretical knowledge. It is typically learnt through reading books and by formal education. Embodied knowledge is possible to be characterised as individual and tacit, which is action oriented. It is the practical, individual type of knowledge which is learnt through experience and training based on apprenticeship relations. Encoded knowledge is possible to be characterised as collective and explicit (codified), which is shared within organisations through formal information systems. Any member of an organisation can easily gain access to relevant databases using information technology. Encoded knowledge is formed by making explicit as much as possible of tacit knowledge. Embedded knowledge is possible to be characterised as collective and tacit, which is built into routines, habits and norms that cannot easily be transformed into information systems. Embedded knowledge is produced by an interaction among different members of the organisation. It is relation-specific, contextual and dispersed.

On this basis, it is possible to conceptualise the "learning economy" more precisely as an economy in which individuals, firms and even national economies will create wealth and gain access to wealth in proportion to their capacity for learning. This will be true, regardless of their present level of development and competence (Lam, Lundvall 2006). Tacit knowledge (embodied and embedded) is at the centre of attention of many authors (e.g. R. Hudson, A. Lam, B. A. Lundvall, A. Malmberg, P. Maskell) because it is regarded as crucial for development, using the endogenous concept of development. Attention given to codified/explicit knowledge (embrained, encoded) is usually minor. But the research on regional and local development empirically acknowledges the suitability and applicability of a mixture of endogenous and exogenous approaches to regional development and, from this point of view, codified/explicit knowledge is also important (Husák 2010).

Therefore, this paper is focused on the types of knowledge which are also significant for the development of individuals, localities, regions and even national economies, as also acknowledged by Lundvall (2001) when considering educational systems. Educational systems should be geared to encourage the ability to learn mainly for weak "students". The first of the components is to use modern information and communication technologies, such as, for example, multimedia. The second component is the regulation of the possibility and equality of access to modern information and communication technologies for disadvantaged individuals, less developed regions and national economies (Lundvall 2001).

Material and Methods

The paper is focused on the preferences of potential applicants for university education within the process of university choice, in the context of the knowledge based economy or "learning economy" as defined above. From this fact results the attention which is paid mainly to embrained and encoded knowledge as a special type of codified knowledge (Lam, Lundvall 2006). Focus is also on the preferences of potential students before entering a university, because universities are one of the most important sources of codified knowledge. Universities are expected to be

active in the process of the creation of a knowledge society or "learning economy" and they play an important role within this process. This is mainly because of their twofold traditional vocation of research and teaching. However, they are also confronted with new specific challenges, mainly the new public funding mechanism, competition for grants and research contracts and the evaluation of outputs (Margarisová, Šťastná, Stanislavská 2010). As also claimed by Rymešová and Kolman (2010), a university is not only a definitive component in a student's choice of career, but is also important in its graduates' career paths. Thus the preferences of potential applicants for university education significantly influence their professional careers and vicariously also knowledge dynamics within society.

The main aim of this paper is to identify and analyse the preferences of potential applicants for university education within the process of university choice and to compare these preferences with the demands of the "learning economy". On the basis of this aim and the theoretical background, it is possible to formulate three main research questions:

1. What are the preferences of potential applicants for university education within the process of university choice?
2. Do these preferences correspond with the demands of the postmodern society and the "learning economy"?
3. How are potential applicants responsible for the creation of their knowledge and the knowledge dynamics?

From the methodological point of view, mainly standardised interviews with potential applicants for university education were used. These interviews were conducted in the International Education and Lifelong Learning Exhibition Gaudeamus in Prague and Brno during the years 2009 and 2010. The Answer Sheet consisted of 34 standardised questions considering three main topics – the previous education of applicants, their preferences within the process of university choice and identification questions. Statistical software SPSS and simple descriptive statistics (mean, median, skewness and kurtosis) were used in the analysis of the data. The Chi-square test, appropriate coefficients for nominal and ordinal variables and Z-scores were also used for testing of the dependency of variables and their degree –according to Hendl (2009) and Řezanková (2007).

A random selection of respondents at the International Education and Lifelong Learning Exhibition Gaudeamus in Prague and Brno was used for the quantitative empirical research. A sample population was defined as people (participating at the Gaudeamus Exhibition) of the age of 18 years and older, who have achieved the highest level of secondary education (previously, or in the current year) and who are actively interested in the choice of university education. On the basis of this random choice, a sample with the characteristics stated below was chosen. The total number of respondents who were listed in the analysis was 196 – 129 women and 67 men. This disproportion results from the generally higher participation of women in the choice of an appropriate university, corresponding also to the structure of visitors to the Gaudeamus Exhibition. The age structure of respondents also corresponds to the structure of visitors to the Gaudeamus Exhibition and also to those people actively interested in university choice. 62.2% of respondents were younger than 19 years, 11.7 % were between 20 – 25 years, 15.3 % between 26 – 35 years and 10.7 % of respondents were older than 36 years.

Also the structure of respondents according to gainful activity corresponds to the general structure of visitors to the Gaudeamus Exhibition and the structure of potential applicants. 66.8 % of respondents were not employed full-time and 33.2 % of respondents were possible to be characterised as gainfully employed. For representativeness of the sample, regional structure is also important. The sample consists of respondents from 52 districts of the Czech Republic – most respondents were from Prague (27%). 36.9% of respondents had their permanent residence within municipalities of more than 100 000 inhabitants and 18.5% of respondents lived in villages with less than 2000 inhabitants, which closely corresponds to the distribution of population within this category of municipalities. From the characteristics of the sample stated above, it is clear that the sample could be considered as a representative selection from the sample population as defined above.

Results

Whole sample results

The empirical section is divided into two important parts. The first part is focused on the results related to the whole sample of population and the second part provides results concentrated on the differences among the chosen groups of potential applicants.

Figure 1 depicts the preferences of 11 factors which are important for potential applicants for university education during the process of university choice. The factors are ordered from the most important to the least important according to the "top two boxes". The most preferred factor is the field of study which is important or the most important to 90.8% of respondents. In addition, the possibility of obtaining a Master's degree at the same institution, the reputation of the university, similarity between the field of study and field of employment, and an individual approach to students were among the most highly preferred factors (all of these are important or the most important to more than 60% of respondents). Among the least preferred factors are the distance of the institution from the place of residence, the tradition of the university, the possibility of obtaining a Doctoral degree at the same institution and the size of the university.

On the one hand, a positive factor, from the viewpoint of the knowledge society and "learning economy", is possible to be evaluated from the special emphasis placed on the preferred field of study and the aspiration of attaining a Master's degree at the same university. Thus potential applicants appreciate the importance of a Master's education in their preferred field of study for their future careers, which is also significant for the knowledge dynamics within society. On the other hand, the lesser importance of a Doctoral education could be evaluated as a problem due to the increasing importance of post-graduate education within the postmodern society, particularly in the context of the increase in persons with Bachelor's and Master's education within the present society.

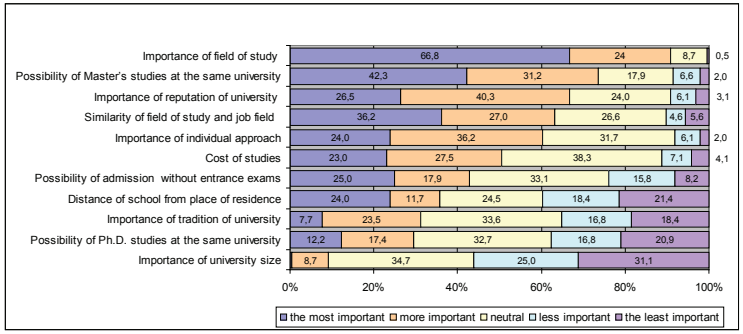


Figure 1: Importance of factors during the process of university choice

Considering the field of study as the most preferred factor, which is important or the most important to more than 90% of respondents, it is also important to examine the particular fields of study which are preferred by potential applicants. The most preferred field of study is Economics for almost 36% of respondents (Figure 2) – it is significantly higher than the other fields of study. Preferences for the other fields of study are evenly distributed among them, with only Technical and Social Sciences (excluding Economics) being slightly more preferred than the others.

Therefore, the question is whether the preferences for particular fields of study correspond to the demands of current society and the "learning economy". On the one hand, Economics and the Social Sciences (with almost 45%) provide a general education which is required by current society, particularly when considering the concept of endogenous development and the significance of tacit knowledge (embodied and embedded). Education in Economics and the Social Sciences assists in cooperation within the community by the use of social capital and trust and, from this perspective, codified knowledge is directly connected to tacit knowledge (with regard to the appreciation of the significance of local and regional identity). But, on the other hand, the preferences for the Technical Sciences (12.2%) could be regarded as a potential problem for the future development of society, from the point of view of exogenous development (where technical innovations are preferred), especially if a mixture of endogenous and exogenous development is suitable, applicable and currently also the most preferred (Husák 2010).

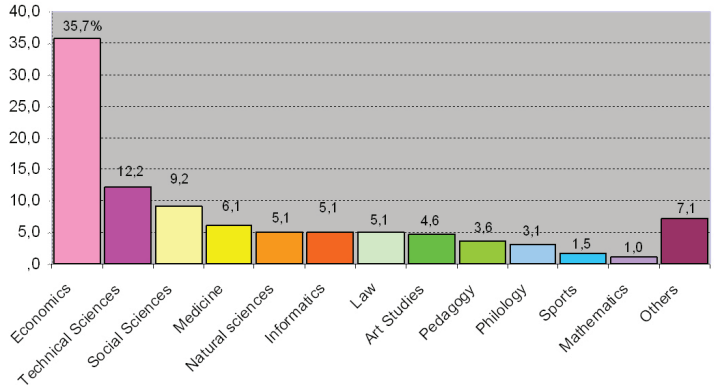


Figure 2: Preferred field of study

The concept of the "learning economy" also anticipates the responsibility of individuals for their education and knowledge creation. Factors chosen for the evaluation of the responsibility of potential applicants are commuting distance, commuting time and willingness to pay study fees. Because these factors do not rank among the most important, it is possible to anticipate that potential applicants are responsible for their education, but only a detailed analysis could provide an accurate view. The average distance which respondents are willing to commute is

126 km, but the median is only 100 km (Table 1). A comparison of the mean and median and also the value of skewness indicate a predominance of the lower values within the sample of respondents. It is necessary to evaluate these results together with the commuting time. The average commuting time is 115 minutes and the median is 120 minutes (Table 2). A detailed insight into this factor shows that 28% of respondents are immediately willing to commute for 60 minutes and 16.3% of respondents are not willing to commute at all. From these facts, it is possible to deduce that, from the commuting point of view, the responsibility of potential applicants towards university education is rather less, but a few potential applicants appreciate the significance of education and particularly education in their preferred field of study (there are a few exceptions within the sample of respondents).

mean	126.56 km
median	100 km
skewness	2.316
kurtosis	6.069

Table 1: Commuting distance

mean	115.47 min.
median	120 min.
skewness	2.219
kurtosis	6.924

Table 2: Commuting time

The willingness to pay study fees is another indicator of the responsibility of individuals for their education and knowledge creation. The results of this indicator are depicted in Table 3. The first important fact is the number of missing answers (25% of respondents). These respondents could not answer the question about the amount of study fees because they did not have any idea about it (as results from the standardised interviews indicate). It probably results from only a low awareness of the costs of university education and the idea still persisting about free education (or that education costs nothing). But the average amount of study fees that respondents are willing to pay is 17 292,- CZK per semester and the median is 20 000,- CZK per semester. These amounts are similar to the actual study fees at private colleges and within the lifelong learning programmes at public universities. It is significant to consider the skewness predominance of the lower values of study fees within the sample of respondents. Almost 15% of respondents are willing to pay study fees of less than 10 000,- CZK per semester and more than 33% of respondents are willing to pay study fees of between 10 000,- and 15 000,- CZK per semester. From this point of view, the responsibility of potential applicants for university education is rather low.

mean	17 292 CZK
median	20 000 CZK
skewness	1.209
kurtosis	3.559
No. of answers	147
No. of missing answers	49

Table 3: Willingness to pay study fees

Results according to chosen groups

Besides the results related to the whole sample of the population, the results concentrated on the differences among the chosen groups (mainly economic activity and size of residence) of potential applicants are also considered. The first test of dependency is focused on the dependency of the willingness to pay study fees and the economic activity of respondents. This analysis indicates differences among the groups of economically active and economically inactive respondents (= students within

this research) considering the responsibility for education and codified knowledge creation. The created Contingency Table shows that 41.5 % of economically inactive respondents and even 62.2 % of economically active respondents are willing to pay study fees of less than 20 000,- CZK per semester, demonstrating significant differences among the chosen groups. Table 4 displays the results of the tests of the Contingency Table. The tested null hypothesis states that dependency does not exist between the willingness to pay study fees and the economic activity of the respondents. This statement denies the alternative hypothesis. According to the results of the Chi-square test, it is not possible to reject the null hypothesis at 5% significance level, but it is possible to reject the null hypothesis at 10% significance level. Thus the Chi-square test confirms a dependency between the willingness to pay study fees and the economic activity of respondents at a 10% significance level. If Z-scores are applied to the Contingency Table, it is possible to state that economically inactive respondents are willing to pay higher study fees. Considering the coefficients of contingency and the values of Z-scores, the dependency between the variables is rather weak. It is possible to derive from this analysis that economically inactive applicants are more responsible for their education and knowledge creation than economically active applicants. Analysis of the age structure of potential applicants (economically inactive respondents are younger than economically active respondents) and the willingness to pay study fees also provides similar results. From this point of view, the younger generation seems to be more responsible for its knowledge creation and education than the "older" generation. Thus the attitude of the younger generation to education better corresponds with the demands of postmodern society and the "learning economy".

	Value	P-Value
Pearson Chi-Square	7.523	0.057
Phi	0.226	0.057
Cramer's V	0.226	0.057
Contingency Coefficient	0.221	0.057

Table 4: Tests of Contingency Table – Economic activity vs. Willingness to pay study fees

Attention is also given to the differences of the preferred factors among the economic activity of respondents. For this purpose, a "spider graph" which shows the importance of factors during the process of university choice for economically active and economically inactive applicants, was created (Figure 3). The results are displayed according to the "top two boxes". It is possible to see a significant difference in only four factors. The cost of studies, the tradition of the university and the importance of an individual approach are significantly more important to economically active respondents. The reputation of the university is the only factor which is more important to economically inactive respondents.

Generally, all the factors (except the reputation of the university) are more preferred by economically active respondents. These potential applicants usually have a clear idea about their further education and knowledge creation to answer the demands of the "learning economy". But an analysis of the willingness to pay study fees, as represented above, shows that they are also very careful in considering the cost of studies and, from this point of view, could be considered less responsible for their education. On the one hand, economically inactive applicants are usually nondescript, but on the other hand, they are more flexible in their preferences. A flexibility of their attitude to knowledge creation and the educational process is their significant advantage, considering the demands of postmodern society.

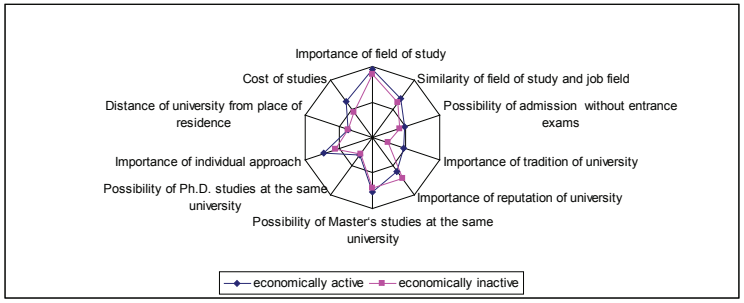


Figure 3: Preferences according to economic activity of potential applicants – "spider graph"

An analysis of the differences between the groups of applicants from rural municipalities (according to the Czech Statistical Office definition – municipalities of up to 2000 inhabitants) and applicants from big cities with more than 100 000 inhabitants provides another important insight into the preferred factors and responsibility of potential applicants. For this purpose, a "spider graph", which shows the importance of factors during the process of university choice for applicants from rural municipalities and also from big cities, was created (Figure 4). The distribution of the importance of factors is rather equable – four factors are more preferred by respondents from big cities, three factors are more preferred by respondents from rural municipalities and three factors are similarly preferred by both groups.

Considering the particular factors, applicants from big cities seem to be more prepared for the demands of the "learning economy" (importance of field of study, similarity of field of study and job field, individual approach, as well as the cost of studies, which seems to be slightly contradictory). Applicants from rural municipalities mainly prefer factors which facilitate entrance to universities and also the whole educational process (admission without entrance exams and distance of school from place of residence). On the one hand, these facts could indicate a higher responsibility of applicants from big cities, but on the other hand, also simpler access to universities and to knowledge creation generally.

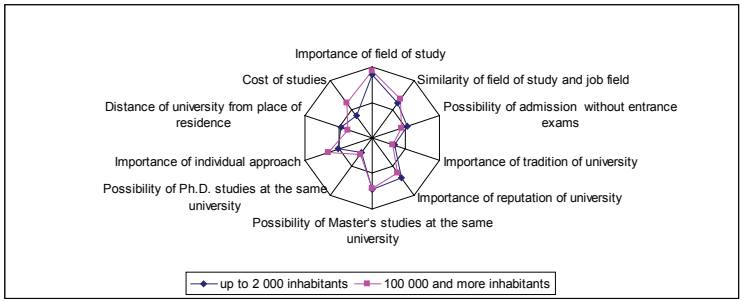


Figure 4: Preferences according to size of residence of potential applicants – "spider graph"

Discussion

Knowledge is one of the most important sources of the development of localities, regions and also national economies. This fact is also reflected in the theoretical concepts which emphasise the role of knowledge and knowledge dynamics. These theoretical concepts evolve from the concepts of learning organisations, learning regions to the relatively new concept of the "learning economy". Attention is paid mainly to tacit (embodied and embedded) knowledge, which is usually regarded as a source of competitiveness of firms, regions and national economies. Less attention is paid to explicit or codified knowledge (embrained and encoded) which is also important,

mainly considering innovations, as well as support for tacit knowledge creation.

Therefore, knowledge both tacit and codified, is important for the development of individuals, regions and society as a whole. But the question is, how does it function in practice? What are the preferences of potential applicants for university education and do these preferences correspond to the demands of current society? How are these facts reflected within the university educational system of the Czech Republic? Considering the factors preferred during the process of the choice of universities, the field of study is the most preferred factor. This fact seems to be positive, because potential applicants appreciate the significance of a particular field of study for their future careers.

Evaluation of the most preferred fields of study is ambivalent – Economics and the Social Sciences provide a general education focused on society and its problems. This approach could also aid in tacit knowledge creation, because it may strengthen the local and regional identity of individuals. But the lack of technical knowledge as a result of the relatively less preferred Technical Sciences could compromise future innovations. It is not only their preferences, but also the responsibility of potential applicants for their further education, which is important.

The problem of the responsibility of potential applicants is possible to be characterised as a "perception that education and also university education is free of charge". However, education is not free of charge, but is paid for from the taxes of everyone. The willingness to pay study fees (thus to be responsible for education and knowledge creation) is rather low and 25 % of respondents even have no idea about an approximate amount of study fees. This situation leads to the wasteful use of the educational system and to an inflation of Bachelor's and Master's education within the current society. In this context, the fact that only a few preferred a Doctoral education could be evaluated as a problem, due to the increasing importance of post-graduate education within the postmodern society.

Considering the differences among the chosen groups of potential applicants, only small differences could be observed. But these differences lead to the consideration that applicants from big cities and especially economically inactive applicants (= students and also younger applicants – within this research) are slightly more responsible for their education and knowledge creation. They are willing to pay higher study fees and their neutrality considering the preferred factors could be evaluated as an integral part of their flexibility, which corresponds to the demands of postmodern society and the "learning economy".

Conclusion

This paper is focused on the preferences of potential applicants for university education within the process of university choice, in the context of the demands of the "learning economy". Three main research questions were formulated at the beginning (see above). The first research question is focused on the preferences of potential applicants for university education. Among the most preferred factors are the field of study, the possibility of obtaining a Master's degree at the same university and a similarity between the field of study and job field. A preference for these factors could indicate the responsibility of potential applicants for their knowledge creation and further education. The possibility of obtaining a Doctoral degree at the same university, which ranks among the few preferred factors, can be evaluated as a contradictory fact.

The second question is focused on a comparison of the preferred factors with the demands of the "learning economy". If one summarises the main characteristics of the "learning economy"

as 1. the ability to obtain new competencies, 2. the acceleration of knowledge creation and knowledge destruction and 3. the capacity to learn, the most preferred factors (regardless of different groups) correspond to the demands of this concept. Potential applicants rather prefer factors which are connected to the ability to learn and the acceleration of knowledge creation, with fewer preferring those factors which are only formal or which facilitate entrance to universities. An emphasis on knowledge creation within the chosen fields of study and a preference for Economics and the Social Sciences could strengthen the flexibility and capacity to learn and also the innovation process within society (but the lack of technical innovations could be a potential problem).

The third question is focused on the responsibility of potential applicants for their further education. The responsibility of potential applicants could be characterised as rather low, considering commuting time, commuting distance and a willingness to pay study fees, but higher responsibility is possible to be observed when considering the preferred factors. There are only slight differences among the chosen groups, but current high school students and younger applicants seem to be more responsible for their further education and knowledge creation.

This could be an opportunity for the development of the "learning economy" within Czech society. This research has been focused on potential applicants for university education, but it would also prove interesting and important to examine the same questions among groups of university students or graduates, which could provide the theme for further research.

Acknowledgements

This paper is supported by the internal Grant: "Education for rural areas as a part of regional development priorities" No. 201011190008 of the Internal Grant Agency of the Faculty of Economics and Management of the Czech University of Life Sciences in Prague.

References

Hendl, J. (2009): "Overview of statistical methods: analysis and meta-analysis of data" (in Czech). Portál, Prague, 695 p.

Hudson, R. (1999a): "The Learning Economy, the Learning Firm and the Learning Region: A Sympathetic Critique of the Limits to Learning", European Urban and Regional Studies, Vol. 6, No. 1, pp 59-72.

Hudson, R. (1999b): "What makes economically successful regions in Europe successful? Implications for transferring success from west to east", [online], EGRG Working Paper No. 99/01, http://www.egrg.org.uk.

Husák, J. (2010): "Regional policy of the European Communities and cross-border cooperation within the South Bohemia Region", Agricultural Economics – Czech, Vol. 56, No. 6, pp. 292-300.

Lam, A., Lundvall, B.A. (2006): "The Learning Organization and National System of Competence Building and Innovation" In: Lorenz, E., Lundvall, B.A. (eds.) How Europe's Economies Learn: Coordinating Competing Models. Oxford University Press, Oxford, pp 109-139.

Lundvall, B.A. (1995): "The Learning Economy – Challenges to Economic Theory and Policy", BETA Working Papers, No. 95/14, University Louis Pasteur, Strasbourg, pp 1-23.

Lundvall, B.A. (2001): "Innovation Policy in the Globalizing Learning Economy" In: Archibugi, D., Lundvall, B.A. (eds.) The Globalizing Learning Economy. Oxford University Press, Oxford.

Margarisová, K., Šťastná, K., Stanislavská, L. (2010): "Communities of Practice and their Role in the Field of Higher Education", Journal on Efficiency and Responsibility in Education and Science, Vol. 3, No. 2, pp. 86-96.

Maskell, P., Malmberg, A. (1999a): "Localised learning and industrial competitiveness", Cambridge Journal of Economics, Vol. 23, pp 167-186.

Maskell, P., Malmberg, A. (1999b): "The competitiveness of firms and regions: ubiquitification and the importance of localized learning", European Urban and Regional Studies, Vol. 6, No. 1, pp 9-25.

Murdoch, J. (1995): "Actor-networks and the evolution of economic forms: combining description and explanation in theories of regulation, flexible specialization and networks", Environment and Planning A, Vol. 27, pp 731-757.

Nielsen, P., Lundvall, B.A. (2006): "Learning Organizations and Industrial Relations: How the Danish Economy Learns" In: Lorenz, E., Lundvall, B.A. (eds.) How Europe's Economies Learn: Coordinating Competing Models. Oxford University Press, Oxford, pp 161-177.

Rymešová, P., Kolman, L. (2010): "A Reflection on University Studies and further Career development of Chosen CULS Faculties' Graduates", Journal on Efficiency and Responsibility in Education and Science, Vol. 3, No. 2, pp. 42-53.

Řezanková, H. (2007): "Analysis of data from questionnaire surveys" (in Czech). Professional Publishing, Prague, 212 p.

Journal on Efficiency and Responsibility in Education and Science
ISSN: 1803-1617

THE IMPLEMENTATION OF CORPORATE SOCIAL RESPONSIBILITY IN MONGOLIAN BUSINESS SECTOR

Oyungerel Tudev[1], Erhembayar Lkhagvasuren[2]

[1]Tomas Bata University in Zlin
[2] Institute of Finance and Economics, Mongolia
zurvas@yahoo.com

ARTICLE INFO

Article type
Full research paper

Article history
Received: December 14, 2010
Received in revised form: May 18, 2011
Accepted: June 2, 2011
Available on-line: June 30, 2011

Abstract

The global aspirations regarding Corporate Social Responsibility remain far from being met in many developing countries today. More specifically, research regarding Mongolian companies´ social responsibility behaviour is missing and, from overall observation the performance is weak. This research is principally focused on explaining existing conflicts about the comprehension or understanding of just what Corporate Social Responsibility means from a theoretical perspective, and precisely, within Mongolian business circles. To give an answer to this question, the economic, legal, ethical and philanthropic responsibilities of companies was reviewed.

Key Words

corporate social responsibility, Mongolia, stakeholder

Introduction

The different viewpoints on what Corporate Social Responsibility (CSR) is, and on how to measure, implement, and develop the responsiveness of companies for the benefit of society has been widely investigated. Despite the noticeable growth in debate among scholars about this central question, there is still no consensus regarding the definition of the notion and most academics have agreed on vagueness of the operational meaning of CSR (Lee, 2007; Birch&Moon, 2004). Lee (2007) concludes, systematic and operational application of CSR is still absent. As noted by Birch and Moon (2004), there is no single formula for CSR. Aupperle et al. (1985) explain this difficulty by reason that the concepts itself have ´ideological and emotional interpretations´. From the other hand, as a word ´society´ is a multilateral, complicated aspect, and has a broad meaning, thus being socially responsible depends on many direct and indirect factors (Man&Jianxin 2008). Thus, Moon (2007) presumes that the rules or principles of the application of CSR are relatively ´open´ and cannot be easily codified.

The definition given by The World Business Council for Sustainable Development (WBCSD) declares:

> *´Corporate social responsibility is continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large.´ (WBCSD, 2002)*

This approach to view CSR as ´the managerial obligation protecting and improving the welfare of society, environment and the interest of the organization´ supported by many academics and is mentioned in their definitions (Gail&Nowak, 2006; Edoho, 2007; Werther et.al., 2005; Lea, 2002).

As mentioned before, the fundamental problem was, and remains, that no definition of social responsiveness provides an accurate framework of accomplishment; the term social responsiveness carries no clear meaning for managers, citizens, or staff, which seriously limits its usefulness in practice. The literature encompasses the broad scope of the CSR from internal to external possibilities; starting from internal management principles to be ethical and fair; corporate donations and volunteering policies along with a broad philosophy to minimize negative environmental impacts (Michael, 2003; Smith, 2003; Chandler, 2007). Research in the area has largely been focused on the importance of responsiveness, and should the company implement these actions or not, rather than how it could be implemented.

The global aspirations remain far from being met in many developing countries today. Although there is great debate about CSR in the literature, there is little empirical research on its nature in developing countries, and mainly, in the particular cases of individual countries. According to Visser (2009), very few developing countries are concerned about CSR on the institutional level, and the majority of journal articles commonly analyzed countries like China, India, Malaysia, Pakistan, and Thailand. In the Journal of Corporate Citizenship, a special issue on CSR in Asia, (i.e. Issue 13, spring 2004), Birch and Moon (2004), note that CSR performance varies greatly between countries in Asia, with a wide range of CSR actions. More specifically, research regarding Mongolian companies´ social responsibility behaviour is missing and, from overall observation, Mongolia is weak in term of CSR performance.

The CSR policies greatly depend on the economic development of countries. In many countries, especially in the third world, governments and public institutions are unable or unwilling

to implement many of their duties. In such a situation, corporations then have no automatic way to become involved in social problems since business cannot succeed in societies that fail. As governmental control over the social, ethical as well as environmental performance of companies, particularly in the mining sector, was lacking in Mongolia; activism by stakeholder groups has become one of the critical drivers that has forced firms to speak out, and act upon, CSR.

Finally, having considered the various drivers for CSR in developing countries, the question is: ´Are current Western conceptions and models of CSR adequate for describing CSR in developing countries?´ In the extant literature, the majority of American and European research is based on the most popular model — Carroll´s (1991) CSR Pyramid, comprising economic, legal, ethical, and philanthropic responsibilities. Therefore, we consider that Carroll´s four-part pyramid construct can be useful to look at how CSR is manifested in a Mongolian context and these elements will be briefly discussed below.

Material and Methods

The research design of this study can be classified as both descriptive and explanatory to distinguishing the patterns in the theory and the empirical findings, to develop a more detailed understanding within the area. Firstly, this study uses theory testing approach, to gain

knowledge of the previous studies and to provide a test of the worth of the theory, does a certain phenomenon follow in the real world (De Vaus, 2004). As we are interested in a phenomenon which is a very broad we found it most rewarding to retrieve deep and highly subjective information and thereafter analyze the information gathered from questionnaire and secondary data from written sources.

This study has also been intended to develop a better understanding of companies´ way of using CSR. Following stakeholders theory, various stakeholders may contribute to a different perception of this notion. First, CSR generally is considered as a staff functions and depends upon staff within the firm. Second, the perception associated with the concept may depend on consumer´s familiarity with the firm´s image and financial performance. Finally, its performance largely depends on the firm´s managerial decisions, practices and policies. Considering that these parties are important to CSR policy, this paper investigates the knowledge and the perception of CSR from three groups; employees, consumers, and managers. In terms of the employees, we decided to ask about HR policy and programs as an element of the firm´s CSR performance. We received 254 responses to the survey. At each company, all samples were stratified by departmental distribution. In terms of consumers, we chose to ask about the familiarity with the understanding of CSR. In sum 214 individuals participated in this survey and results were analyzed. Additionally, unstructured interviews were made with ten mid-level managers of the companies.

Results

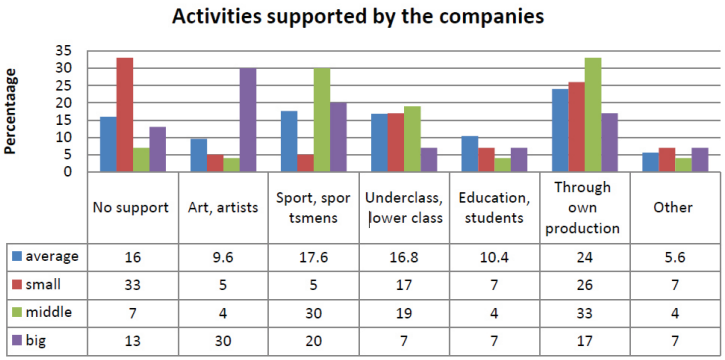
The survey results conducted to illustrate the knowledge of employees and consumers regarding CSR in Mongolia are provided below.

Employees' perception

The majority of the respondents were middle and low level employees who had worked in the companies for up to three years. As a first step, human resource practices, as an internal responsibility, were investigated. The relatively important aspect of how CSR honours the law (legislation) was asked to evaluate

the legitimacy of their managers´ decisions. While half of the respondents answered that their companies working within the law, another half rejected this approach. Additionally, only 32 percent of the employees reported that managers consulted them or asked for their opinions when making decisions. However, the interesting point is that the greater part - i.e. 65 percent, consider that the routine decisions are comparatively open and fair.

Subsequently, the question was posed: ´Association between the job duties and related salary´ to obtain the information about internal responsiveness of the companies. More than two thirds of all respondents considered salary level as sufficiently linked with their actual performance. Approximately 65.7 percent agreed that their organizations in some way organize training and development programs. Nevertheless, the percentage who evaluated them as ´efficient´ and also ´not efficient´ was the same.



	No support	Art, artists	Sport, spor tsmens	Underclass, lower class	Education, students	Through own production	Other
average	16	9.6	17.6	16.8	10.4	24	5.6
small	33	5	5	17	7	26	7
middle	7	4	30	19	4	33	4
big	13	30	20	7	7	17	7

Figure I. Respondents' perception of the CSR

Next, several questions were designed to obtain information relating to existing CSR programs and an actual performance. Figure I present the results of the question ´Define which activities the companies mostly support´.

On the next question, regarding companies´ environmental protection programs, the majority or 74.5%, reported that their companies do not perform any type of action. From this point of view, it might be concluded that Mongolian business companies do not pay much attention to the environmental protection. To the open-structured question designed to define ´What is Social Responsibility?´ employees widely explained it as a concept like: duty, spending part of profits on society, actions beneficiary to society, solution of employee´s problems, production of high-quality products, and legitimacy.

Consumers' perception

The main purpose of this questionnaire was to investigate what the CSR means from the consumers´ point of view, and whom, and for which actions they evaluate as a socially responsible firm. In general, the majority - or 92% of all respondents judge Mongolian companies´ CSR performance as lower than the median, 45%, or almost half, evaluate it as bad or insufficient. Even at the lower evaluation level, consumers´ appraisal of the industry varied. The most responsible sectors - as can be seen from Figure II, were telecommunication, banking, trade and service, and mining, with the telecommunication sector being evaluated the highest.

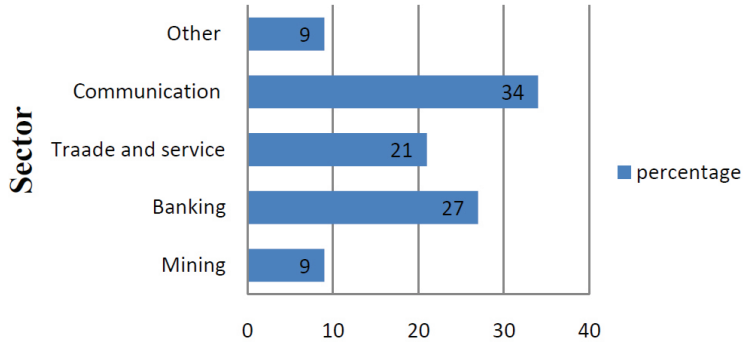


Figure II. Ranking of sectors

Subsequently, the consumers´ impressions of ´being a responsible company´ were interested. The general public perceive donation to the poorest citizens as the main issue of the CSR, and there is a tendency to evaluate companies with good PR of their philanthropy activities as ´good citizens´.

Discussion

A. Understanding the term CSR

This research is principally focused on explaining existing conflicts about the comprehension or understanding of just what CSR means from a theoretical perspective, and precisely, within Mongolian business circles. The research results show that the Social Responsibility approach developed by Montana (2000) is dominant in Mongolian companies. Top managers believe that their business should be based not only on economic gain, but should also go beyond the legal compliance for social benefit - even though many companies did not integrate social concerns in their daily business operations. The managers agree that CSR is perceived as a marketing tool in the overall strategy to increase the image of their company, to be an employer of choice, and to obtain strategic advantages in the marketplace; and this could be observed from the actions taken by companies. Entire companies, regardless of sector, support a wide variety of activities in the education sector, and have extended the practice of working with students to attract and retain workers in an era of high competition for talented staff.

However, the general public perceive both donation to the poorest citizens and reduction of pollution resulting from operations (mainly in the mining sector) as the main issue of CSR; thus, there is a tendency to evaluate companies with good PR of their philanthropy activities as ´good citizens´. Thus, we assume that supportive activities like state encouragement, enhancement of education and training, of and within, the young generation, along with the establishment of continuous reporting of organizations about their CSR activities to the society can change this mistaken perception and facilitate further positive development of this aspect in the future in Mongolia.

The Mongolian Chamber of Commerce has taken the first steps on this, and companies have started to report their activities in the given format. These are the pros; but the con is that these criteria are based purely on gross levels of money/finance provided. This fact has an extreme influence on the perception of others - which we would like to state as being exclusively wrong.

B. Describing CSR in Mongolian context

The question addressed by this research is: Are current model of CSR, namely Carroll´s CSR Pyramid (1991) suitable for describing CSR in Mongolia? To give an answer to this question,

the economic, legal, ethical and philanthropic responsibilities of companies was reviewed.

Economic responsibility

CSR is institutionalized and practiced in the Mongolian business sector at some level, usually by large, high-profile national and foreign investment companies. From the statistical data, it is noticeable that Mongolia suffers from unemployment, under-employment, and widespread poverty. The economic contribution of companies is high. The economic responsibility taken by companies in Mongolia includes investment in technological innovation, producing safe products and services, creating jobs, investing in human capital, in education and the Arts, establishing local business linkages, spreading international standards, and building physical infrastructure. From these facts, it could be concluded that companies in the Mongolian business sector take economical responsibility.

Legal responsibility

As with other developing countries (Visser, 2009), legal responsibilities perform poorly in Mongolia; this does not mean that the legal infrastructure is poorly developed, but rather it is because of administrative in/efficiency. Of course, terms like human rights and other relevant CSR issues are incorporated in corporate legislation. But again, the governmental capacity to enforce, and its control over legal responsibility, is limited. Both domestic and foreign investors report similar abuses of inspections, permits, and licenses by Mongolian regulatory agencies (U.S. Embassy, 2010). The Corruption Assessment conducted by Casals & Associates, Inc. (C&A), stated that weak government control of institutions, including the Central Bank, National Audit Office, Parliamentary Standing Committees, Prosecutor General, Generalized State Inspection Agency, State Property Committee, and departments within the Ministry of Finance (USAID, 2009).

Ethical responsibility

The Commission of European Community believes that, through CSR practices, enterprises can play an important role in preventing and combating corruption and bribery. However, from the Vissen (2009) point-of-view, ethics have the least influence on the CSR agenda, and he used the Global Corruption Barometer instead. Transparency International ranks countries according to the perception of corruption in the public sector, and according to this survey the situation in Mongolia is unpleasant. International organizations also agree, and mention in their reports, that corruption still affects business in Mongolia to a large extent. The World Bank´s (2010) Investment Climate Survey concluded that: ´Corruption in Mongolia, including bribery, raises the costs and risks of doing business and the overall Mongolian business climate´. Since governmental control over the social, ethical as well as environmental performance of companies - particularly in the mining sector, was lacking; activism by stakeholder groups has become one of the critical drivers that has forced firms to speak out and act on CSR.

Philanthropic responsibility

As Crane and Matten (2008) state, philanthropic responsibility in Europe and United States tends to be compulsory via the legal framework, while in developing countries - mostly in Asia, it is based on cultural factors. In Mongolia, practicing Buddhism, philanthropy is an expected norm for society. Based on the general principles of Buddhism, the rich should help the poor;

with the most common form of charity being to benefit the poor by giving money, clothes, homes, food, and by helping orphans or any other appropriate help.

Another reason is the immaturity of the CSR concept itself. As can be seen from the survey presented above, the understanding of the meaning of socially responsible is still poor in societies, and people equate responsibility with philanthropy. Thus, this type of responsibility is common in Mongolia.

Conclusion

This paper describes the present conditions of CSR implementation in the Mongolian business sector. The main results of this research are twofold. First, summarizing the present condition in Mongolia, we conclude that the concept itself is not strengthened in business environment, and society perceives it as the program of charity or donation. Second, managerial staff is not concerned intensely on every single CSR activities, essential to environment protection. It could be explained that individual market-oriented companies may not be able to appropriately connect their strategies with social aspects. There are no codes and standards on national language, everyone does what they think is right by themselves; thus, national and international policy makers should actively promote the creation and enforcement of obligations to be responsible on companies. It is important to mention here that the NGOs and public-private partnerships are necessary to promote better performance in the field in Mongolia.

Additionally, authors state that there is actual necessity to expand the practice of reporting responsible activities to the society, which as a result will change the mistaken understanding of CSR within all stakeholders. However, it should be classified by the size of the business organization, and identify the associated performance, thus increasing the possibility of progress in this area. Additionally, the supportive activities such as state encouragement, enhancement of education and training of within young generation, along with the establishment of continuous report of organizations about their CSR activity to the society can facilitate the development of this aspect in the future in Mongolia.

Next, the conflict surrounding understanding and realization of CSR in practice shows that it is necessary to investigate the applicability of existing theory in different context of culture, religion and economic development. Even though several empirical studies suggest that culture may have an important influence on perceived CSR priorities, it would thus be of interest to learn how the nature of CSR in developing countries, and how it varies between countries in Asia and Europe. Our findings prove the research observation suggested by Visser (2009), that in developing countries, economic responsibilities still get the most emphasis. Then philanthropy is given second highest priority, followed by legal and then ethical responsibilities.

References

Aupperle, K. E., Carroll, A. B., Hatfield, J. D. (1985) *´An empirical examination of the relationship between corporate social responsibility and profitability´*, Academy of Management Journal, pp. 446-463, Vol. 28, no. 2.

Birch, D., Moon, J. (2004) *´Corporate social responsibility in Asia´* Journal of corporate citizenship, pp. 18-23, Vol. 13.

Carroll, A. B. (1991) *´The pyramid of CSR: toward the moral management of organizational stakeholders´*, Business horizons, pp. 39-48, Vol. 34.

Chandler, D. (2007) *´A guide to Corporate Social Responsibility´*, University of Miami.

Crane, A., Siegel, D., Moon, J., Matten, D., Mcwilliams, A. (2008) *´The Oxford handbook of corporate social responsibility´*, 1st ed. Oxford University Press, Oxford Handbooks Series.

de Vaus, D. (2004) *´Research Design in Social Research´*, 4th ed., London: SAGE Publications.

Edoho, F. M. (2007) *´Oil transnational corporations: corporate social responsibility and environmental sustainability´*, Corporate Social Responsibility and Environmental Management, pp. 210-222, Vol. 15.

Gail, T., Nowak, M. (2006) *´Corporate social responsibility: A definition´*, Working paper series 62, Perth: Curtin University of Technology, Graduate School of Business.

Lea, R. (2002) *´Corporate Social Responsibility: IoD Member Opinion Survey´*, p. 10, UK: The Institute of Directors.

Lee, K.H. (2007) *´Corporate social responsiveness in the Korean electronics industry´*, Corporate Social Responsibility and Environmental Management, pp. 219-230, Vol. 14, no. 4.

Man, W. Jianxin, Y. (2008) *´Study on Establishment of Corporate Social Responsibility System´*, Wireless Communications, Networking and Mobile Computing, pp. 1-4, Dalian.

Michael, B. (2003) *´Corporate social responsibility in international development: an overview and critique´*, Corporate Social Responsibility and Environmental Management, pp. 115-128, Vol. 10.

Montana P. J., Charnov, B. H. (2000) *´Management´*, 3rd ed. New York: Barron's Educational Series.

Moon, J. (2007) *´The contribution of corporate social responsibility to sustainable development´*, Sustainable Development, pp. 296-306, Vol. 15, no. 5.

Smith, C.N. (2003) *´Corporate Social Responsibility: Not whether, but how?´*, Working Paper No. 03-701, p. 4.

U.S. Embassy (2010) *´Mongolian Investment Climate Statement´* [Online]. Embassy of the United States, 2010 [quot. December 2010]. Available on World Wide Web: http://mongolia.usembassy.gov/root/media/pdf/2010-mongolia-investment-climate-statement.pdf.

USAID (2009) *´The Mongolia Monitor´* [Online]. [quot. Nov 2010]. Available on World Wide Web: http://www.usaid.gov/mn/documents/January_09_Mongolian_Monitor.pdf

Visser, W. (2009) *´Corporate social responsibility in developing countries´* in Crane, A. ´The Oxford handbook of corporate social responsibility´ London: Oxford Handbooks Online, p. 473-499.

WBCSD (2002) *´Corporate Social Responsibility: The WBCSD's journey´* [Online]. World Business Council for Sustainable Development, [quot. 16 December 2009]. Available on World Wide Web: http://www.wbcsd.org/.

Werther, Jr., William, B., Chandler, D. (2005) *´Strategic Corporate Social Responsibility: Stakeholders in a Global Environment´*, 2nd ed., London: SAGE Publications, p.448.

World Bank (2010) *´World Development Indicators database´* [Online], [quot. April 2010] Available at World Wide Web: http://data.worldbank.org/indicator.

Journal on Efficiency and Responsibility in Education and Science
ISSN: 1803-1617

A NEW APPROACH TO MEASURING OF COMPUTER LITERACY AT THE UWB

Tomáš Přibáň, Jan Hodinář, Václav Vrbík

University of West Bohemia
tpriban@kvd.zcu.cz

ARTICLE INFO

Article type
Short communication

Article history
Received: March 14, 2011
Received in revised form: May 10, 2011
Accepted: June 2, 2011
Available on-line: June 30, 2011

Abstract

Nowadays, computer literacy is one of the required conditions demanded by an employer, who wants to success in today's labour market. Unfortunately a so called necessary minimum of knowledge is not exactly defined. Computer literacy is an important part of basic education in the Czech Republic. Our educators face a difficult issue of assessing a level of computer literacy among our students. Because of that, this case study compares two tools used for testing of computer literacy. We selected two testing tools for this study, the Original Testing System (OTS) and the Modified Testing System (MTS), and then investigated them thoroughly by quantitative comparison. This quantitative comparison of those testing tools was done using data collected from a freshman-level Word and Excel course in fall 2010 semester in the University of West Bohemia (UWB). Comparison was based on an analysis of the performance of 138 students attending this course. We analyzed correlations between scores from our two testing instruments. We conducted a paired sample t-test for the sake of comparison of the students' performance between their examination scores. This study has its limitations, which were discussed in the paper. Directions and recommendations for a future work were included based on those limitations.

Key Words

computer literacy, computer education, computer skills, assessment

Introduction

Information age is around us and more and more people are forced to live and work using information and communication technology. Because of this fast changing society and workplace, it is very important for citizens and employees to understand and be able to use a technology around them. But when can we say that a person is computer literate and when we cannot? That is the question. For everyone that line is somewhere else and unfortunately there is no uniform definition.

Question of knowledge and skill evaluation of students is very current nowadays, which is proved by current effort of Ministry of Education, Youth and Sports. It wants to initiate evaluation of students in fifth and ninth grade and initiate state graduation exams. The issue of evaluation is a cynosure even in foreign countries (Creighton et al., 2006). That is proved by existence of several institutions, specialized in this issue. They are for example Qualifications and Curriculum Development Agency, Education Testing Service, European Computer Driving License Foundation. Work on evaluation tool for measurement in an area of computer literacy started in 1983, when a team of experts was created. Their goal was not only to create a tool, but also to define the term computer literacy (Lockheed et al., 1983). Main accomplishment of this expert team was creation of evaluation tools set, that measured usage of particular computer programs, programming and knowledge of computer terminology in addition to social aspects of work with computer. Nowadays, two main approaches are chosen in an area of measurement of computer literacy. The first one is measuring computer literacy using self evaluation (Kontos G., 2007 or Berger C. F., Carlson E. A., 1988), the second one is focused on measurement using practical assignments (ECDL, 2010 or ETS, 2010). The second approach is dominant thanks to its focus and worldwide extension. Because of that, authors of this paper tend to prefer this approach of measurement.

Our educators face the challenging issue when they have to ascertain computer literacy level among our students. On account of that, a main purpose of this case study was to assess student's computer literacy using two different testing approaches. The particular objectives of this research were:

- To make a quantitative comparison of our two testing tools: the Original Testing System (OTS) and the Modified Testing System (MTS). And to examine advantages and disadvantages of each testing tool.
- To find out if in our case, there is any correlation between the OTS testing scores and the MTS testing scores.
- To find out if in our case there is any difference between the mean OTS testing scores and the mean MTS testing scores.

Material and Methods

"Computer literacy is a term that has been widely discussed, but whose meaning has rarely been agreed upon (Lockheed et al, 1983)." Those words remain as true today as they were when they were first written over a decade ago. The exact origin of the term computer literacy is unclear. Kurshan (in Hess, 1994) has reported that computer literacy courses were introduced at many colleges as early as 1965. The term computer literacy was also promoted in the early 1970s by Arthur Luehrmann in an effort to promote understanding of the uses of computers as opposed to the workings of computers. Luehrmann has also coined one of the more concise and pragmatic definitions of computer literacy (in Lockheed et al, 1983): "If you can tell the computer how to do things you want it to, you are computer literate." This definition has an advantage, because it admits a continuum of

computer skill levels and it also allows for a concept of computer literacy that is both technology and environment or context dependent. Computer literacy can thus be seen to comprise multiple elements ranging from a spectrum of skills for using a computer, to broader definitions that attempt to describe an impact of computers on society and changes in society wrought by an advent of the so-called "information age".

All freshman students at the Faculty of Education, University of West Bohemia are required to finish a basic common curriculum that includes courses in these areas of education: Math, Chemistry, Physics, Biology, Geography and other basic courses. In addition, all these students must finish the course called "Introduction to the Processing of Textual Information and Basics of Data Processing". Both courses are for freshmen students. Specifically, these courses are aimed to teach how to work with MS Word, MS Excel and MS Access. Students may use e-learning support, which were developed for both courses. This e-learning support contains a necessary expository text, which is completed by large amounts of multimedia elements (video sequences, animation). Thanks to these multimedia elements, learning is more effective and dynamic. For those who are interested, the e-learning support is available at: http://www.kvd.zcu.cz/cz/materialy/uzti7_kn/uzti/word_2007/index.htm - but only in Czech language.

The original testing system (OTS)

This testing system was developed at the Department of Computer Science and Educational Technology, Faculty of Education, University of West Bohemia. The major characteristic of the OTS is theoretical orientation on Word, Excel and Access. The OTS includes a test battery which offers a single choice (true/false questions) or multiple choice questions to the students. The OTS also contains two practical exercises which should validate the skills of students. One demerit of this system is that the correct or plausible answer by a student may be judged "incorrect" in some rare situations because of the fact that simulated environment may not be able to recognize the way of accomplishing the task.

As mentioned above, this testing system was created by employees of the KVD FPE. It was sometimes around a year 2000, when methodology of International Computer Driving Licence (ICDL) was not fully developed yet. Which is a main difference compared to undermentioned MTS testing system, that was created on basis of ICDL methodology. Also, when you consider current knowledge in the field, theoretical and practical part of OTS does not look valid enough. On the other hand, MTS attempts to reflect current viewpoints of computer literacy. Constructivism fundamentals are used to create its questions, which in addition to ICDL methodology should provide testing tool, which is valid enough for today's age.

The modified testing system (MTS)

The comparison tool for testing was the modified testing system (MTS). Basis of this system consists of the Computer Skills Placement (CSP) assesment (Computer Skills Placement, 2010). CSP was introduced in June (2006) at the ACCUPLACER conference. It was developed in collaboration with the CollegeBoard and ACCUPLACER as a component of the International Computer Driving Licence (ICDL), which is also called the European Computer Driving Licence (ECDL) Certification program (European Computer Driving Licence Foundation, 2010) and is based on the world's leading basic computer skills program that currently has over 6 million participants in over 140 countries. This system's theoretical part

is opposed to the OTS. It has moreover fill-in-blank questions, short answer questions and matching questions. Furthermore, the practical part of the MTS is connected to a MySQL database and is easily modifiable.

A testing system similar to MTS is Internet and Computing Core Certification (IC³). Internet and Computing Core Certification is designed to validate an individual's basic computer skills and Internet knowledge to promote success in school, work, and life (Certiport, 2010). This group of testing tools usually includes a set of skills and knowledge base, against which the test subjects would be compared. Although suppliers that provide the tests often claim that the tests can be adapted, adjusted or modified to fit the specific needs of the submitters, it seems that the customization is quite limited (if possible at all) compared to the first group of testing tools. The instructors would not have much need for a change of the tests and the administration of the exam would be therefore easier.

Research methodology

The research in this study is quantitative and is centered about the following research questions: Is there any correlation between testing scores of the OTS method and the testing scores of the MTS method? Is there any difference between the mean testing scores of the OTS method and the mean testing scores of the MTS method?

To assess the strength of the linear relationship between two test scores, Pearson's correlation coefficient (r) is used. And to find out statistical significance of r, we are using a t-test. The two hypotheses for this test are:

H_0: r = 0

H_a: r <> 0

If a p-value for this test is very low (for example less than 0.05), it would mean that there is evidence to reject the null hypothesis in favor of the alternative hypothesis. Other explanation is that there is a statistically significant relation between the two test scores.

On the contrary, for comparison of the means of two variables within a single group the paired-sample t test is used. Which means a paired t-test is usually used to compare means of the same or related subject over a period of time or in differing circumstances. In case of our study, it was used to determine if there was a statistically significant difference between the MTS test scores and the OTS test scores among our 138 students.

The paired t-test is in fact a test in which a difference between two observations is 0. In that case, if D stands for the difference between observations, the hypotheses are:

Ho: D = 0 (the difference between the two observations is 0)

Ha: D <> 0 (the difference is not 0)

The t is a test statistic with n -1 degrees of freedom. If the p-value conjugated with t is low (less than 0.05), there is a strong evidence for rejection of the null hypothesis. Therefore, we would have the evidence that there is a difference in means athwart the paired observations.

Results

In 2010, at the end of the fall, during winter semester, students from four classes of "Introduction to the Processing of Textual Information and Basics of Data Processing" were given two final exams: 30 questions and 2 practical exercises from the OTS and the MTS exam, which also consisted of 30 questions plus 2 practical exercises. The OTS exam was applied first. When the OTS exam finished, students were given codes to allow them to access the MTS exam. Students were made to believe that both test scores would be regarded with in calculating their final exam grade and final semester grade, which turned out to be a strong motivation.

All collected data were introduced into the STATISTIKA, a statistical and mathematical software package. We used descriptive statistics to analyze the data to get a demographic summary of 138 students. Then we used correlation and paired-samples T test in inferential statistics to test two pairs of hypotheses.

This study examined performance of 138 students in four classes in both courses. In the sample were more females (56.2%) than males (43.8%). The t-test was administered to test each of two pairs of hypotheses. The first pair of hypotheses examined if there is any correlation between the testing scores of the OTS test and the testing scores of the MTS test. The p-value was calculated from the test scores and any value less than 0.05, was rejected. First hypothesis was rejected solely on this basis. That was because there is the evidence to reject the null hypothesis in favor of the other hypothesis, or that there is a statistically significant connection between the scores of those two tests (see Table 1 for details).

		N	Correlation	Sig.
Pair 1	MTS score & OTS score	138	.724	.000 (**)

Table 1. Paired Samples Correlations

The second pair of hypotheses establishes if there is a statistically significant difference between the MTS test scores and the OTS test scores. A p-value was calculated from test scores and any value less than 0.05, was rejected. Second hypothesis was therefore rejected on this basis. That was because there is an evidence to reject the null hypothesis in favor of the other hypothesis, or that there is a statistically significant difference between the MTS test scores and the OTS test scores (see Table 2 and Table 3 for details).

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	MTS score	57.76	138	9.395	.818
	OTS score	67.45	138	9.640	.839

Table 2. Paired Samples Statistics

Paired Differences ((MTS_Score – OTS_ Score)					t	df	Sig. (2-tailed)
Mean	Std. devia.	Std. error Mean	95% Confidence Interval of the difference				
			Lower	Upper			
-9.689	7.071	.615	-10.907	-8.472	-15.743	131	.000(**)

Table 3. Paired Samples Test

** Difference is significant at the 0.01 level (2-tailed).

Discussion

Pearson's correlation was used for an evaluation of a linear relationship between MTS scores and OTS scores. In this evaluation a statistically significant linear relationship was discovered. Using Pearson's correlation coefficient, a relationship between OTS score and MTS score was $r(130) = 0.724$, $p < 0.001$. From these data, the mean (SD) for the MTS test is 57.76(9.395) and for the OTS test it is 67.45 (9.640). Because the p value is very close to 0.000, it seems that the two test scores are highly correlated. Even though we felt that the tests similar to the OTS may be superior to MTS (or resembling test tools), after three quantitative analysis, we feel that both testing tools could be viable options and can be used to a certain degree in some situations. For example we would recommend MTS (or resembling test) in case there are instructors available to slightly modify and customize the tests.

A cut-score logically need to be set if one of these tests is used for a bypass test as computer literacy requirement. Or if it is used as a testing tool for "credit-by-exam" classes. It always will be a challenging and difficult issue to do so, objectively and correctly (exactly the right number). Process of setting cut-score very much depends on capacity of educators involved and it is always a matter of judgment. Our suggestion is that the cut-score is set to be an equal to the mean plus standard deviation. Therefore, in case of the MTS test, we recommend that the cut-score should be set to 57.76 + 9.395 = 67.155 or 67, and for the OTS test, the cut-score should be set to 67.45 + 9.640 = 77.090 or 77.

This study was centered mainly on this two testing tools, the Original testing system (OTS) and the Modified testing system (MTS). We choose them both, because we think that they represent two main groups of testing tools very well. But on the market, there is yet another group of testing tools: Information and Communication Technology (ICT) Literacy Assessment (Honey, M., Pasnik, S. and Fasca, C., 2006). Two major examples from this group are iCritical thinking - Information and Communication Technology Literacy Test by Education Testing Service (Education Testing Service, 2010) and on-Screen Test for ICT at Key Stage 3 (National Assessment Agency, 2010, Qualifications and Curriculum Authority, 2010). The iCritical thinking (formerly known as iSkills or ICT Literacy Assessment), which was developed by Education Testing Service (ETS), is a comprehensive test of ICT proficiency originally aimed for higher-education environment. iCritical thinking test divides ICT literacy into seven key abilities: access, create, define, evaluate, manage, integrate and communicate. It is scenario-based test and it measures technological literacy. It means a measure of how well can students apply their computer skills and knowledge into real-life scenarios. That often includes sifting through multiple information resources and applications (like websites, emails, charts, spreadsheets, databases and search engines). After that, it needs to be decided which sources to use and then use them effectively. While we agree that goals of this test are a little lofty, the idea, in our opinion is very interesting and intensions of this test are certainly good. We still think that the ICT Literacy Assessment is much more involved and the students' performance may be affected very significantly by some other known factors (e.g., cognitive skills, critical and logical thinking skills, etc.) and maybe even some unknown ones. It is however difficult in this stage of research to compare these three approaches (e.g., compare iCritical thinking, OTS, and MTS) and analyze them quantitatively or qualitatively.

Conclusion

Based upon the results of our quantitative study, we concluded that the testing scores of the OTS and the testing scores of the MTS are highly correlated. We also concluded that there is a significant difference between the mean testing scores of the OTS and the mean testing scores of the MTS as administrated in UWB in fall 2010. We speculate that portable and mobile computing technologies are very much the defining technologies of this decade. The Internet has connected PCs around the globe, but PCs for the most part have remained stationary devices. Wireless technology truly frees laptops to be mobile, providing the ability to connect to the Internet from anywhere and at any moment. Portability frees an application from a particular platform at a particular location. In essence, portability and mobility imply access to information and the ability to communicate from any place and at any time (Hoffman, 2003). In this regard, we think a so called system of cloud computing will be supported more widely.

We can anticipate an advancement in definition of computer literacy in this context. Transfer of education materials into electronic form can be expected, because of need to use them in mobile devices (PDA, cell phones, Ipads,…). This need will be very challenging for researchers involved in this study. Because of it, they will be forced to transfer e-learning courses (didactic tests), they are currently using, to the needs of today's mobile devices. At the present time, we are undergoing quasi-standardization of the MTS test and we know already, that we will have to adjust some parts of it, which we discovered during evaluations. There were elements of the test, which were too difficult or by contrast too easy. Evaluations of the MTS tests were done in agreement with methodology used in Chráska (1999) and Gavora (2000). In the next semester, there will be a verification of the problematic parts in tests, that were now adjusted. And simultaneously, as was noted above, we will need to think up a modification of test, which will put much more emphasis to ability of using internet browser. It will open a gate to future full use of cloud computing.

Acknowledgements

The department gained its first experience with e-learning in 2003, thanks to the participation in the project Leonardo da Vinci II BATCOS (Development & Piloting of Basic On-Line Training Courses). E-learning course was created on the basis of this project and we are using some versions of it in our classes ever since. Data collection and analysis for this study was carried out by project SGS-2010-073. Furthermore, we cannot ignore our colleague Filipi, who was involved in teaching of the class: Introduction to the processing of textual information.

References

Berger F. C., Carlson E. A. (1988) *"Measuring computer literacy of teacher trainers"*, Journal of Educational Computing Research, Vol. 4, No. 3, pp 287-301.

Computer Skills Placement (2010) "*Benefits & Features*", [online], http://www.csplacement.com/csp_benefits.html.

Certiport (2010) "*IC³ certification*", [online], http://www.certiport.com/portal/DesktopDefault.aspx.

Creighton, W., Kilcoyne, M., Tarver, R. and Wright, S. (2006) *Computer literacy levels of students enrolling in a post-secondary computer applications/information technology course*. Information Technology, Learning, and Performance Journal, Vol. 24, No. 1, p. 15-23.

Education Testing Service (2010) "*iCritical thinking certification*", [online], http://www.ets.org/icriticalthinking/about

European Computer Driving Licence Foundation (2010) "*About ECDL Foundation*", [online], http://www.ecdl.com/publisher/index.jsp.

Gavora, P. (2000) *Úvod do pedagogického výzkumu.* Brno: Padio, 207 p.

Hess C. A. (1994) "*Computer literacy: An Evolving Concept"*, Journal of the School Science and Mathematics, Vol. 94, No. 4, pp 208-214.

Hoffman, M., Blake, J. (2003) *Computer literacy: today and tomorrow*. Journal of Computing Sciences in Colleges, Vol. 18, No. 5, p. 221-233.

Honey, M., Pasnik, S. and Fasca, C. (2006) "*Is having the right answer enough? Developing new forms of assessment for 21st century learning*", [online], http://www.ciconline.org/thresholdspring06.

Chráska, M. (1999) *Didaktické testy,* Brno: Paido, 91 p.

Kontos G. (2007) *"A Survey: A Simple Tool to Measure Computer Literacy"*, [online], http://works.bepress.com/george_kontos/1

Lockheed M. E., Hunter B., Anderson R. E., Beazley R. M., Esty E. T. (1983) *Computer Literacy: Definition and Survey Items for Assessment in Schools*. Educational Testing Service. Prepared for the National Center for Education Statistics under contract with the U.S. Department of Education, 222 p.

National Assessment Agency (2010) "*The essential guide to the key stage 3 ICT test"*, [online], http://www.naa.org.uk/naaks3.

Qualifications and Curriculum Authority (2010) "*Key stage 3 ICT onscreen assessment tasks*", [online], http://www.qcda.gov.uk/assessment/6555.aspx.