**Automated certification of competences as a part of a diploma**

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**Abstract**

When seen from an employer's perspective, owning certain competencies related to the tasks to be completed is a requirement of future employees / beginners is an important expectation. Similarly to other materials related to manufacturing, or conditions related to services, labour is also bought at its specific market by firms. It is understandable how the firm also wants to purchase labour which abides by certain requirements, similarly to any other material they work with, in order to reach the performance they wish to realise. This is why the firm chooses its employees similarly to how they procure materials - selecting from the various sources, searching for those that satisfy the most requirements, in the most favourable way - on the labour market, choosing the most fitting employee-to-be for the job. This results in the bachelor, master and combined courses including competency training in the training and qualification requirements, considered to be success indicators definable via behaviour elements. The goal of this research is to analyse if behaviour-patterns defining competencies can be identified a measured via log data.

Keywords: Competency, measurement, similarity analysis, COCO Y0

**Introduction**

The training and qualification requirements currently determined for university bachelor, master and combined courses are regulated by Appendix 2 of Minister for Education's decree 15 of 2006 (3'rd April) on training and qualification requirements of bachelor and master courses. The diploma handed to those students who finished their studies not only has to certify (in theory) that the student absolved his/her education requirements, but validate that they also obtained the competencies listed in the TQR.   
The fact that competency-based thinking surfaced in HR brought the inclusion of task-related requirements based on competencies into work-requirements with it. Meaning, defining the employer's requirements of the employee doesn't happen from the perspective of general knowledge, wisdom, competence and ability, but these are interpreted on the level of behaviour instead (Fehér, 2014; Komor et al., 2001).

This research introduces the first partial results of the series of experiments conducted by the R&D&I group of the SZIE FESS ISST and the Institute of Management Sciences which began in 2015.

The goal of our research is to create a competency measurement method, and a methodology intended to calculate a competency-index based on log data[[1]](#footnote-1) and evaluating its feasibility.[[2]](#footnote-2) The project's other goal is to advise on, and contribute to the quality control of diplomas issued by higher education, and to assure the results of said quality control.

**Competency**

The theoretical definition system of competencies is constructed and handled differently by pedagogy, psychology and management sciences. The common trait of all three disciplines' definitions is complexity:   
Our research tries to understand competencies from the perspectives of management sciences, human relations, and the labour market, however, we wish to comment that to understand the theoretic thought behind competencies, knowing the basics is indispensable.   
One side of the complex definition is the English terminology's roots (competency-competence, which are both referred to as 'kompetencia' in Hungarian). While competency would translate to the characteristics describable via behaviour signs and influencing performance, competence would translate to task affinity, in other words, measurability (Klein - Klein, 2008, p. 66-67). McClelland (1973) states that competency is the forecast indicator of personal performance. Klein (2009) handles competency as a group of basic attributes, which are required to conduct a task exceptionally. Vekerdy (2005) and Fehér (2011) highlight that competency in its entirety is the indicator of success, or in other words, a behavioural (or behaviour-deduced) factor related to highly exceptional performing. They proceed further with their idea, and summarise it as follows:   
The characteristics of personal competencies:

* they are basic, definitive characteristics of the person,
* they are in a causality relationship with effective / exceptional performance (realised results),
* they can be observed in behaviour patterns, and they are implemented in actions (who does what, and when?),
* their existence can be forecast from the intent to act, and how deliberate it is (what someone thinks of the current situation; is he / she willing to behave in the same way in a situation that's more of a challenge),
* and the previous (including currently observed, f. e. during an interview) specific behaviour,
* their validity is dependent on changes in the organisational context,
* and in case they're identified effectively:
* they're clear, unmistakable, understandable, acceptable within the organisation.

The constructive critique of the literary source is that there're no other definitions for competencies which would lead to the transactional levels of events, meaning definition creation is conducted with a high abstraction level, which prevents exact interpretation, and by extension, automation. Defining competencies by using log data as the basis has to climb through this obstacle first and foremost (e.g. 'word magic'[[3]](#footnote-3)).   
However, improvements could also be made in what's been said.   
Even though competencies can be considered to be inherent factors of a person (e.g. faith, motivation), stating that it's a basic, definitive characteristic is unfound. Competencies, similarly to other attributes which would go into the 'affinity' category can be learned and improved via time, practice and experience for most people. For example, creativity can be considered to be one manifestation of competencies in a profession's certain scenario, as it results from the deeper knowledge of practical experiences and theoretical knowledge due to human motivation, and these elements' implementation in a way that neither the experience to be gained, nor the long practice conducted, or even the synergy between the two could teach to a human - however, in some circumstances, people who weren't competent in the given field to begin with can also be creative, even though the thought handles creativity as the crystallisation of competencies. However, if competencies don't exist to begin with as a human attribute, they can't be basic either, even though it's no question that they're still definitive.   
Also, it's important to take note of the fact that not only the validity of personal competences are dependent on the context, but their life expectancy as well. In a context which is supportive (e.g. inspiring), competency is also developing, since the person considers success resulting from competencies a motivational factor, and induces his / her own competitiveness based on their successes, thereby searching for new challenges, and experiencing solving said challenges as further successes. However, in a context that a person's own competencies may be against the processes of practice (e.g. bureaucracy, where even though routine processes aren't negative factors, they require constant fine-tuning and improvements, as there's no universal, perfect solution to anything), the imaginary curve of competencies assumes a downwards trend quite quickly.

**On measuring competencies**

We also had to interpret competencies for the research and measurement presented in this study beyond the terminology of the literary sources, and we had to grab indicators which are objective (as soon as possible), and allow translation to numerical data. Including these policies, we defined competencies as behaviour attributes which can be summarised in logs, are additive and oriented. When we say 'summarised in logs', we consider behaviour patterns, actions and activities to be recordable and measureable (in other words, completely detachable from the observer, and automatable by a robot). The additive attribute is related to adding different values together[[4]](#footnote-4). The oriented attribute refers to the feasibility of 'the more <a>, the more <b>' logic. The objectivity level of attribute is depending on the stability of these orientations. Orientations (c.f. ceteris paribus forms between attributes) can also be optimum-oriented, not only monotone like linear and inverse relationships. In this study, orientation will be defined as linear or inverse relationships, because in the observed situations extreme conditions (needing optimum characteristics) could not be realized. If experts are not able to evaluate orientations of attributes concerning competencies, then the knowledge to analyse real situation are still not given. Robot, however, can only be created, if declarative knowledge is available at least on the level of orientations of attributes. Rational orientations could also be derived based on inductive processes for rule generation (c.f. B. Molnár Á., 2012[[5]](#footnote-5)). The form of ceteris paribus function is not constant for each background constellation, but a kind of “average” pattern can mostly be assumed.

In the first phase of the series of experiments, we analysed the measuring possibilities of "being cut out for teamwork" as a so-called super-competency, and defined said competency on a group level. We have to take note here that some competency models define affinity for teamwork, or the behaviour-group describing it as the sum of various other competencies.

The affinity for teamwork on a single individual's level is described with f. e. the following behaviour indicators:

* willing to think together with others,
* willing to take note of other members' opinions,
* willing to listen to others,
* willing to accept others, and their opinions,
* aims for compromises,
* contributes to the performance of the team,
* doesn't force own will onto others,
* etc. [[6]](#footnote-6)[[7]](#footnote-7)[[8]](#footnote-8).

According to WHO global competency model[[9]](#footnote-9) definition of “teamwork” is: „Develops and promotes effective relationships with colleagues and team members. Deals constructively with conflicts.” Teamwork can be described with following acts:

* Works collaboratively with team members to achieve results
* Encourages co-operation and builds rapport among fellow team members
* Supports and acts in accordance with team decisions
* Accepts joint responsibility for team’s successes and shortcomings

Identifies conflict early and supports actions to facilitate its resolution

The experiment questions if a competency can be managed on a group level. Meaning, can an ideal - typical "teamworky" team be defined? Based on the phenomena listed above and attributes listed below, an ideal group's members are willing to think together, take note of each other's opinions, try to achieve a compromise, each member has their share of the work of the group, etc. However, we mustn't forget that the results and the overall efficiency of the group is also influenced by its members' roles. The composition of the ideal team was discussed by Belbin, among others (Belbin, 2003): Also, the affinity for teamwork can only be measured in a given scenario, if the measurement factors of the group itself are identified and matched to it, since the attributes of the affinity for teamwork are also influenced by the attributes of the team itself - f. e. group dynamics, which sometimes goes beyond the extra value added to the group's work by its members. We can think of f. e. a group whose work is heavily influenced by the technological environment, where even the best, most efficient group can fall apart if the technological environment is insufficient or ill-conceived, which may poison the work process long-term.   
One of the quality management layers of the modelling process is the definition of inverse force fields (e.g. conducting consistency checks). In our case, unearthing the ideal - typical team's inverse is the other benchmark, compared to which the ideal can also be legitimised: f. e. there's no interaction between various team members, the team's tasks are not completed by everyone in the end, or even a single person completes it. The possible activity of group members appears as the partial tasks compared to each other with relative homogeny, etc.

All in all, one of the problems related to measuring competencies is that the behaviour indicators are usually measured on scales of either "agreement" or "resemblance", or are defined on them, and this method contains various subjective value decisions, be it either self-evaluation, or other 'observer' methods[[10]](#footnote-10). They try to raise the reliability, validity and objectivity of measurement results using varied questioning and scaling techniques, subjecting them to a 360 degree evaluation system along the mainstream test thesis' definition system. Even if the competency measurement methods became more and more refined over the years, measurements clearly 'based on facts' (c.f. data-driven policy making) is still the less popular way to go. The work of Pitlik and co-writers falls into the latter category.[[11]](#footnote-11)

**Source and Methodology**

In order to measure the competencies of the students, an experimental scenario was formed. The persons taking part in the experiment were selected from those attending the 2014/15 year of the SZIE FESS' Human Resources BA. (sixth semester students), and Leadership and Management MSc. (second semester students).   
Taking part in the experiment wasn't mandatory. Forming the group was left for the members to handle. The partakers were asked to give various other data of themselves before the groups were formed: their self-estimated IT knowledge on a scale of 1 to 5, applicable to the evaluation using a 5-level grading system; also, in case of the BA. students, the average of the grades they got for their Basics of Leadership and Management course, Human Resource Management course, and Person-by-person Case Activities I. course, and in the case of Leadership and Management MSc. students, the average of their grades for their Enterprise and Institute Strategies course, and Personal Leadership course.

The students' teams, organised by their own hands were tasked with writing a Wiki-based article[[12]](#footnote-12). The topic of the article was the "Human Resource Management System". The contents of the article were bound for every chapter. The following parts were mandatory to write for each group (also: <http://miau.gau.hu/lexikon/>, and https://miau.gau.hu/mediawiki/index.php/Szak%C3%A9rt%C5%91i\_rendszer:

1. History module
2. Ontology module
3. Historical contradictions and statements without basis module
4. Definition-creation module
5. Self-evaluating test questions module
6. Processed and advised literary sources module.

Articles of groups can be found from the main page of the project: (<https://miau.gau.hu/mediawiki/index.php/Csoportmunka_projekt>)

Each participant was given a unique username insufficient to identify the person itself, and its password, which they could use to log in to the user interface as an editor. Introducing the login protocol was required for the data to be organised into logs later. This is how we could determine who and when modified which part of the group's task in what amount. Individual activities were tracked using the page history related to the article and the discussion page.

We would like to announce that the researchers state the following: the ones participating in the experiment offered their personal identification data, which was handled appropriately, and the results of the experiment are only publicised in a way that guessing the identities of the participants is impossible. The participants can only view their own, personal research results.

During the data procession, only four out of the six formally established groups produced results which could be evaluated. This means that two groups didn't finish the article in the end. The chart below lists some attributes of the partaking groups subject to the final evaluation.

Chart 1: attributes of the partaking groups subject to the final evaluation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Group | Members | IT avg. | Grade avg. | Gender F/M | Course |
| G1 | 3 | 3 | 3,2 | 3/0 | HR BA |
| G3 | 5 | 3,2 | 3,3 | 5/0 | HR BA |
| G4 | 7 | 3,3 | 3,3 | 4/3 | HR BA |
| G5 | 5 | 3,2 | 4 | 5/0 | LM MSc |

Source: self-made

Before evaluating the data, we defined observable predictors which may become the forecast factors of the ideal group. These variables can be seen in Chart 2 below.

Chart 2: attributes and their orientation.

|  |  |
| --- | --- |
| **Attributes** | **Orientation** |
| Character per capita (modification - absolute value) | 0 |
| Members per capita who only worked on one module | 1 |
| Deviation of members' average modifications per capita | 1 |
| Deviation of members' activity by module | 1 |
| Character modification by capita logged by the discussion page | 0 |
| Arguers per capita | 0 |
| Time homogeneity | 1 |

Source: self-made, where the 0 code of orientation follows the logic that the more, the better, and the 1 code of orientation follows the logic that the less, the better.

Based on the orientation values listed in Chart 2, we can say that:

1. The more characters per capita,
2. the less members per capita who only worked on one module,
3. the lower the deviation of members' average modifications per capita is,
4. the lower the deviation of members' activity by module is,
5. the more the character modifications by capita logged by the discussion page,
6. the more arguers per capita, and
7. the less time was spent before beginning writing the article,

**the closer the group is to being ideal.**

The verification of the orientation (see above) can be made based on inverse thinking (c.f. inverse modelling for detecting function symmetry problems):

1. if nobody writes no character – then the work is not done
2. if a module of a wiki-article is only a one-man-show – then it can not be spoken about team-working
3. if a module of a wiki-article is dominated only by one person in case of modifications per capita in the article – then it is not really a teamworky situation
4. if a module of a wiki-article is dominated only by one person in case of member’s activities/presence in the article – then it is not really a teamworky situation
5. rule no.3. is also valid for the discussion page of the wiki-article
6. rule no.4. is also valid for the discussion page of the wiki-article
7. if a team are not capable to work at once effective and efficient – the this team is not really a team in the moment of the beginning of work

Here and now should be declared, that each abstraction (like capability of team-working or even “becoming a team”) needs in general a specific parameter-set to define orientations of attributes. If in case of two abstractions based on the given (measurable) set of phenomena, the orientation parameters are the same then in the given modelling level the abstractions should be interpreted as the same – in vain uses human brain two words/phrases.

Attributes can be added or changed freely, if the ones in the analysis manage to come to terms at a sufficient level of reliability and consensus regarding orientation.

If experts have rational arguments concerning parallel parameter sets for orientations, then each constellation can be used for modelling – like a kind of sensitivity analysis. The parallel models can be evaluated in a holistic system to see, what kind of differences the final conclusions show depending on model layers and whether a compromise solution can be derived?

After collecting the data, the next chart (Chart 3) was made as the initiation chart, and we began evaluating it.

Chart 3: Initial data

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Characteristic | Relative | Relative | Relative | Relative | Relative | Relative | Relative |
| Orientation | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| Attribute | Characters/  capita | 1 module/  capita | Avg. character deviation | Module main deviation | Discussion activity/  capita | Arguers/  capita | Time  homogeneity |
| G1 | 3646 | 0,3 | 240,9 | 3,0 | 20,0 | 1,0 | 636,5 |
| G3 | 6250 | 0,4 | 361,6 | 1,2 | 0,2 | 0,2 | 805,9 |
| G4 | 19384 | 0,0 | 992,6 | 0,5 | 2,3 | 0,7 | 756,2 |
| G5 | 6284 | 0,2 | 302,9 | 1,7 | 11,8 | 0,8 | 38,9 |

Source: self-made

Data were analysed using the "object comparison aiming to adhere by objective component-based evaluation" (COCO).[[13]](#footnote-13) The Y0 model was used. Processing the results happened using Microsoft Excel (with a standard Solver module).

The first step was to arrange the objects (groups) into a standard ranking, using the attributes (behavioural patterns). The ranking based on the variables can be seen in Chart 4.

(The ranking of raw measured values is a kind of standardization. The aggregation later needs internal values without different measurement units.)

Chart 4: Ranking of groups based on the variables.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Attribute | Characters/capita | 1 module/capita | Avg. character deviation | Module main deviation | Discussion activity/capita | Arguers/capita | Time homogeneity | Naive |
| G1 | 4 | 3 | 1 | 4 | 1 | 1 | 2 | 2,29 |
| G3 | 3 | 4 | 3 | 2 | 4 | 4 | 4 | 3,42 |
| G4 | 1 | 1 | 4 | 1 | 3 | 3 | 3 | 2,29 |
| G5 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 2,00 |

Source: self-made

During a "naive" analysis, the averages of the ranks allocated to various groups based on their values would decide that G5 would be the victor (2,00) as the most "teamworky" team. G1 (2,29) and G4 (2,29) would finish in second place, and G3 (3,42) would be the farthest from the ideal group.   
Why the analysis is "naive": as it permanently comes up during grading in elementary, middle and high schools, why are all grades given the same impact? Why can the results of mathematics suffer a loss of a grade, but still be compensated for via a grade increase in the grades off. e. PE or Home Ec.? And the naive nature of this evaluation becomes worse when considering how the various attributes of being cut out for teamwork are graded by taking the various conditions into consideration - do we perceive the weight of attributes? Do we have to lengthen the scale due to one serious attribute by either expanding it with raising the maximum value, or multiplication of the entire scale? If we have to, how much would we have to expand it? And what happens, if we identify even more analysis attributes, and add it to the mixture?

But what results would we get, if we were to follow up, using the logic of the COCO Y0, which aims to use anti-discriminative processes to understand if all groups can have a differently same value along the various attributes and orientations?

The anti-discriminative modelling means: objects should be seen as different, when no parameter-set can be found to describe them with the same final evaluation value. The abbreviation “Y0” stands for: modelling without real consequences. If a real Y is given, then the same modelling approach is searching for production functions (Y=f(X1, …Xi, …Xn). The description of abstract phenomenon expects during the modelling, that the consequences should be derived based on the orientations of attributes and their ranking values and not from learning of given patterns (like in case of production functions).

The next step was writing the stair-function. The rows of the matrix were the grade levels, and the columns were the observed attributes. During the later "solution" made with the SOLVER[[14]](#footnote-14) we defined that the result of taking the value of the grade after the value of the one above it can never result in a value less than one as a limiting condition, since the forcing the difference into positive guarantees that the logic of orientation holds true.   
As we wrote the stair-function, we also made a goal function. The goal function was filled out with the levels calculated by Microsoft Excel's SOLVER expansion, using the VLOOKUP function. By summing the stand-in values related to each attribute, we get the estimated value as a result. The fact value was a constant 1000 according to the Y0 model's logic, which usually gets determined by constant empirical processes. The higher the constant's value, the better - meaning the chances are reduced that the conclusion-values of the objects are underestimated, the only option remaining is to overestimate - which would signify the instability of the model.   
The estimated value is then taken out of the fact value. The sum squares of differences results in the error value. Using the SOLVER, we tried to minimise the error value. We continuously re-ran the SOLVER until the error value reached its lowest stabile level (all details: in http://miau.gau.hu/miau/209/csm\_projek\_nyers\_comment.xls)

We got the results seen in Chart 5 by running the analysis.

Chart 5: Goal function (run 1)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Objective function | Characters/ capita | 1 module/  capita | Avg. character deviation | Module  main deviation | Discussion activity/  capita | Arguers/  capita | Time homogeneity | estimation | fact |
| 1. | 152,0 | 139,3 | 163,5 | 113,3 | 134,9 | 142,5 | 154,5 | 1000 | 1000 |
| 3. | 153,0 | 138,3 | 160,8 | 125,3 | 131,3 | 138,8 | 152,5 | 1000 | 1000 |
| 4. | 155,0 | 141,3 | 151,8 | 126,3 | 132,3 | 139,8 | 153,5 | 1000 | 1000 |
| 5. | 154,0 | 140,3 | 161,8 | 114,3 | 133,3 | 140,8 | 155,5 | 1000 | 1000 |

Source: self-made

Based on Chart 5, we can say that the groups we used as the objects were on a level playing field, according to the behaviour factors we used, meaning that each group is differently similar to the other, and each one is ideal - or at least would be, if seemingly all known inputs were used in the mode.

Chart 6: steps table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Steps | Characters/capita | 1 module/capita | Avg. character  deviation | Module main deviation | Discussion activity/capita | Arguers/ capita | Time homogeneity |
| 1 | 155,0 | 141,3 | 163,5 | 126,3 | 134,9 | 142,5 | 155,5 |
| 2 | 154,0 | 140,3 | 161,8 | 125,3 | 133,3 | 140,8 | 154,5 |
| 3 | 153,0 | 139,3 | 160,8 | 114,3 | 132,3 | 139,8 | 153,5 |
| 4 | 152,0 | 138,3 | 151,8 | 113,3 | 131,3 | 138,8 | 152,5 |

Source: self-made

Chart 6 shows “steps” table. In case of attributes where the distance between change values is one the information was not used. The second run excluded the variables with used information from the analysis system, meaning variables which aided the realisation of the "everyone's differently similar" logic.

This is how the "character per capita" (modification - absolute value), "members working on a single module per capita", and "time homogeneity" were further evaluated. The results can be seen in Chart 7.

Chart 7: Goal function (run 2)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| objective function | Characters/  capita | 1 chapter/  capita | Time homogeneity | estimation | fact | difference | inverse | control |
| G1 | 316,2 | 364,3 | 318,0 | 998,5 | 1000 | 1,5 | -1,5 | valid |
| G3 | 317,2 | 363,3 | 316,0 | 996,5 | 1000 | 3,5 | -3,5 | valid |
| G4 | 319,2 | 366,3 | 317,0 | 1002,5 | 1000 | -2,5 | 2,5 | valid |
| G5 | 318,2 | 365,3 | 319,0 | 1002,5 | 1000 | -2,5 | 2,5 | valid |

Source: self-made

Based on the estimation column of Chart 7, we can say that groups 4 and 5 are the best, based on the analysis' observation variables. They're followed by group 1, while group 3 is the one which comes farthest from the ideal - typical group's characteristics.

To investigate validity of model we have changed initial orientation of attributes. According to phrase: "So the last will be first, and the first will be last." For example the less characters per capita were written the closer the group is to being “ideal”, etc. Inverse column shows the results of inverse run of analysis. The model with assembled orientation could be resulted practically inverse outputs. In this case we have settled for opposite sign of inverse values.

**Conclusions and suggestions**

Based on the experiences of the experiment we conducted, timing is a critical factor of measuring student competencies. The partaking students were mostly ones who were about to graduate, who had to hand their thesis in at the time of exams. This kind of time constraint definitely makes it harder to conduct measurements, and may even deform results. The other question of competencies' placement in education is if we have to evaluate what kind of career they had during their studies. If there's a need for conducting this kind of measurement, the evaluation of competencies should be conducted both when beginning, and when concluding studies. Semesters I and V are suggested to be when these happen.   
We briefly mentioned the quality of diplomas issued by higher education in the preface. Some Bachelor, Master and combined courses have requirements for competencies beyond the knowledge required for graduating, which are to be learned and owned by the graduate. Does the future employer ask for its factuality with reason?   
If the employer has a reason to stress the importance of evaluating the quality of diplomas, the student has to marketing him/herself on the market, as a product would have to in its own market. The student would carry his/her diploma with him/her through this process, issued by the alma mater as a reference material (e.g. the laboratory examination of certain drugs, certificates, validation papers, etc.), since the employer won't necessarily conduct processes, with which competencies may be measured, and which could be used to understand if the student will be able to perform as a future employee. In this case, we have to stress the responsibility of the institution (university) - may the institution issue the diploma based on grades the student got (see more: naive conclusion), even if that may misinform employers? And if the institution decides they may not issue the diploma, what kind of changes do they have to make? How much, and in what way does the university itself have to measure competencies before issuing the diploma?

Multiple press organisations[[15]](#footnote-15) publicised an article based on the assumed changes of the act on higher education, stating that students in higher education will be subject to competency measurements at the time of admission, and the time of graduation. However, right now, we don't have information which may give us a clue as to what kinds of competencies they wish to measure, or how the measurement process would be conducted. As a basis for research results publicised here, and in the future, we also wish to give advice on the methodology of competency measurements, since the institution is influenced by not only the assessment of the employers, but the performance of its graduates with their diplomas in hand. If the graduates either find it hard to, or cannot find jobs, not only the diploma itself might be influenced, is influenced, but the organisations issuing them as well - on the one hand, in terms of general assessment, and on the other hand, in terms of internal processes, and the quality of higher education, and while these factors are important in and of themselves, they create a synergy together, which may cost the institution its brand name.   
We plan to unearth the attributes which may be used to measure competencies of students according to what's been written in the preface, and we also plan to similarly evaluate the methodology which can be used to make a profile of personal competencies.

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12. <http://miau.gau.hu/miau/172/email_v1.docx> (downloaded: 15.01.2016)
13. <http://miau.gau.hu/miau/172/eb_mcm2.docx> (downloaded: 15.01.2016)
14. <http://miau.gau.hu/miau/172/eb_mcm2.docx> (downloaded: 15.01.2016)
15. <http://pda.rnao.ca/content/teamwork-competency-and-defining-behaviours> (downloaded: 15.01.2016)
16. <https://www.uvic.ca/coopandcareer/assets/docs/corecompetencies/Core_competency_teamwork.pdf> (downloaded: 15.01.2016)
17. <https://www.theice.com/publicdocs/ICE_Competency_Framework.pdf> (downloaded: 15.01.2016)
18. <http://www.who.int/employment/competencies/WHO_competencies_EN.pdf> (downloaded: 15.01.2016)
19. <http://miau.gau.hu/miau/172/email_v1.docx> (downloaded: 15.01.2016)
20. <http://miau.gau.hu/miau/196/My-X%20Team_A5%20fuzet_HU_jav.pdf> (downloaded: 15.01.2016)
21. <https://support.office.com/hu-hu/article/Probl%C3%A9ma-meghat%C3%A1roz%C3%A1sa-%C3%A9s-megold%C3%A1sa-a-Solverrel-5d1a388f-079d-43ac-a7eb-f63e45925040?ui=hu-HU&rs=hu-HU&ad=HU> (downloaded: 15.01.2016)
22. <http://www.portfolio.hu/gazdasag/munkaugy/meg_formalodik_a_felsooktatasi_torveny_modositasa.212962.html> (downloaded: 15.01.2016)
23. <http://eduline.hu/kozoktatas/2015/5/17/a_het_hirei_osszefoglalo_9OECRS> (downloaded: 15.01.2016)
24. <http://miau.gau.hu/miau/209/csm_projek_nyers_comment.xls> (downloaded: 15.01.2016)

1. <http://miau.gau.hu/miau2009/index.php3?x=e0&string=begriff-> (downloaded: 15.01.2016.) [↑](#footnote-ref-1)
2. <https://miau.gau.hu/mediawiki/index.php/Csoportmunka_projekt> (downloaded: 15.01.2016.) [↑](#footnote-ref-2)
3. <http://miau.gau.hu/miau/201/20150508.doc> (downloaded: 15.01.2016.) [↑](#footnote-ref-3)
4. The alternative of additive is multiplicative: [https://www.google.hu/search?q=hasonlóságelemzés+"multiplikatív+modell"+site%3Amiau.gau.hu](https://www.google.hu/search?q=hasonlóságelemzés+%22multiplikatív+modell%22+site%3Amiau.gau.hu), where if one of the impacting factors is not present, the output level of the system as a whole should be considered 0 (e.g. production - even if all required materials are at hand, if there's no water, there won't be production) [↑](#footnote-ref-4)
5. <http://miau.gau.hu/miau/172/eb_mcm2.docx> (downloaded: 15.01.2016) [↑](#footnote-ref-5)
6. <http://pda.rnao.ca/content/teamwork-competency-and-defining-behaviours> (downloaded: 15.01.2016.) [↑](#footnote-ref-6)
7. <https://www.uvic.ca/coopandcareer/assets/docs/corecompetencies/Core_competency_teamwork.pdf> (downloaded: 15.01.2016.) [↑](#footnote-ref-7)
8. <https://www.theice.com/publicdocs/ICE_Competency_Framework.pdf> (downloaded: 15.01.2016.) [↑](#footnote-ref-8)
9. <http://www.who.int/employment/competencies/WHO_competencies_EN.pdf> (downloaded: 15.01.2016.) [↑](#footnote-ref-9)
10. See more: Leadership Practice Inventory Self/Observer [↑](#footnote-ref-10)
11. <http://miau.gau.hu/miau/172/email_v1.docx> (downloaded: 15.01.2016) [↑](#footnote-ref-11)
12. [↑](#footnote-ref-12)
13. http://miau.gau.hu/miau/196/My-X%20Team\_A5%20fuzet\_HU\_jav.pdf (downloaded: 15.01.2016.) [↑](#footnote-ref-13)
14. <https://support.office.com/hu-hu/article/Probl%C3%A9ma-meghat%C3%A1roz%C3%A1sa-%C3%A9s-megold%C3%A1sa-a-Solverrel-5d1a388f-079d-43ac-a7eb-f63e45925040?ui=hu-HU&rs=hu-HU&ad=HU> (downloaded: 15.01.2016) [↑](#footnote-ref-14)
15. See f.e.:

    <http://www.portfolio.hu/gazdasag/munkaugy/meg_formalodik_a_felsooktatasi_torveny_modositasa.212962.html> (downloaded: 15.01.2016)

    http://eduline.hu/kozoktatas/2015/5/17/a\_het\_hirei\_osszefoglalo\_9OECRS [↑](#footnote-ref-15)