



The return of behaviourist epistemology: A review of learning outcomes studies



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ABSTRACT

Learning outcomes as a concept has encountered a revival since the beginning of the Bologna process in 1999. The concept itself has a longer history with its roots in the behaviourist tradition of the 1960s. The goal of this review is to study how the historical roots of learning outcomes are noted in current research articles since the launch of the Bologna process and whether the concept of learning outcomes is used critically or uncritically. The review of 90 articles shows that the behaviourist tradition is still evident in the 21st century research with 29% of the articles directly and 11% indirectly referring uncritically to the respective publications or to the behaviourist epistemology. Only a minority of the articles, i.e. 8%, was found to be critical towards the behaviourist meaning of learning outcomes.

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1. Introduction

Senior educators, in particular those who started their career in the 1970s, have experienced a déjà vu when reading policy documents from higher education since the beginning of the Bologna process in 1999. The concept of *learning outcome* in terms of exactly defined end-behaviour has reappeared in educational discussions concerning the quality of higher education (e.g. Adam, 2004, 2008). For example, in chapter 1.3 of its 2009 report, the European Association for Quality Assurance in Higher Education (ENQA) set as a standard for higher education in Europe that “students should be assessed using published criteria, regulations and procedures which are applied consistently. (...) student assessment procedures are expected to be designed to measure the achievement of the intended learning outcomes and other programme objectives.” (p. 17). Since then, many national quality assurance and accreditation systems have adopted the ENQA guidelines into their own national system or directly refer to them (Eurydice, 2007). Most of the authors of these quality assurance documents are administrators or university teachers of different disciplines who lack deeper expertise in educational science or educational psychology.

The idea of defining and measuring learning outcomes has a long history in educational and psychological research. Most of the measures focusing on detailed definitions of learning outcomes (in terms of specific verbs describing targeted behaviours) were developed within the behaviourist tradition, which explicitly focused on learning as external reactions and can be directly observed in changes of the behaviour of the organism (Mager, 1961). The seminal work of Bloom, Engelhart, Furst, Hill, and Krathwohl (1956), “Taxonomy of educational objectives”, became a standard for defining objectives of primary

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and secondary education throughout the world in 1960s and 1970s. It has now become a standard for describing learning outcomes of 21st century university teaching in many administrative documents, such as in the Bologna process documents (e.g. Kennedy, 2008a) and is expressed in the practical guide for writing learning outcomes as follows: “When writing learning outcomes it is helpful to make use of Bloom’s taxonomy of educational objectives. This classification or categorisation of levels of thinking behaviour provides a ready-made structure and list of verbs to assist in writing learning outcomes.” (Kennedy, 2006).

Since the cognitive turn, which already began in the early 1950s, but became strong in the 1970s, the behaviourist perspective has been heavily criticised. The main argument of cognitive theories was that complex conceptual learning in humans can only be understood if internal cognitive processing is deliberately analysed. Studies on human problem solving (Newell & Simon, 1972) and the development of higher cognitive processes highlighted the power of knowledge (Bereiter & Scardamalia, 1998; Feigenbaum, 1989) and resulted in new approaches which took into consideration deep learning (Ohlsson, 2011), reflective and metacognitive processes (Flavell, 1979; Weinert & Kluwe, 1987; Wright, 1992), and the growth of human expertise (Ericsson, Charness, Feltovich, & Hoffman, 2006). This new development did not mean that phenomena described by behaviourists would not exist (Steiner, 1988), but it was doubted whether these reinforced behavioural sequences would be appropriate for explaining all learning phenomena (Lehtinen, 2012). Specifically, complex conceptual, long-enduring learning processes were deemed to be inappropriately dealt with by behaviourist models. The enormous development of scientific knowledge about the nature of conceptual learning and expertise development in recent decades, highlights the importance of an analysis on whether the learning outcome definitions which are based on behaviourist models of behaviour modification are suitable for defining aims of higher education (Boshuizen, Bromme, & Gruber, 2004).

There is no reason as such to oppose the renaissance of clearly expressed aims. Well-defined objectives in terms of learning outcomes can be useful for students and help those who are responsible for developing and evaluating study programmes. There is a danger, however, that if the theoretical background of the “learning outcome” concept is not considered or not known, the use of learning outcomes can lead to unintended consequences. Such could be, for example, a decision to use certain verbs in course descriptions which leads to narrower learning results than was intended.

This article discusses the concept of the learning outcome and reviews the use of it in recent research articles. The time span selected for the analysis starts from the beginning of the Bologna process in 1999 that is especially interesting from the European perspective. The goal of this review is to study how the concept has been used i.e. is the concept used in the sense of referring to the behaviourist tradition, and are the historical roots of the concept discussed, or is the concept used uncritically?

1.1. Reinvention of learning outcomes

Learning outcome as a concept has emerged in European educational policy documents since the Bologna Declaration 1999 as an attractive tool to increase transparency of higher education programmes. The concept has been taken into use without much discussion about its earlier use in the behaviourist era. Since the very beginning of the consolidation of the European Higher Education Area (EHEA), questions concerning comparable degrees and quality assurance with comparable criteria and methodologies have been targets of the intergovernmental co-operation (European Ministers in charge of Higher Education, 1999). When EHEA was officially launched in 2010, common standards for education had been settled and member countries of the area had committed to the common goals, with quality assurance being one of the most important. Defining, describing and assessing learning outcomes had soon become one of the main focusses of European higher education institutions in quality assurance. As Adam (2008) puts it: “The humble learning outcome has moved from being a peripheral tool to a central device to achieve radical educational reform of European higher education.” (p. 5).

Along with the EU, the European higher education institutions have played a prominent role in the process of constructing the EHEA. A university driven project, Tuning Educational Structures in Europe, was started in 2000 to implement the Bologna process goals and to ensure the independence and autonomy of universities. Learning outcomes and competences approaches were seen as tools to imply changes in teaching, learning and assessment methods (González & Wagenaar, 2008). Many national projects were also implemented to support the goals of European co-operation (focus on the structure of higher education in Europe: Eurydice, 2007).

Soon after the Bologna Declaration in 1999, a guideline was published that defined learning outcomes as “statements of what a learner is expected to know, understand and/or be able to demonstrate after completion of a process of learning” (CQFW, NICATS, NUCCAT, & SEEC, 2001, p. 3). Accordingly, the Tuning project defines learning outcomes as “statements of what a learner is expected to know, understand and/or be able to demonstrate after completion of a learning programme” (González & Wagenaar, 2008, p. 9). Learning outcomes have also been viewed as an expression of the quality of the expected understanding, skills and abilities of learners after an instructional period, e.g. a case, lesson, module or study programme (European Community, 2004, 2009; Froment, Kohler, Purser, & Wilson, 2006).

The revival of the concept of learning outcomes has not only been a European process, but many other countries have also focused on the nature of outcomes in learning. As in Europe, these are closely connected with the quality assurance goals, such as the Learning Outcomes Assessment (LOA) movement led by the National Institute for Learning Outcomes Assessment (NILOA) in the USA (Kuh et al., 2015) and the Australian Government led Tertiary Education Quality and Standards Agency (TEQSA; Hay, 2012). According to Bennett and Brady (2012), “the roots of the LOA movement, as opposed to engaged learning

practices, can be tracked back to Taylorism and the theories of scientific management. LOA is really another manifestation of the standards movement, which emerged alongside the efficacy movement at the turn of the 20th century.” (p. 147).

The general development of the society has had a major impact in universities. Developing a quality management system in a university offers a tool to compete with universities. Accreditation processes need objective measurements, which in practise mean quantitative data. Students are seen as customers and they should be offered the best resources and teaching: “In fulfilment of their public role, higher education institutions have a responsibility to provide information about the programmes they are offering, the intended learning outcomes of these, the qualifications they award, the teaching, learning and assessment procedures used, and the learning opportunities available to their students.” ([European Association for Quality Assurance in Higher Education, 2009](#), p. 19) The main aim of the concept of the learning outcome was to help to assure the quality and comparability of degrees.

The concept of learning outcomes is closely related to other popular concepts connected to the Bologna process, the concepts of competency ([Baumert et al., 2001](#); [Strijbos, Engels, & Struyven, 2015](#)) and, relatedly, educational standards ([Goldstein & Heath, 2000](#); [Klieme et al., 2003](#)). Competences can be seen as “capacities via a dynamic combination of attributes that together permit a competent performance or as a part of a final product of an educational process” ([González & Wagenaar, 2008](#), p. 28). Two types of learning outcomes can be distinguished: general competences (transferable skills) and subject specific competences ([González & Wagenaar, 2008](#); see also [CQFW et al., 2001](#)). The learning outcomes approach is based on the idea that it is possible and meaningful to predefine precise standards for expected performance and later test if students have achieved intended knowledge and skills.

Despite having many advantages, the redefined concept of learning outcomes has been criticised. According to [Entwistle \(2005, p. 72\)](#), “formal statements of intended learning outcomes may fail to communicate the essence of the individual disciplines and professional areas, which depends on a holistic view of the knowledge and values involved”. University teachers were asked in a study about what they were trying to achieve with their students. Most teachers stated that a distinctive way of thinking was their most important goal, not the detailed knowledge or professional skills ([Entwistle, 2005](#)). If the goal of university education is seen as a whole way of treating questions that is affected by domain specific training, stating specific learning outcomes is not easy ([Entwistle, 1997](#)). The original behaviourist conception of learning outcome may not be inherently the right term for describing the goals of current education.

1.2. The problem with the behaviourist epistemology

The attempt to define expected learning outcomes precisely has its roots in the behaviourist tradition of learning research. One of the ideas of the educational applications of behaviourism was to define the “end behaviour” in precise terms in order to create a basis for optimal instructional treatment (sequences of reinforcement). Behaviourism strived for objective analysis, and, as a result, internal processes were neglected as unscientific ([Watson, 1913](#)). The human mind was seen as “a black box” which could not be observed, so it was scientifically sounder to measure only external stimuli and reactions. Behaviourism was born at the turn of the 19th century into the 20th century; a time when the psychological study of the human adopted methods and explanations from natural sciences due to Darwin’s evolutionary theory. The aim was to connect research of human learning to research on the adaptive processes of any living organisms. In this era of positivism, human learning was thought to be studied and controlled on the basis of observable conditions and behaviour. According to [Watson \(1913\)](#), “psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behaviour.” (p. 158) Pavlov’s conditioning tests with salivating dogs gave evidence of the power of training methods that could be applied to human education. Skinner’s radical visions of mass education and programmed instruction on the basis of his theory of operant conditioning had a major impact on American education ([Adam, 2004, 2006](#)). From this point of view the idea of learning outcomes was just a question of setting the goals and finding the right conditioning methods to reach the desired outcomes.

In 1948, a group of psychologists interested in achievement testing discussed the possibility of creating a taxonomy of educational objectives ([Krathwohl, Bloom, & Masia, 1964](#)). A comparison was made to biological taxonomies that had been found useful by biologists as a means of insuring accuracy of communication about their science and as means of understanding the organisation and interrelation of the various parts of the animal and plant world ([Bloom et al., 1956](#)). The taxonomy of educational objectives was intended to help educators to “discuss educational problems with greater precision”. For example, nebulous terms as “really understand”, “grasp the core” or “comprehend” could be avoided by reference to the taxonomy as a set of standard classifications. This aspiring goal was a starting point for the wide-spread work of many scholars ([Gagné, 1965](#); [Mager, 1961](#)) who since then have created taxonomies and classifications of learning outcomes. According to the ideas of behavioural psychologists, learning outcomes and ways to pursue those, aimed to be objective, teacher independent, detailed in their content, easy to use, suitable for any students and situations, and prove excellent outcomes. [Mager \(1961\)](#) was responsible for extending the idea of educational objectives to the furthest in terms of end behaviour, for example, in the form of a book that allowed proceeding only when learning outcomes set on earlier pages were reached.

The most well-known learning outcome model is Bloom’s taxonomy of learning objectives ([Bloom et al., 1956](#)). It states six hierarchical outcomes, assuming that learning at higher levels is dependent on having attained prerequisite knowledge and skills at lower level. The lowest level of learning is “knowledge”, that means recalling information. The next stages are: comprehension (translating, interpreting or extrapolating information), application (using principles or abstractions to solve novel or real-life problems), analysis (breaking down complex information or ideas into simpler parts to understand how the

parts relate or are organised), synthesis (creation of something that did not exist before), and the highest level is evaluation (judging something against a given standard). What makes Bloom's taxonomy so attractive for educational practitioners is the possibility to describe learning outcomes on several levels.

The most profound problem of the behaviourist learning outcome idea lies in the epistemology of behaviourism. The term *behaviourist epistemology* was first presented by Russell (Kitchener, 2004) who became interested in the naturalistic nature of knowledge used by early behaviourists such as Watson (1913). However, in this article the term is used with a more general meaning and refers to ideas of knowledge as separate units, or, as Skinner (1957) put it, as repertoire of behaviour, without active construction of meaningful structures of knowledge. The behaviourists reduced knowledge to external behaviour, and for the most part were not interested in discussing the question of epistemology, since they did not want to go into the "black box". However, behaviourism does make a claim about the nature of knowledge. Bereiter and Scardamalia (1998) call this assumption the conception of a "mental filing cabinet". As Bloom et al. (1956, p. 29) put it: "(...) think of knowledge as something filed or stored in the mind". The higher levels of Bloom's taxonomy would be just about manipulating, i.e. applying, analysing etc., the pieces of knowledge stored in the cabinet of mind. Lakoff and Johnson (1980, 1999) call this the mind-as-container metaphor, a conception coming from folk psychology. Although behaviourism has waned as a theoretical program, the container metaphor persists (Bereiter & Scardamalia, 1998) and it is the basis for Bloom's taxonomy.

Behaviourist epistemology, i.e. seeing knowledge as pieces of information stored and manipulated in a mental cabinet, is compatible with a naive conception of learning outcomes. Writing verb lists about what students should be able to do with their gained pieces of information looks effective, but conflicts with our current understanding of learning and development of expertise. The most established finding of last decades' cognitive research is that it is the richness and organisation of knowledge that is fundamental for deep learning and high level expertise (Bereiter, 2002; Ericsson, 1996; Ericsson et al., 2006; Ohlsson, 2011). The explanatory power of cognitive analyses has been shown by a number of different approaches. Computational theories that provide models of the functioning of cognitive mechanisms make testable predictions about skill acquisition, e.g. the template theory to model chess memory performance (Gobet & Simon, 1996). Furthermore detailed analysis of the formation of knowledge in text comprehension (Kintsch, 1998) or the complex role of prior knowledge learning scientific concepts (Vosniadou, 2013) are examples of educationally highly relevant findings of cognitive research which give theoretical basis for learning goals and learning outcome assessment. Educational theories that transfer assumptions from expertise research into daily learning situations underline the viability of such concepts e.g. transfer of the deliberate practice approach into mathematics learning (Lehtinen, Hannula-Sormunen, McMullen, & Gruber, 2017).

The most important indicator of the quality of learning is how rich and well organised the knowledge structures are. A consequence of this is that defining learning outcomes, teaching strategies, and evaluation according to the levels of the Bloomian taxonomy does not catch the core processes needed in higher order learning. Thus a danger is, as Bennett and Brady (2012) write that it might be pretended that student problems have more to do with easily quantifiable outcomes than with the need to create an environment conducive to truly engaged students learning through legitimate faculty-driven efforts at curriculum development and course evaluation. Writing learning outcomes based on Bloomian taxonomy can be done without adequate analysis of pedagogical content knowledge; it is the analysis of the conceptual construction steps needed for higher order learning of particular knowledge and skills.

1.3. Objectives of the review study

The goal of this review is to explore if and how the behaviourist roots of learning outcomes are visible in research articles since the launch of the Bologna process in 1999. A second goal is to determine if a clear reference to the behaviourist tradition can be found and whether the reference is used critically or uncritically. The term "critical" refers here to explicit awareness of the substantial scientific knowledge about the importance of the organisation of knowledge structures which has accumulated after the Bloomian taxonomy and the ideas of learning outcomes as end-behaviour were developed. The term "uncritical" refers to writing in which the behaviourist references are used without any discussion about the validity of these concepts for describing complex conceptual knowledge learned in higher education. In addition, we aim to analyse papers where behaviourist epistemology can be detected without a clear reference to the behaviourist tradition. The following research questions are to be answered in this study:

- (1) Direct reference to behaviourist tradition:
 - a) Is the behaviourist tradition visible in the learning outcome articles in terms of direct or second hand references to behaviourist literature?
 - b) Are the references critical towards behaviourist theory or is the theory used uncritically?
 - c) Is there a difference between articles referring to and not referring to the Bologna process or similar government or state guided processes, aiming at higher education quality assurance?
- (2) Use of behaviourist epistemology without a clear reference to behaviourist literature:
 - a) Can behaviourist epistemology be found in the research on learning outcomes studies since the beginning of the Bologna process without a reference to the behaviourist literature?
 - b) Is there a difference between articles referring to and not referring to the Bologna process or similar government or state guided processes, aiming at higher education quality assurance?

2. Method

2.1. Literature search strategy

To gain an overall conception of the amount of literature on learning outcomes, we conducted a preliminary literature search. We used the search terms “learning outcome” and “learning outcomes” or “learning outcome*”, depending on the search tool’s functioning ability. By reading a random sample of the abstracts and taking into account the huge number of hits when using the search term “learning outcome” without limitations (e.g. in Google Scholar more than 4 million hits), we decided that the best way to limit the search results to the desired articles was to search for articles with the concept in the title. The targeted educational level of our study was higher education, and thus the search was limited to articles that had “higher education” as subject term, descriptor, keyword or subject heading, depending on the term which the database used. The study was limited to articles written in English that were available in databases between January 1999 and March 2015.

In conducting the final search used in this study, we used the search terms “learning outcome” in the title and “higher education” as a subject term. We searched the following databases in EBSCOHost (a powerful online reference system which offers a variety of proprietary full text databases and popular databases from leading information providers): Academic Search Premier, Business Source Complete, Education Research Complete, ERIC, SocINDEX, and Teacher Reference Center. Databases PsycArticles and Science Direct were also used, however these did not contribute any relevant articles to the earlier searches and were omitted. The search resulted in 586 hits (March 12, 2015) and after exact duplicates were removed from these results, the total number of articles was 441.

2.2. Data evaluation and reduction

The titles, abstracts and subject terms of all 441 articles were read. In addition, in some unclear cases entire articles were skimmed. The principles of the [Prisma, 2009](#) Flow Diagram were implemented for this systematic review to ensure reporting all data reduction stages. The papers that were not relevant for the aim of this study were omitted, for example, a large group of articles using “learning outcomes” as a synonym for simple numeric grades. A typical article of this type was a study comparing two different learning situations in which the difference was measured as course grades. Other excluded articles were either focusing only on one specific learning outcome or the focus of the article was elsewhere, leaving the learning outcomes theme only in a very minor role in the article. After this procedure, 219 articles were discarded, leaving a total of 222 articles.

The next phase was to read the 222 articles in order to evaluate their relevancy for the aims of this study. Again, following the same principles as above, the non-relevant papers were excluded. In addition, at this point, all reports and other non-peer reviewed papers were omitted that were not refereed, due to the fact that there was a limited number of them and they seemed not to form a complete body of papers. For example, some EU seminar papers had been included in the database, but clearly not all. An additional study would be needed to analyse the reports of institutions. The total number of papers remaining after the last reduction round was 90.

2.3. Data analysis

The 90 articles were read carefully by the first author and a preliminary classification of articles was constructed. The two co-authors read a sample of articles and the classification was discussed and modified. Unclear cases were re-read and negotiated until the authors agreed on the classification. The selected descriptive factors and classification criteria were:

- Does the paper refer to the Bologna process or any other international or national quality assurance program?
- Does the paper refer to the behaviourist literature, i.e. is there a clear reference to the behaviourist tradition, for example, to Bloom’s taxonomy or to other publications from the same period or to a second hand reference to behaviourist tradition?
- If there is a reference to behaviourist literature, is the reference critical or uncritical?
- Is the paper expressing behaviourist epistemology without a reference to the behaviourist literature?
- Country group: 1) Europe, 2) USA, and 3) Other

3. Results

3.1. Indications of the use of the behaviourist epistemology

The quantitative results of the analysis are shown in [Table 1](#). There were no major differences between Europe and the USA (including 1 article from Canada) in the number of articles included in the analysis, while from other countries the number was smaller. In all country groups, frequent reference to government or state powered processes, such as the Bologna process in Europe, were made. In Europe, this rate was highest with 84%, in the USA 53%, and in other countries 41%. Some papers note

Table 1
Analysis of the reviewed learning outcome articles.

Country group	Number of reviewed articles	Reference to Bologna or similar	Reference to behaviourist literature	Uncritical reference to behaviourist literature	Critical reference to behaviourist literature	Expressing behaviourist epistemology without a reference
1. Europe	32	27 (84%)	16 (50%)	9 (28%)	7 (22%)	4 (13%)
2. USA ^a	36	19 (53%)	6 (17%)	6 (17%)	–	3 (8%)
3. Other ^b	22	9 (41%)	11 (50%)	11 (50%)	–	3 (14%)
Total	90	55 (61%)	33 (37%)	26 (29%)	7 (8%)	10 (11%)

^a Including 1 from Canada.

^b Countries and number of articles: Australia 9, New Zealand 3, Hong Kong/China 3, Taiwan 1, Brazil 1, Iran 1, Qatar 1, United Arab Emirates 1, South Africa 1, Singapore 1.

that “learning outcomes have gained much interest recently”, but these were not counted unless an explicit reference was made to some wider process.

When reviewing the literature referring to the behaviourist concepts, clear differences emerged between the country groups. Half of the European and other countries’ articles made these references while only 17% of the USA papers did so. However, it is noteworthy that of the 16 European papers making reference to the behaviourist tradition, seven were critical, which is almost half of the articles making the reference. Thus, the highest rate in uncritical references is in the group of “other” countries, with Europe having the second highest rate in referring and the USA being the lowest.

The expressions of behaviourist epistemology without a reference to the behaviourist literature in the country groups are quite equal. When adding the numbers of uncritical references to behaviourist literature ($N = 26$) and expressions of behaviourist epistemology ($N = 10$), we can conclude that 40% of the published literature during the selected time span used the behaviourist epistemology in explaining and defining learning outcomes. Thus, the behaviourist tradition is vividly alive in research articles. If we include the seven critical papers, we can conclude that almost half (48%) of the published papers are somehow connected to the behaviourist theory.

To explore the results in more detail, [Table 2](#) was created to show which articles were classified to certain categories. Among the articles referring to the behaviourist tradition, critically or uncritically, as well as the articles expressing behaviourist epistemology without a reference to publications of the behaviourist tradition, the division between articles referring to Bologna or similar processes was quite equal. Only in the category of articles not referring to behaviourist literature and not expressing behaviourist epistemology, the number of articles referring to Bologna or similar processes was notably higher ($N = 28$ versus $N = 19$). Proportionally this indicates that there are more articles making some link to the behaviourist tradition among those articles not referring to Bologna or similar. This may indicate that researchers being aware or research projects being attached to government of state powered processes are less likely to use behaviourist epistemology. However, there are also a number of articles using behaviourist epistemology uncritically among the papers referring to Bologna or similar process ($N = 19$, being 21% of all articles).

3.2. Detailed analyses of the contents of papers connected to behaviourist epistemology

In order to gain a better understanding of the nature of references to the behaviourist epistemology, we present more detailed descriptions of the results in this section. Excerpts were sought from the articles to represent the use of behaviourist epistemology.

3.2.1. Critical papers

For the purposes of exploring the behaviourist tradition in the learning outcomes literature, we searched for critical articles paying attention to the problems with behaviourist epistemology which make a reference to the behaviourist literature or clearly criticise the behaviourist epistemology. These articles were quite congruent in their views. According to [Addison \(2014, p. 322\)](#) “LOs deny the complexity of learning/teaching by rejecting its contingent, emergent and unknowable qualities. In particular, LO systems dismantle the affective relations that underpin the sociality of learning, the give and take of human interaction.” [O’Brien and Brancalone \(2011, p. 10\)](#) add to this: “Learning outcomes do not adequately engage with such deeper learning insights”, and conclude (p. 14) that “the validity of learning outcomes is seriously questioned”. [James \(2005, p. 93\)](#) writes that “learning outcomes (...) has a deceptive simplicity and all the appearance of a concept that ‘cuts to the chase’, that is focused on ‘the bottom line’, and which refers to matters about which there is high consensus, but in reality it is none of these things. Reality is more complex.”

The two papers by [Hussey and Smith \(2003, 2008\)](#) highlight the importance of emergent learning outcomes, emerging in the teaching event or session. According to them, “(...) too tight a focus on learning outcomes is at odds with notions of good learning, good teaching and empirical experience” (2003, p. 359). The [Hussey and Smith \(2003\)](#) paper has no reference to behaviourist publications, but they refer to their own previous paper ([Hussey & Smith, 2002](#)), where they make this type of reference.

Table 2
Results of the classification in relation to references to Bologna or similar processes.

Category	Articles referring to Bologna or similar process	Articles not referring to Bologna or similar process	Total
Articles referring critically to behaviourist literature	Addison (2014); Brancaleone and O'Brien (2011); Harden (2002); Hussey and Smith (2003); Hussey and Smith (2008); James (2005); O'Brien and Brancaleone (2011). N = 7	N = 0	N = 7
Articles referring uncritically to behaviourist literature and expressing behaviouristic epistemology	Gonçalves, Pimenta, Braga, and Cota (2013); Henrichsen and Tanner (2011); Kennedy (2008b); Keshavarz (2011); Klefstad, Maribu, Horgen, and Hjeltnes (2010); Maher (2004); Meyer-Adams, Potts, Koob, Dorsey, and Rosales (2011); Pouyioutas, Gjermundrod, and Dionysiou (2012); Pukelis (2011); Savic and Kashef (2013); Savickiene (2010); Shephard (2008); Žiliukas and Katiliūtė (2008). N = 13	Chan, Tsui, and Chan (2002); Fiegel (2013); Hewege and Perera (2013); Khoza (2013); Lim, Yoon, and Park (2013); McNeill, Gosper, and Xu (2012); Meyers and Nulty (2009); Pettijohn, Ragan, and Ragan (2003); Praslova (2010); Reddy and Hill (2002); Spronken-Smith, Walker, and Batchelor (2012); Thambyah (2011); Yen, Lee, and Chen (2012). N = 13	N = 26
Articles not referring to behaviourist literature and expressing uncritical behaviourist epistemology	Brawley et al. (2013); Harden, Crosby, Davis, and Friedman (1999); Hay (2012); Jurich and Bradshaw (2014); Pierce and Robisco (2010); Smith and Yu (2005); Svanström, Lozano-Garcia, and Rowe (2008). N = 7	Capon (1999); Ducrot, Miller, and Goodman (2008); Lightner and Benander (2010). N = 3	N = 10
Articles not referring to behaviourist literature and not expressing behaviourist epistemology	Al-Thani, Abdelmoneim, Daoud, Cherif, and Moukarzel (2014); Applegate (2006); Brooks, Dobbins, Scott, Rawlinson, and Norman (2014); Brown (2008); Caspersen, Frølich, Karlsen, and Aamodt (2014); Coates and Richardson (2012); Daugherty, Black, and Ecclestone (2008); Douglass, Thomson, and Zhao (2012); Entwistle (2005); Gallagher (2008); Hubball, Gold, Mighty, and Britnell (2007); James and Brown (2005); King, Brown, and Lindsay (2007); Knight (2014); Kuh and Ewell (2010); Liu, Bridgeman, and Adler (2012); Maguire, Mernagh, and Murray (2007–2008); Mossa (2012); Oliver, Tucker, Gupta, and Shelley (2008); Pedrosa, Amaral, and Knobel (2013); Prentice and Robinson (2010); Royal (2010); Sharp, Komives, and Fincher (2011); Sin (2014); Somerville (2008); Steedle, Kugelmass, and Nemeth (2010); Sum and Light (2010); Sweetman, Hovdhaugen, and Karlsen (2014). N = 28	Avis (2000); Batten (2012); Calderon (2013); Clark (2002); Clarke (2009); Erlich and Russ-Eft (2011); Gijbels, van de Watering, and Dochy (2005); Harris (2003); Herdlein, Kline, and Boquard (2010); Jones, van Kessel, Swisher, Beckstead, and Edwards (2014); Lam and Tsui (2013); Lichtenstein, Thorne, and Cutforth (2011); Lim and Morris (2009); McClellan (2011); Orsmond, Merry, and Sheffield (2006); Rubin and Matthews (2013); So (2012); Thaler, Kazemi, and Huscher (2009); Willingham-McLain (2011). N = 19	N = 47
Total	N = 55	N = 35	N = 90

Harden (2002) suggests that learning outcomes should be understood more broadly than the 1960s based instructional objectives. According to him (p. 152), “the instructional objectives movement became, in practice, a ritualistic listing of long sets of behavioral statements, which at best had only a marginal effect on the educational process and at worst stifled any enthusiasm on the part of the teacher for teaching and on the part of the student for learning”. Although Harden (2002) notes the historical problems of the behaviourist conception of instructional objectives, he suggests that learning outcomes can be used in some sophisticated way. Harden wrote another article included in this review study (Harden et al., 1999), which was classified as not referring to the behaviourist literature, but expressing uncritical behaviourist epistemology. Both papers by Harden contain some critique, but there are also some features that can be classified as representing behaviourist epistemology. The 2002a paper is more critical, with the 1999 paper is more uncritical.

In some papers, the problems with behaviourist epistemology were connected to the question of managerialism. For example, Brancaleone and O'Brien, whose other paper was quoted above, also note the managerialist problem: “Learning outcomes may constitute an illusory promise, which is set within the very real context of a neoliberal drive towards educational commodification.” (2011, p. 514). In addition to the critical articles presented here, there were papers among the 90 articles included in the review which were critical towards managerialism (e.g. Avis, 2000; Batten, 2012). Because the question of managerialism was not in the scope of the current paper, analyses of this question were not conducted.

3.2.2. Uncritical papers

Due to the large number of articles referring uncritically to the behaviourist literature, we present the results in table form. Excerpts from each paper are shown in Table 3 in order to show the argument for the placement in this category. In order to further analyse the excerpts, they were classified on the basis of the main argument for the use of behaviourist theory. On the basis of this analysis, most papers ($N = 13$) are using authority as the argument for using the behaviourist epistemology. They wrote, for example: “Outcomes are commonly developed by using Bloom's taxonomy” (Fiegel, 2013, p. 239), “This list

Table 3

Articles uncritically referring to the behaviourist tradition of learning outcomes and examples of the texts and referencing. Underlined show classification criteria in the main argument for the use of behaviourist theory.

Bibliographical information of the article	^a ^b	Example of the uncritical reference to behaviourist tradition	Main argument for use of behaviourist theory
Chan et al. (2002)	O No	"The objectives were to compare three educational taxonomies, namely, the Structure of the Observed Learning Outcomes (SOLO) taxonomy, Bloom's taxonomy and reflective thinking measurement model – and to test the application value of these taxonomies." (Abstract, p. 511) "... further studies could explore whether using the new version of Bloom's taxonomy could improve the <u>accuracy</u> of assessing cognitive learning outcomes." (p. 519)	Clarity
Fiegel (2013)	U No	"Learning outcomes have been referred to as instructional objectives (Mager, 1984)." (p. 238) "Outcomes are <u>commonly</u> developed by using Bloom's taxonomy." (p. 239) "Having <u>clear, well-defined, and measurable</u> learning outcomes simplifies the process of developing formative and summative assessment measures." (p. 252)	Authority & Clarity
Gonçalves et al. (2013)	E Yes	"Bloom's taxonomy was used because <u>it is a standard</u> ..."	Authority
Henrichsen and Tanner (2011)	U Yes	"... <u>most general format</u> for a learning outcome is the following: "Program graduates will be able to [action verb] + [something]" (Guidelines for writing expected learning outcomes, n.d., p. 1)." (p. 403) "... Bloom et al.'s (1956) taxonomy of educational objectives can be helpful." (p. 403)	Authority
Hewege and Perera (2013); Khoza (2013)	O No	"According to Bloom's taxonomy of educational objectives (Bloom et al., 1956; Krathwohl, 2002), the above objectives belong to "simple categories" that measure knowledge and comprehension of a study phenomenon. ... it was also expected that the incorporation of wikis would facilitate students achieving the learning objectives of "complex categories" such as synthesis and evaluation" (p. 58)	Framework
Kennedy (2008a,b)	E Yes	"This paper covers the background to the concept of learning outcomes, the use of Bloom's taxonomy to write learning outcomes, the relationship between learning outcomes and competences, and the linking of learning outcomes to both teaching and learning activities as well as to assessment." (Abstract, p. 387) "... Bologna process with its emphasis on student-centred learning, and the need to have <u>more precision and clarity</u> in the design and content of curricula. From one perspective, learning outcomes can be considered as a sort of common currency" (p. 396)	Clarity
Keshavarz (2011)	O	"The following are guidelines assembled from <u>various sources</u> as well as the author's experience in writing course learning outcomes: i. Action verbs from Bloom's taxonomy with an emphasis on higher-order thinking skills should be used. ii. To facilitate the assessing of outcomes, one verb per learning outcome should be used. iii. There should be between 4 and 8 learning outcomes for each course, in fact the fewer the better. iv. Course learning outcomes should describe what a student should be able to DO at the end of a course rather than what the instructor teaches." (p. 4)	Authority
Khoza (2013)	O No	"... this article itself is framed by Bloom's taxonomies of learning." (Abstract, p. 1)	Framework
Klefstad et al. (2010)	E Yes	"A learning outcome is not a new concept. As early as 1956, Benjamin Bloom ... published a list of learning outcomes ... This list is <u>well known</u> in the educational system and <u>has experienced a renaissance in recent years</u> , as a result of greater interest in learning outcomes ..." (p. 4) "To ensure the quality and (the) validity of tests, we have seen a need for increasing teachers' awareness of the importance of classifying the questions in a taxonomy and for using learning outcomes." (p. 10)	Authority
Lim et al. (2013)	U No	"One <u>widely adopted</u> view has been the taxonomy proposed by Bloom et al. (1956)." (p. 36) "To develop a work-transfer facilitating framework of learning outcomes, we categorized different types of learning contests in the cognitive domain, consisting of <i>facts, concepts, procedures and principles</i> (Merrill, 1983), <i>problem solving</i> (Newell & Simon, 1972), and <i>cognitive strategy</i> (Gagné, 1984), combining the classification of learning levels from Merrill (1983) and Bloom (Bloom & Krathwohl, 1984)." (p. 39)	Authority
Maher (2004)	E Yes	"In the UK, recent educational reforms in HE ... have resulted in significant awareness and <u>increase in use</u> of Bloom's taxonomy across the entire HE sector." "Although there have been many criticisms of learning outcomes and their use in HE, there is also recognition that <u>considerable gains</u> can be made by focusing on the <i>outcomes</i> of education rather than on <i>inputs</i> ." "The competency-based movement of assessment that first emerged in the 1970s focused on creating valid and reliable measures ..." (p. 491) " <i>Knowledge inventory</i> . This is a multiple-choice instrument to assess knowledge of program content." (p. 497)	Authority
Meyer-Adams et al. (2011)			Framework
McNeill et al. (2012)	O No	"An adaptation of Anderson and Krathwohl's (2001) taxonomy was used as a theoretical framework to explore the categories." (p. 286) Note: Anderson and Krathwohl (2001) offer a revision of Bloom's taxonomy of educational objectives.	Framework
Meyers and Nulty (2009)	O No	Several <u>well-known</u> learning taxonomies specify hierarchies of intellectual skills and understanding for students' thinking. For example, Bloom's et al. (1956) taxonomy and the	Authority

(continued on next page)

Table 3 (continued)

Bibliographical information of the article	^a ^b	Example of the uncritical reference to behaviourist tradition	Main argument for use of behaviourist theory
		refinements of that model by Anderson and Krathwohl (2001) focused on cognitive processes." (p. 565)	
Pettijohn et al. (2003)	U No	"... careful design of an assessment strategy (not task or items) can ensure that the students engage with the associated learning resources provided and in learning activities that lead to achievement of the desired learning outcomes." (p. 574)	Framework
Pouyioutas et al. (2012)	E Yes	"...we used Bloom's taxonomy to suggest action verbs that can be employed to invoke the desired level of cognition." (p. 190)	Framework
		"Another important concept is learning outcomes (LOs) (Kennedy Hyland & Ryan, 2006), which allows courses/programmes to be expressed in terms of what a learner/student is expected to know by the end of the course/programme." (p. 137)	Framework
		Note: Kennedy et al. (2006) further refer to Bloom's taxonomy.	
Praslova (2010)	U No	"This article proposes a comprehensive and systematic approach to aligning criteria for educational effectiveness with specific indicators of achievement of these criteria by adapting a popular organizational training evaluation framework, the Kirkpartick's four level model ..." (p. 215)	Authority
Pukelis (2011)	E Yes	"When formulating a learning outcome on the basis of professional activity functions, it is extremely important to choose an appropriate action verb." (p. 58)	Framework
Reddy and Hill (2002)	E No	"... for the use of concise level descriptors and for transparency and clarity in line with the proposal of Bloom, Krathwohl, and Masia (1964) for clarity in the language of educational objectives. ... Unlike the NVQ model no portfolio is required and the consequent paper chase is avoided, as are the time-consuming portfolio assessment and validation procedures. The complex structure and baroque language of NVQ performance criteria and range of statements are replaced by simple assessment grids with level descriptors at three levels." (p. 104–105)	Clarity
Savic and Kashef (2013)	O	"Educational institutions today rely on variations of Bloom's taxonomies for laying out teaching strategies and learning outcomes." (p.)	Authority
Savickiene (2010)	E Yes	"... comprehensive learning outcomes should comprise all three domains of the Bloom's et al. (1956) taxonomy – cognitive, psychomotor and affective." (p. 39)	Authority
		"... The validity of these requirements could be described by the following criteria: description of a learning outcome by a single verb ..." (p. 57)	
Shephard (2008)	O No	"The hierarchical nature of affective learning outcomes, as proposed by Bloom et al., may prove to be important as it emphasizes that, as with cognitive skills, some outcomes may be easier to achieve than others. This hierarchy is relatively straightforward to apply to the developing environmentally aware learner." (p. 90)	Framework
Spronken-Smith et al. (2012)	O No	"The first part used Bloom's et al. (1956) taxonomy and asked students to rate to what degree the course had encouraged them to engage in activities such as memorizing, explaining, analyzing, applying, evaluating/judging, creating, reflecting, etc." (p. 60)	Framework
Thambyah (2011)	O No	"Bloom's taxonomy (1956) is a well-known and widely used learning theory ..." (p. 37)	Authority
Yen et al. (2012)	O No	"The revised Bloom's taxonomy (Krathwohl, 2002) was used to divide the content of learning into the following six dimensions in order to understand the content of reports from groups using different methods of concept-mapping." (p. 314)	Framework
Žiliukas and Katiliūtė (2008)	E Yes	"Bloom's taxonomy is frequently used for writing learning outcomes, since it provides a ready-made structure and list of verbs. It can be argued that the use of the correct verbs is the key to the successful writing of learning outcomes." (p. 74)	Authority
		Number of mentions of authority	13
		Number of mentions of clarity	4
		Numbers of usages as a framework without arguments about the reason	10 ^c

^a Country group: E = Europe, U = USA, O = Other.

^b Referring to Bologna or similar.

^c One item was double-coded.

[Bloom's list of learning outcomes] is well known in the educational system" (Klefstad et al., 2010, p. 4), and "Bloom's taxonomy is frequently used for writing learning outcomes, since it provides a ready-made structure and list of verbs. It can be argued that the use of the correct verbs is the key to the successful writing of learning outcomes." (Žiliukas & Katiliūtė, 2008, p. 74).

Four of the articles reasoned the use of behaviourist model with gaining clarity (Fiegel, 2013, p. 252; Reddy & Hill, 2002, p. 104–105), accuracy (Chan et al., 2002, p. 519), measurability (Fiegel, 2013, p. 252), and having more precision (Kennedy, 2008b, p. 396). Many (10/25 = 40%) of the papers did not present any argument for why they selected this theory for their paper; they just noted, for example, that "we used Bloom's taxonomy to suggest action verbs that can be employed to invoke the desired level of cognition" (Pettijohn et al., 2003, p. 190), or "(...) taxonomy was used as a theoretical framework to explore the categories" (McNeill et al., 2012, p. 286).

In most cases, the classification of the papers into the category of uncritical papers was quite straightforward. In some cases, however, it was not so clear. One of the most difficult papers to classify was the paper by Meyer-Adams et al. (2011). The paper notes (p. 491) that "the competency-based movement of assessment that first emerged in the 1970s focused on creating valid and reliable measures", and continues "(...) yet critiques argued that because it measured only concrete,

observable behaviors, it was not valid for assessing the more abstract components". The writers do not state whether they agree with the critique or not, but some parts of the article suggest that they are using some measures that may be based on 1970s behaviourist models, such as the knowledge inventory used in the study. This paper might also be classified as a hybrid study, expressing some behaviourist notions, but also showing a more developed conception of knowledge.

3.2.3. Papers expressing behaviourist epistemology without a reference to behaviourist literature

The review analysis revealed papers that seemed to use behaviourist epistemology, although the paper did not make a reference to the behaviourist literature or tradition. Some of these were clearer than others. [Jurich and Bradshaw's \(2014\)](#) paper expresses a clear example of a use of the behaviourist epistemology: They illustrate the application of diagnostic classification models in assessing student learning outcomes. According to them (p. 52), "in educational settings, possessing an attribute is often referred to as mastery of an attribute". They also state (p. 52) that "attributes are often binary meaning they are measured with two categories: Examinees either possess the attribute or they do not." They go on to measure if students "respond correctly" to given items (p. 55). According to [Svanström et al. \(2008, p. 349\)](#), "once the outcomes of learning (...) have been agreed on, the strategies for teaching and assessing these outcomes must also be chosen. Curricula, syllabi, and teaching and learning activities have to be formed so as to reach the LOs". They present Bloomian lists of outcomes, such as "students will be able to define (...) explain (...) utilize" (p. 346).

[Brawley et al. \(2013\)](#) present lists of learning outcomes in categories of knowledge, skills, communication, and reflection and practice. Under these categories they define more precisely what the students are able to demonstrate, practice, identify, or exercise. [Hay \(2012\)](#), [Pierce and Robisco \(2010\)](#), and [Smith and Yu \(2005\)](#) present lists very similar to [Brawley et al. \(2013\)](#). Although there may be an intention for describing learning in a more sophisticated way, these lists reflect, at least partly, the behaviourist epistemology. The three-circle model by [Harden et al. \(1999\)](#) was even harder to classify; there are hints of expertise theory, but also behaviourist features with notions of "clear and unambiguous expressions" (p. 546). In this study we decided to classify it as uncritical.

There were three articles that did not refer to Bologna or other processes. [Lightner and Benander's \(2010\)](#) paper is a clear evidence of the visibility of the behaviourist tradition in learning outcomes without a clear reference to the behaviourist literature. They advise: "(...) it is helpful for the faculty developer to give many examples of student learning outcomes (...) These examples are available from colleagues or from a simple Google search for 'student learning outcomes' (...) the faculty developer can collect some poor examples, revise them according to the principles of student-centred, concrete, and measurable student learning outcomes, calling attention to revision process. For example, 'develop knowledge' can become 'describe, apply, explain'" (p. 38). It is noteworthy that the concept student-centred is used here, although it was not used by behaviourists.

[Capon \(1999, p. 184\)](#) aims at maximising the learning outcomes by making learning objectives explicit at the start of the project. He suggests that a limited number of clearly stated and varied learning objectives should be specified and that the assessment criteria should relate directly to the required deliverables (p. 198). [Ducrot et al. \(2008\)](#) present a learning outcomes framework for an undergraduate program. They illustrate their intention with many figures and tables, some being quite technical and expressing behaviourist epistemology. For example, Appendix 1 (pp. 118–120) consists of a list of desired skills with sub-lists of desired abilities, such as the ability to understand certain concepts. There are also more sophisticated skills, such as communication skills, but the basic tune of this list can be classified as behaviourist.

There were some papers in this data that used the SOLO taxonomy by Biggs ([Biggs & Tang, 2007](#)) and if they also included a reference to the behaviourist tradition, they were classified as uncritical. Three papers ([Gijbels et al., 2005](#); [Jones et al., 2014](#); [So, 2012](#)) used the SOLO taxonomy, but did not refer to the behaviourist tradition. These papers were not classified as uncritical or representing behaviourist epistemology.

4. Limitations of the study

Due to the vast amount of articles written about learning outcomes, this study was restricted to those peer reviewed papers using the word pair "learning outcome(s)" in the title. Thus, there is a possibility that another kind of selection of papers would have given a different kind of result for the research question of this study. However, an assumption was made that if the writers wrote the words in the title, they did pay specific attention to the concept. Thus, it can be supposed that the result is at least giving a direction about the situation.

The analyses of expressions of behaviourist epistemology were quite difficult to conduct in some cases, and there is a possibility that other researchers may have arrived at a different kind of classification, especially in cases expressing behaviourist epistemology without a clear reference to the literature. The analysis of this article also neglected the critics that were presented toward learning outcomes without a clear reference to behaviourist literature because this type of an analysis would have been too wide a project to add to this paper. The aim of this paper was to focus on the existence of behaviourist epistemology and thus only this critique was analysed.

Reports and other non-peer reviewed papers, such as EU seminar papers, were not in the scope of this article. Admittedly, a study of those would shed more light on the nature and usage of learning outcomes, as well as a study of the impact of the

learning outcome articles, i.e. how and how often these articles are referred to in educational practice-oriented, non-scientific, journals and other documents.

5. Discussion and conclusions

The results of this review show quite clearly that the behaviourist tradition is visible and vivid in scientific articles published between the beginning of the Bologna process 1999 and March 2015. Almost half of the papers (48%) made either direct reference to behaviourist literature (37%) or expressed behaviourist epistemology (11%). The papers making a direct reference to behaviourist literature could be further divided into critical and uncritical papers. The critical papers (8% of all reviewed papers) analysed the problems of behaviourist theory in learning outcomes, while the uncritical papers (29% of all reviewed papers) used the behaviourist theory in suggesting the use of it or analysing the results with it. The given explanations for the use of behaviourist theory found in uncritical papers could be further divided into those 1) which justified the use with authority, 2) praised the clarity of Bloomian taxonomy, or 3) just used the theory without explaining why they chose it.

When looking at the differences between Europe, USA and other countries, we can conclude that the writing activity in this sample was quite similar between the first two groups and slightly lower in the group of the other countries. Referring to Bologna or similar government or state powered learning outcome or quality assurance processes was most frequent in European articles (84%). In other countries, about half of the papers made this type of reference. When looking more closely at the division of papers into those referring or not referring to Bologna or similar processes, some conclusions were drawn: First, all the critical papers noted the government or state powered processes. Second, the papers making uncritical references to behaviourist literature were divided quite equally into those noting and not noting the processes. Third, the articles that did not clearly refer to behaviourist literature but implicitly expressed behaviourist epistemology were more common in the group paying attention to government or state powered processes. This may suggest that recommendations to use learning outcomes may at some stage have resulted in the return of behaviourist epistemology without the writers being aware about the underlying epistemology. Finally, the papers not referring to or expressing behaviourist epistemology were more common in the group noting the government or state powered processes. Thus, most of the critical papers and papers not referring to or expressing behaviourist epistemology in this review study were aware of the wider processes around the learning outcomes concept.

The results showed that 40% of the papers in this sample made either uncritical reference to the behaviourist literature or otherwise expressed behaviourist epistemology. The most common expression of this was relying on the ideas of Bloom's taxonomy. Bloom's taxonomy and its revised version (e.g. Anderson & Krathwohl, 2001; Krathwohl, 2002) have served several decades as practical tools for designing learning goals and assessment methods in primary and secondary education. These more than 50 years old ideas are now intensively disseminated to higher education particularly as a part of the European Bologna process. Why should we worry about this development? The strength of Bloom's taxonomy has been that it has encouraged teachers to go beyond of just measuring the retention of facts. This could of course be beneficial for university teaching as well.

However we need to be aware that the behaviouristic epistemology underlying the taxonomy approach considers knowledge as isolated facts and the human mind as "mental cabinet" (Bereiter & Scardamalia, 1998) or "mind-as-container" (Lakoff & Johnson, 1980, 1999). It fails to describe the dynamically developing knowledge structures and conceptions which the cognitive research of recent decades has shown to characterize higher order learning (Bransford et al., 2006). These metaphors underlying the taxonomy approach to learning outcomes lead to the problematic outcome expectations, which were described by the critical papers, such as deceptive simplicity without real content (James, 2005), impeding deeper learning insights (O'Brien & Brancalone, 2011), and denying the complexity of social learning and teaching processes by rejecting their contingent, emergent and unknowable qualities (Addison, 2014). Harden (2002) notes that long lists of behavioural statements may stifle any enthusiasm for both teaching and learning. According to Entwistle (2005), learning outcomes may lead to neglecting the holistic view of the knowledge and values involved.

Emphasis on more carefully planned approaches to define and assess learning outcomes in higher education is beneficial for the quality of teaching and learning. Better descriptions of learning outcomes and assessment criteria can for example, help teachers and students to communicate about the goals and making them more visible (Brooks et al., 2014). However, current traditions in learning research offer alternative and probably more relevant and better evidence based models for defining goals and assessment criteria for complex conceptual learning than Bloom's taxonomy. For example the US National Research Council project "Knowing What Students Know: The Science and Design of Educational Assessment" (Pellegrino, Chudowsky & Glaser, 2001) and the several later works applying and further developing the approaches of the project (e.g. Pellegrino, DiBello, & Goldman, 2016) provide a comprehensive evidence based framework for defining learning goals and assessing learning outcomes.

The conclusion of this review is that the behaviourist epistemology is vividly appearing in research articles, and as such, we need to be aware of the use of the concept of learning outcomes and to prevent it from becoming an ideology. It can be stated that if students are successful in achieving exactly the predetermined learning objectives and nothing else, the university has failed in its mission. The goal of university education is to produce something new and open opportunities of novel thinking that cannot be stated in advance. On the other hand, it would be beneficial for students to get accurate information

about the goals that they are expected to achieve. This paradoxical situation can be tackled if the concept of learning outcome is used with caution.

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