Learning outcomes analysis

Summary

The paper analyses learning outcomes of undergraduate and graduate studies of Faculty of humanities and social Sciences, University of Zagreb, and compares them with levels of Bloom’s taxonomy. Also, the paper analyses the similarities of learning outcomes between different studies and courses, and identifies the most frequent or core learning outcomes.

**Key words**: learning outcomes, analysis, correlation, similarity

Introduction

Learning outcomes are the abilities that are expressing what will a student know, understand or be able to achieve after a longer or shorter learning process[[1]](#footnote-1). Outcomes may refer to one level of study, one subject or one module, however, they are cumulative and interconnected so that they together contribute to the overall learning outcomes of the study program. Outcomes state the competences of the learning program that can also be used to correlate it with its level in the European Qualifications Framework.

Data acquisition and initial processing

The first step of research is acquisition of study programs learning outcomes, which was made during the faculty’s accreditation process. Learning outcomes were collected for each study course separately using a web application, and entered into the database. From total of 138 study programs, there were 16 programs that had no associated learning outcomes and were not taken into further analysis.

Table 1 shows the number of single and double major studies in each level of study. It can be seen that double major studies (or courses) form little less than 75% (90) and that graduate studies form almost 66% (80) of all studies. The only integral study (undergraduate and graduate) is History and Geography that has no double major variant. This paper observes various differences between levels of study programs, and because the number of integral studies is inadequate for quality analysis, History and Geography is also omitted from analysis. In other words, the research is based on total number of 121 study programs.

Table 1: The structure of study programs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Undergraduate** | **Graduate** | **Integral** | **Total** |
| **Single major** | 10 | 21 | 1 | 32 |
| **Double major** | 31 | 59 | 0 | 90 |
| **Total** | 41 | 80 | 1 | 122 |

The second step is acquisition of Bloom taxonomy action verbs. The action verbs were collected from different internet sources, manuals and literature. They were also loaded into the database and associated with one of the levels in their learning domains: cognitive, affective or psychomotor. Each level was assigned a value that is used in later analysis for calculating the value of learning outcomes.

The third step is determination of relationships between outcomes and action verbs. The majority of learning outcomes are associated with only one action verb, in which case, they were assigned a value of their action verb. For example, outcome “Analyse the basic concept…” has one action verb, *analyse*, (cognitive domain, 4th level) and thus its assigned value is 4.

There were two exceptional cases:

* learning outcome contains more than one action verb, e.g. *define and describe concepts*…
* learning outcome contains an action verb that exists in more than one level or learning domain, e.g. *explain* exists in cognitive (Comprehension) and affective domain (Valuing and Organization)

These problems were solved equally: learning outcome was split for each existing verb or level. E.g. *define and describe concepts* was treated as two outcomes, *define concepts* and *describe concepts*.

Table 2. shows the statistics of processed learning outcomes. From total of 151 action verbs in cognitive domain, 77.48% were used in at least one learning outcome. Also, there are 3592 learning outcomes that were classified in cognitive domain, because of their relations with cognitive action verbs. The cognitive domain consists of 7 levels, thus the average level can take value from interval [1, 7]. The calculated value of 3.41 shows that the average level of all study programs is approximately in the middle between Application and Analysis level. Similar applies to affective domain, where average level is between Valuing and Organization. The weakest level is found in psychomotor domain, which was expected because of the field of the observed studies.

Table 2: Action verbs usage and average levels

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Total verbs** | **Used verbs (%)** | **Outcomes** | **Average level** |
| **Cognitive** | 151 | 77.48 | 3592 | 3.41 / 7 |
| **Affective** | 129 | 51.94 | 2336 | 3.33 / 5 |
| **Psychomotor** | 69 | 42.03 | 825 | 2.68 / 7 |

Analysis of common outcomes

Relationship between outcomes and studies was analysed in a way to discover which outcomes are common to all or majority of studies and courses, i.e. which outcomes are not subject specific. Those outcomes should be generic, which means that they are not related to any discipline or field, but to the level of study.

Analysis showed that there exists very small number of common outcomes. As it is shown in Table 3, the most frequent outcome appears in less than 19% of courses. It is included only in undergraduate studies, which is understandable because it also refers to the selection of further education and graduate study. The other four most frequent outcomes appear only in teaching-oriented studies.

Table 3: Common learning outcomes

|  |  |
| --- | --- |
| **Learning outcome** | **Percenage** |
| Assess own interests and competencies and select appropriate areas for further education | 18.85 |
| Prepare and transmit course materials in accordance with the fundamental articulation models | 9.84 |
| State, explain and apply basic psychological factors of successful learning and teaching | 8.20 |
| Apply the skills of lifelong learning and language training in certain field, depending on the needs of the job | 5.74 |
| Explain didactic theories and models and apply them in teaching | 5.74 |

Data was further analysed for common outcomes between undergraduate and graduate level of each study program (Figure 1, darker fill). Most study programs overlap from 0% or 20% of their outcomes, which corresponds to one or two common outcomes. In this interval there is a total of 18 (out of 41) study programs. For example, *Undergraduate study of Information sciences* and *Graduate programme of library science* overlap in one learning outcome: Implement programs of material and data protection. It is interesting to observe that one study program on graduate level completely overlaps with its undergraduate level.

Figure 1: Common outcomes analysis

Figure 1. also shows the overlapping of learning outcomes between courses of their corresponding study program (e.g. Graduate study of Informatics, Teaching-oriented and Research-oriented study). There are 10 courses with completely overlapping outcomes, 6 courses with 90% overlap, etc. There exists a certain regularity: higher similarity level (above 50%) is noticed only between single and double major variants of the same course. Other combinations (e.g. between two single major courses) have lower level of similarity.

Differences between study levels

Undergraduate level of study should be formed so that it provides [[2]](#footnote-2)general knowledge in the field of study, that is, students are supposed to gain principles and concepts relating to the field. Graduate level of study[[3]](#footnote-3) provides highly specialized knowledge and students gain specialized skills that enable problem solving, integration with other fields and developing new knowledge.

Figure 2. shows the relationship between levels in each domain and two observed levels of study. Vertical axes shows the percentage of each outcome level in undergraduate or graduate studies.

Figure 2: Relationship between outcome levels and study levels

Analysis showed that graduate studies are more represented in higher levels of cognitive domain, i.e. 10% of their learning outcomes is associated to 6th cognitive level, as opposed to 7% in the undergraduate studies. Synthesis level (5th) refers to integrating and combining ideas and knowledge into new ones, and Evaluation level (6th) refers to assessment and critique of values and ideas. Both levels are emphasised in graduate studies, which is in accordance with differences between undergraduate and graduate studies (explained in previous paragraph).

In affective domain, there exists a very small difference between levels of study. The average level of undergraduate studies is 3.19, while graduate studies have average level of 3.42. Graduate studies are noticeably more represented only in the 5th level of the affective domain.

As it is shown in Table 2, psychomotor domain is the least represented one, with only 12% of learning outcomes, versus 53% in cognitive and 35% in affective domain. Thus, each increase in action verb usage has strong influence on study level representation in that domain. It is noticeable that graduate studies are more represented from 3rd to 7th level of the psychomotor domain.

Difference in distributions between outcome and study levels is statistically significant; calculated Chi-Square value was 61.95, which is above critical value of 26.3 with 16 degrees of freedom. The null hypothesis (there is no difference between distributions) is rejected and the alternative hypothesis (there exists a difference between distributions) is accepted.

Differences between levels of the same study

Data was also analysed to determine differences from undergraduate to graduate level of the same study (e.g. from *Undergraduate study of Information sciences* to *Graduate study of Informatics – Teaching-oriented study*). Values of learning outcomes were summed together for each study level, so study levels could take a value from the interval [1, 15]. The increment was calculated so that the final value of the undergraduate study was subtracted from the final value of graduate study. For example, final value for the *Undergraduate study of Information sciences* was 7.15, and for the *Graduate study of Informatics – Teaching-oriented study* was 9.99 (increment is 2.83).

The importance of increment is that it is a measure that shows how much a graduate level of study is above an undergraduate level. In the above example, an increment of 2.83 means that graduate study is almost 3 levels above undergraduate. Those levels can be situated within the same domain, but a difference may be caused by any combination of levels.

Figure 3 shows the number of courses in each increment interval. It can be seen that there are seven courses with almost no change in outcome levels, for which the increment takes value between 0 and 0.5 (dashed vertical line). Full vertical line represents an average increment value, which is 1.74.

Figure 3: Increments from undergraduate to graduate studies

There are 19 (23%) courses located left of the dashed vertical line, which means they have negative increment and their graduate level is below their undergraduate level. Detailed analysis showed that the maximum decrement is -1.2 for cognitive, and -1.4 for affective and psychomotor domain.

Still, the majority of studies have positive increment; 70% of them have increment greater than 0.5. The greatest increment was 6.7 that is quite surprising, as it shows a big leap from undergraduate to graduate level. It is composed of the following increments: 2.27 in cognitive, 1.00 in effective and 3.42 in psychomotor domain.

Differences between single and double major studies

Double major studies are generally combined with

Figure 4: Relationship between single and double major studies

1. http://www.unizd.hr/Portals/0/bolonjski\_proces/pdf/Vodic\_za\_korisnike\_ECTS-a.pdf [↑](#footnote-ref-1)
2. http://www.makeyourmark.edu.au/study-options/choosing-what-to-study/levels-of-study/ [↑](#footnote-ref-2)
3. https://ec.europa.eu/ploteus/content/descriptors-page [↑](#footnote-ref-3)