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Does activation of higher-order thinking skills lead to students (dis)satisfaction with their academic experience?

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ABSTRACT

Although satisfaction with academic experience in the context of higher education has been an area of research for nearly 40 years, it is still unclear how pedagogical practices in the development of thinking skills are related to students' satisfaction. This study aims to investigate the relationships between students' satisfaction and the levels of thinking skills aligned with Bloom's revised taxonomy (BRT) taking into account students' characteristics. Relying on survey data (14 341 undergraduate students from five US universities), this study shows that when students are engaged in thinking skills higher on cognitive hierarchy of BRT, they are more likely to feel satisfied. Whereas engaging students in low thinking skills activities does not increase satisfaction with their academic experience. This study contributes to better understanding of how course design can be associated with student satisfaction and how instructors can implement the principles of BRT in their courses.

KEYWORDS

Bloom's revised taxonomy; higher order thinking; lower order thinking; satisfaction; student experience

Introduction

Students' satisfaction with academic experience in the context of higher education has been an area of research for nearly 40 years because of its importance to student experience at universities (Bell, 2022). Students' satisfaction has links with student motivation (Bailey et al., 2021), perceived learning (Baber, 2020), and intention to continue the study (Wu et al., 2015). Furthermore, studies show that satisfaction is related to other outcomes, such as academic achievements (Pascarella & Terenzini, 2005) and retention (Rehman et al., 2022). During the COVID-19 pandemic, the topic of student satisfaction has become even more important as many studies demonstrated changes in students' satisfaction due to issues with psychological health caused by increase in frustration, mental health disorders, stress, and anxiety (Essadek & Rabeyron, 2020). As measures of students' satisfaction with their academic experience are often used by universities as indicators of the quality of education and services provided to students both internally for quality control, and externally as a measure of educational performance (Sitanggang et al., 2021), students can be

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considered as important stakeholders in higher education, and because university revenues and budget systems increasingly depend on student choices, the process of attracting and keeping students satisfied is essential to institutions (Wiers-Jenssen et al., 2002).

Students' satisfaction is closely tied to the course design and the approaches teachers use to deliver materials (Alsowat, 2016; White et al., 2016). Although the active teaching approach is universally supported by educators (Elfeky, 2019) and it aligns with the idea of educating critical thinkers and future leaders (Lu et al., 2021), until now there has been tension between two paradigms – 'students as active learners' and 'students as customers' (Taylor Bunce et al., 2023). The first paradigm proclaims the promotion of higher-order thinking skills (HOTS) over lower-order thinking skills (LOTS) because HOTS are associated with learning outcomes (such as grades, critical thinking, creativity, etc.) which lead students to more meaningful learning and preparation for the future (Kumpas-Lenk et al., 2018; Lu et al., 2021). Conversely, in the second paradigm teachers see students more as passive learners, and they concentrate on transferring established and priori knowledge through traditional formats (e.g. lectures) with the focus on skills such as remembering and understanding, and rarely require HOTS such as evaluation or synthesis (White et al., 2016). Some studies show a passive teaching approach still dominates at many universities (Børte et al., 2020). The reluctance of instructors to implement a more active teaching approach that induces students to engage in learning activities of higher cognitive complexity can be explained by some tension between difficulty of courses and satisfaction of students driven by modern market-oriented higher education, as some studies found, difficulty of courses and grades can be the strongest predictor of student's satisfaction (Letcher & Neves, 2010). Difficult modules and low grades drive student dissatisfaction with their learning process (Sutherland et al., 2019). A number of studies confirm that the percentage of students expecting high grades in courses is increasing and that grades in university courses have risen despite students reporting less time spent studying (de Vise, 2012). For these reasons, some instructors may feel incentivised to have simpler classes and/or award higher grades to students in return for high assessment for their courses.

The reluctance of some instructors to implement more challenging material in the learning process may proliferate as there have been a limited number of studies that have been conducted on the relationships between students' satisfaction with the learning process and activation of students' HOTS when they are instructed in class. The studies which exist provide mixed results. For example, some of these studies show that HOTS are connected to more satisfaction (Alsowat, 2016; Kumpas-Lenk et al., 2018; Pikhart & Klimova, 2019), while others point to negative consequences of activation of higher thinking when it is associated with active learning and higher workload – such as irritation, anger, confusion, and dissatisfaction (Bramming, 2007). Therefore, this study aims to investigate the relationships between students' satisfaction and the levels of thinking skills aligned with BRT (Anderson & Krathwohl, 2001; Bloom, 1956) taking into account students' background characteristics. Thus, this study addresses the following research question: What are the relationships between the different levels of thinking skills and student satisfaction with their academic experience from students' perspective?

Conceptual framework

In this study, we use BRT (Anderson & Krathwohl, 2001) as a conceptual framework for levels of thinking (Anderson & Krathwohl, 2001; Bloom, 1956, 1978). The taxonomy suggests that there are six types of thinking: *remembering*, *understanding*, *applying*, *analysing*, *evaluating*, and *creating*. These six types of thinking are typically classified into either LOTS (*remembering* and *understanding*), or HOTS (*applying, analysing*, *evaluating*, and *creating*). While LOTS require limited cognitive processing (retrieving information for *remembering* and interpreting information for *understanding*), HOTS require substantially more processing (implementing previously learned information to new situations for *applying*, determining the relationship between different pieces of information for *analysing*, coordinating different pieces of information to be judged for *evaluating*, and hypothesising, planning, and producing for *creating*) (Anderson & Krathwohl, 2001; Nguyễn & Nguyễn, 2017).

Researchers believe that tasks that require HOTS (e.g. problem solving) can promote students' conceptual understanding, foster their ability to reason, and capture their interests and curiosity (Pascarella & Terenzini, 2005). When students are asked to solve authentic and varied problems, they can use diverse approaches, apply previously acquired knowledge, and employ convincing strategies to justify their ideas (Albay, 2019). Students should constantly be challenged with tasks that require skills and knowledge beyond their current level of mastery to maintain their motivation and engagement.

On the one hand, BRT is perceived as a helpful tool for teachers to structure lesson-level objectives based on the complexity of the material they are delivering (Nguyễn & Nguyễn, 2017), and it is still widely accepted and used (Salmon & Barrera, 2021). On the other hand, it is not free from criticism. Some researchers criticise it for oversimplification of the nature of thought and its relationship to what is happening within the classroom (Furst, 1994). Cognitivists state that complex conceptual and long-enduring learning processes cannot appropriately be dealt with by behaviourist models such as BRT (Murtonen et al., 2017). Also, some researchers argue that the six levels in this structurally cumulative and hierarchical system constitute a succession, not an authentic integration from real-life situations, and for this reason the levels are unlikely to impact learners' experiences directly (Soozandehfar & Adeli, 2016). Although BRT looks attractive for educational practitioners due to the possibility to describe learning outcomes on several levels, many of the researchers believe that it can conflict with the current understanding of learning and development of expertise (Murtonen et al., 2017). Nonetheless, this study is aimed not at highlighting the pitfalls of the taxonomy but rather using it as a benchmark to distinguish between tasks aimed at activating either HOTS or LOTS from students' points of view and relating them with students' satisfaction with their academic experience.

Student satisfaction and complexity of thinking skills

Research shows that in learning contexts where students are able to develop HOTS, students have greater academic achievements (Rabe-Hemp et al., 2009), and a primary driver of academic achievement is student satisfaction (Kumpas-Lenk et al., 2018). Also, studies provide evidence that instruction which is targeted at memorisation and simple

retrieval of the studied material does not maximise students' skills to their highest potential and lowers student satisfaction with academic experience, while lessons where students are asked to solve non-trivial problems can increase student satisfaction and foster their cognitive development (Pascarella & Terenzini, 2005).

In reference to the relationship between HOTS and satisfaction, empirical studies tend to support the notion that HOTS are connected to more satisfaction. Alsowat showed that the highest levels of HOTS correlate with satisfaction (2016). While this shows a connection with satisfaction and the highest levels of thinking, learning outcomes for Alsowat's study were not designed for the use of any LOTS (2016). Examining all types of thinking is important because extant research stipulates that for learners to effectively use HOTS, they must first transition from LOTS, and that doing so leads to more success with cognitively challenging outcomes (Booker, 2007). This also translates to student satisfaction, as when students who are able to progress through the whole range of thinking skills associated with BRT show higher levels of satisfaction with the course (Pikhart & Klimova, 2019). Other studies have shown that being challenged with learning outcomes that require HOTS leads to higher levels of engagement, and thus satisfaction when compared to outcomes that only require LOTS (Kumpas-Lenk et al., 2018).

At the same time, some researchers point out that the higher the intensity of the learning process and engagement in non-trivial tasks, the more painful the learning process can be as it can cause negative emotions in some students, such as irritation, anger, confusion, and dissatisfaction (Bramming, 2007). Also, researchers relate the benefits of activation of higher thinking skills versus lower thinking skills to students' performance (Freeman et al., 2014). For example, as some researchers state, unstructured tasks with multiple solutions can be a challenge to students who have a low level of knowledge on a particular topic and high levels of cognitive complexity may cause cognitive overload (Sweller et al., 2007). It has also been found that when students experience the increased cognitive effort associated with active learning, they initially take that effort to signify poorer learning (Deslauriers et al., 2019).

Methodology

Data

Data from the 2017 administration of the Student Experience in Research Universities (SERU) survey were used to address the research questions. The SERU survey1 was designed as a comprehensive census online that presented a systematic environmental scan of the student experience at major public research-intensive universities in North America. The sample consisted of five US universities (14 341 undergraduate students, 61% were females, average age – 22 years old ($M = 21.9$, SD = 4.4)). For this study, we used convenience sampling; all students of these five universities received an invitation to participate in the survey. However, only those who were willing to participate completed the survey. One of the biggest advantages of convenience sampling is that it can lead to a large and diverse sample, although it can also lead to selection bias. Despite the potential selection bias, convenience sampling remains one of widely used sampling methods among student surveys. The procedures of data collection were the same for all universities participating in the study. All undergraduate students in the target

Table 1. The descriptive statistics of the sample.

	Sample ($N = 14341$)
Gender (female)	61%
Age (Mean)	22
Achievements: GPA (Mean)	3.4
Majors	
Arts and Humanities	15%
Social and Behavioral Sciences	31%
Law	1%
Engineering	18%
Natural Science and Mathematics	20%
Economics, Business and Management	10%
Medicine	4%
Other majors	2%
Level of study	
Freshman	5%
Sophomore	9%
Junior	32%
Senior	54%
Social economic status	
Low-income or poor	10%
Working-class	18%
Middle-class	36%
Upper-middle class	32%
Wealthy	3%
Levels of thinking (the combination of categories 'often' and 'very often', %)	
Recognize or recall specific facts, terms, and concepts	70%
Explain methods, ideas, or concepts and use them to solve problems	75%
Break down material into component parts or arguments into assumptions to see the basis for different outcomes	65%
Judge the value of information, ideas, actions, and conclusions based on the soundness of sources, methods	62%
Create or generate new ideas, products, or ways of understanding	53%
Satisfaction academic experience	
Satisfaction (the combination of the categories 'satisfied' and 'very satisfied', %)	55%
Satisfaction (Mean score, a 6-point scale, from 1- very dissatisfied to 6 - very satisfied)	4,46

population received an email with an individual link to the survey. Students participated in the SERU survey on a voluntary basis, and all universities agreed to share the anonymised data with the university members of the SERU consortium. The response rates varied across campuses with an average of 40%. The detailed description of the sample is presented in Table 1.

Measurements

Thinking skills

SERU 2017 survey contained a block of questions on self-perceived thinking skills based on BRT (Anderson & Krathwohl, 2001). In the SERU survey, the six levels were packaged into five items that mirror the cognitive domains, with the exception of levels three and four (*applying* and *analysing*), which were collapsed together to make the items more appropriate and easier for the participants to understand. The first item represents *remembering*, the second item represents *understanding*, the third item represents *applying and analysing*, the fourth item represents *evaluating*, and the fifth item represents

creating. The students were asked to respond to the question: 'Thinking back over your coursework in your field of study this academic year, how often were you required to do the following?' using a six-point scale (never, rarely, occasionally, somewhat often, often, very often):

(1) recognise or recall specific facts, terms, and concepts;
(2) explain methods, ideas, or concepts and use them to solve problems;
(3) break down material into component parts or arguments into assumptions to see the basis for different outcomes and conclusions;
(4) judge the value of information, ideas, actions, and conclusions based on the soundness of sources, methods, and reasoning;
(5) create or generate new ideas, products, or ways of understanding.

Satisfaction with academic experience

To measure students' satisfaction with their academic experience, a single question was used: 'How satisfied or dissatisfied are you with the following aspects of your university experiences/education: overall academic experience?' with a six-point scale (very dissatisfied, dissatisfied, somewhat dissatisfied, somewhat satisfied, satisfied, very satisfied). Previous iterations of the SERU survey (2012) have looked into academic satisfaction using a greater range of items (Bae & Han, 2019). However, the subsequent iterations of the survey have used a single item to measure satisfaction in general and found that to be a simple and useful way to understand students' experiences (Lenton, 2015).

Analytical strategy

To estimate the frequency of different types of thinking skills students applied in their academic process at university, we generated basic descriptive statistics. To answer the research question about the relationships between the different types of thinking skills required by the students, as perceived by them, and student satisfaction with their academic experience, we ran a three stage hierarchical logistic regression. The main dependent variable 'satisfaction with academic experience' was transformed from a 6-point Likert-type scale into a dichotomous variable where a category 'satisfied' was created by collapsing two response options 'satisfied and very satisfied' (55%) and all others. The transformation was done in the following way: 1) to ensure that categories are equally filled and 2) to divide people who are rather satisfied from others. A newly formed category 'satisfied' equals unity or zero otherwise. Previous research has used this method of collapsing satisfaction variables into two options to allow for binary logistic regressions to be used (Wiers-Jenssen et al., 2002).

To investigate the relationships between students' satisfaction and the levels of thinking skills aligned with BRT and to distinguish the effect of the levels of thinking and the effect of student background characteristics, we ran a three-stage hierarchical multiple regression. Five levels of thinking skills were entered at stage one of the regression; university characteristics, such as major, year in university and GPA were entered at stage two; and variables related to students' socioeconomic status (low-income or poor, working-class, middle-class, upper-middle or professional-middle, wealthy) – at stage

three. The value of Nagelkerke R Square was used to verify the contribution of each block of variables.

Results

The descriptive analysis of the full sample suggested that students were asked to apply more complex modes of thinking less often than simpler modes of thinking (Table 1). More specifically, 70% of students were reportedly asked to recognise or recall specific facts, terms, and concepts and 75% - explain methods, ideas, or concepts and use them to solve problems often or very often. These two items were considered to be the least cognitively complex items but were the most frequently used by instructors. The next most frequently observed types of thinking were: breaking down material into component parts or arguments into assumptions to see the basis for different outcomes and conclusions (65%) and judging the value of information, ideas, actions, and conclusions based on the soundness of sources, methods, and reasoning (62%). Both of these items require more complex levels of thinking skills than the previous two items. Finally, only half of the students in the present study reported being asked to create or generate new ideas, products, or ways of understanding, which was the most cognitively complex cognitive skill. Regarding the degree of satisfaction with academic experience, the majority of students in the sample are satisfied with their academic experience. Among the respondents 55% were either satisfied or better, and only 6% were dissatisfied or worse (Table 1).

The results of the regression suggest that students' satisfaction with their academic experience is related to higher levels of thinking they apply during their studies (Table 2). There is no significant association between the lowest level of thinking skills where students are required mostly to memorise and recall facts and student satisfaction. However, there is a statistically significant positive association between student satisfaction and three levels of thinking skills: the second level of the taxonomy – to explain methods, ideas, or concepts and use them to solve problems (Exp(B) = 1.51, $p < .000$) and higher levels: to judge the value of information, ideas, actions, and conclusions based on the soundness of sources (Exp(B) = 1.27, $p < .003$) and to create or generate new ideas, products or ways of understanding (Exp(B) = 1.48, $p < .000$). They remain significant in the second and the third stages of the analysis after accounting for students' university characteristics and their socioeconomic status. The results also confirm that GPA is the strongest predictor of student satisfaction which is in line with many previous studies (for example, Tomkin & West, 2022). And that is one of the reasons why GPA (together with gender, socioeconomic status and other variables) has to be included in educational models and has to be accounted for.

The final resulting models allow for correct classification of 86% of the respondents (Classification accuracy coefficient). Nagelkerke R Square of the first stage equals .038, meaning that the activation of different levels of thinking skills explains approximately 4% of the variation in students' satisfaction with their academic experience, and students' background characteristics add an additional 5% of explained variance (Nagelkerke R Square for the second stage = .086 and for the third stage = .093). Overall model accounts for 9% of the variance in student satisfaction with their academic experience

Table 2. Three-stage hierarchical logistic regression predicting the likelihood of students' satisfaction with academic experience based on the different types of thinking.

	B	S.E.	Exp(B)	95% C.I.for Exp(B) Lower	Upper	Sig.
STEP 1						
Recognize or recall specific facts	-,078	,079	925	,792	1,081	327
Explain methods, ideas, or concepts***	,414	,090	1,512	1,268	1,804	000
Break down material into component parts	-,057	,087	945	,797	1,120	514
Judge the value of information, ideas**	,240	,081	1,271	1,085	1,489	003
Create or generate new ideas***	,398	,074	1,488	1,287	1,721	000
Constant	1,333	,062	3,791			000
Nagelkerke R Square			**,038**			
STEP 2						
Recognize or recall specific facts	-,067	,083	935	,795	1,100	416
Explain methods, ideas, or concepts***	,424	,095	1,528	1,269	1,839	000
Break down material into component parts	,034	,090	1,034	,868	1,233	706
Judge the value of information, ideas*	,187	,085	1,205	1,020	1,423	028
Create or generate new ideas***	,354	,077	1,425	1,225	1,657	000
GPA***	,934	,066	2,544	2,236	2,893	000
Freshmen(ref)						
Sophomore	-,030	,133	970	,748	1,258	820
Junior*	-,250	,107	779	,632	,961	020
Senior	-,021	,072	979	,850	1,127	765
Gender	-,062	0,06	0,94	0,82	1,07	
Arts and Humanities (ref)						
Social and Behavioral Sciences	,098	,328	1,103	,580	2,097	765
Law	,113	,322	1,119	,595	2,104	726
Engineering	-,109	1,120	897	,100	8,053	923
Natural Science and Mathematics	-,252	,325	777	,411	1,470	438
Economics, Business, Management	-,355	,324	701	,372	1,323	273
Medicine	,477	,334	1,612	,837	3,103	153
Other major	,233	,366	1,263	,616	2,587	524
Constant	−1,682	,390	186			000
Nagelkerke R Square				**,086**		
STEP 3						
Recognize or recall specific facts	-,066	,083	936	,795	1,102	429
Explain methods, ideas, or concepts***	,418	,095	1,519	1,260	1,830	000
Break down material into component parts	,020	,090	1,020	,855	1,218	824
Judge the value of information, ideas*	,210	,085	1,234	1,044	1,459	014
Create or generate new ideas***	,353	,077	1,423	1,222	1,656	000
GPA***	,880	,066	2,411	2,117	2,746	000
Freshmen(ref)						
Sophomore	-,037	,133	963	,743	1,250	779
Junior*	-,250	,107	779	,632	,961	020
Senior	-,028	,072	972	,844	1,120	698
Gender	-0,07	0,06	0,92	0,81	1,06	
Arts and Humanities (ref)						
Social and Behavioral Sciences	,119	,329	1,127	,591	2,147	716
Law	,134	,323	1,144	,607	2,154	678
Engineering	-,049	1,116	952	,107	8,482	965
Natural Science and Mathematics	-,246	,326	782	,412	1,482	450
Economics, Business, Management	-,322	,325	725	,384	1,370	322
Medicine	,491	,335	1,634	,847	3,152	143
Other major	,286	,367	1,331	,648	2,733	436
Low-income or poor (ref)						
Working-class**	-,698	,223	498	,321	,770	002
Middle class	-,409	,211	665	,439	1,005	053
Upper-middle or professional-middle	-,305	,205	737	,493	1,102	137
Wealthy	-,077	,208	926	,616	1,392	712
Constant	−1,237	,440	290			005
Nagelkerke R Square			**,093**			

*$p < .05$, **$p < .01$, ***$p < .001$.

meaning that there are other stronger factors that can possibly affect student satisfaction. However, this study is mainly focused on pedagogical practices which activate HOTS vs LOTS.

Discussion

As universities are striving to maximise student satisfaction not only to survive in the ranking game but also to attract students of high quality, it is important to understand how to improve student satisfaction with their academic experience. This study sought to give insights into how levels of cognitive complexity according to BRT are related to students' satisfaction with their academic experience. Conflicting conclusions have been drawn with regard to whether tasks with the focus on activating HOTS are linked to student satisfaction or not. While some studies make the case that learning outcomes designed for HOTS have a tendency to frustrate learners attempting to process information beyond their processing capacity, and therefore result in dissatisfaction (Bramming, 2007), comparatively fewer number of studies make the case that students are more satisfied when learning outcomes challenge them to the point where they take personal control of their learning experience through the use of HOTS (Kumpas-Lenk et al., 2018). Despite empirical evidence supporting the use of HOTS to promote satisfaction, the results of our study showed a general downward trend in frequency of thinking skills as they became more challenging. This aligns with previous studies that show a dearth of instructors giving students learning tasks at higher levels of cognitive difficulty, with instructors preferring more traditional teaching methods targeted at the cultivation of factual information and the explanation of basic ideas (White et al., 2016).

Regarding our main research question about the relationship with thinking skills and satisfaction, our results showed that the lowest order thinking skill (*remembering*) had no significant relationship with satisfaction with academic experience. This aligns with research claiming that simple recall of information fails to maximise the potential for learning, and therefore leads to an unsatisfying educational experience (Pascarella & Terenzini, 2005). Additionally, the fact that the *evaluating* and *creating* were both linked to higher levels of satisfaction aligns with empirical research that shows HOTS create more engagement with content, generating a sense of personal accountability, which in turn gives students a more satisfying learning experience (Kumpas-Lenk et al., 2018). However, the variable *applying/analysing* did not show a significant relationship with student satisfaction. This goes against research that states when students are able to break down information into its constituent parts and apply it to other concepts, student satisfaction tends to increase (Kumpas-Lenk et al., 2018). Although we do not have a clear explanation of this result, we assume that *applying and analysing* is the least cognitively demanding thinking skill of HOTS. It is plausible that every participant who used *evaluating* also used *applying/analysing*, but not vice versa because *evaluating* was less frequent than applying/analysing. Therefore, it may be the case in the present study that *evaluating* led to more satisfaction than applying/analysing because those who used *evaluating* were able to build on their analysis first, and ultimately were more satisfied because of it.

Although the present study shows that the activation of HOTS can lead to more student satisfaction, the formation of complex cognition cannot be achieved without

a solid foundation of lower levels of cognitive skills (Booker, 2007). Research supports this in that students who are able to go through all of the thinking skills report higher levels of satisfaction (Pikhart & Klimova, 2019). Our results did show that fewer participants used HOTS than LOTS, which indicates that there was a drop off as learning outcomes became more complex. It may be that participants who used the highest level of thinking skills were able to progress through all previous levels of thinking skills, leading to a more satisfying experience. This is important pedagogically, because basic skills should not be devalued due to the promotion of 'higher order thinking' (Booker, 2007). As Demaris and Kritsonis (2008) claim, the classroom experience should be designed to provide positive experiences through the adoption of various learning strategies. From this point of view, instructors should walk students through different stages of the cognitive process, starting from simple remembering to becoming more knowledgeable and more skilled, to develop an improved understanding of the content they are learning. This is possible when learning outcomes of all levels of complexity are not only designed in the curriculum but implemented into practice as well. Therefore, students need to have more opportunities to create things and analyse the products of their creations. At the same time, while they are creating and analysing, they are able to construct deeper knowledge and thorough understanding (Berger, 2018).

Limitations and conclusion

Although this study provides valuable insights into higher education, it has some limitations. First of all, the instruments used for student satisfaction surveys and student assessments of teaching do not measure student learning directly. Such instruments are process-oriented. At best, they give an indirect measure of student learning (Wiers-Jenssen et al., 2002). Second, student satisfaction can be influenced by exogenous characteristics such as institutional characteristics and specific features of academic disciplines which we cannot control for in this study. Third, the previous two limitations can be tied to the result of the statistical analysis where it was shown that the variables related to the activation of thinking skills explain a small percent of the variance in student satisfaction with their academic experience. It means that there are other stronger factors that can possibly affect student satisfaction. For example, student – staff ratio and student employability can be strong influencers of student satisfaction (Lenton, 2015). Fourth, as this study is tied to US higher education, although it uses commonly utilised learning objectives taxonomy, further research in other national contexts is required. Therefore, a more robust research design with more detailed questions on teachers' pedagogical practices can provide more insights in understanding the role of HOTS and LOTS in students' satisfaction with their academic experience.

To sum it up, this study contributes to previous research which investigates the association between HOTS and academic satisfaction in two main ways. First, utilising a large sample of undergraduate students enrolled universities in the USA, it builds a clear picture that in general from students' perspective instructors are not frequent users of HOTS, despite the proclamation of the importance of HOTS by policymakers, educators, researchers, and the general public (Elfeky, 2019). Secondly, this study delivers a clear message for instructors who are fighting for tenure and those hoping to renew their short-term contracts, that students most likely appreciate challenging courses which

stimulate independent thinking even though this learning experience might be 'painful'. The authors hope that these results may help instructors resist the temptation to create easier classes for the purpose of more favourable student evaluations.

Note

1. More information about SERU Consortium can be found here https://www.seru.edu/

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No potential conflict of interest was reported by the author(s).

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