UACES 46th Annual Conference

London, 5-7 September 2016

www.uaces.org

Attendance and First-Year Study Success in Problem-Based Learning
The Case of Maastricht University's Bachelor in European Studies

Working Paper Presented during the 46th Annual UACES Conference
Queen Mary University of London, 5-7 September 2016

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Introduction

The first year of studies is of key importance in determining students' chances of completing their studies in higher education. Many new students struggle with the transition from secondary school to university and often have difficulties adapting to academic norms and expectations (e.g. Briggs, Clark & Hall, 2012; Brinckworth et al, 2009; Bruinsma & Jansen, 2009). Class attendance is often identified as being important for students' persistence and results, with absenteeism being seen as increasing the risk of drop-out (e.g. Assiter & Gibbs, 2007; Moore et al., 2003). In this context, Trotter and Roberts (2006, p. 382) stress the importance of stimulating "an ethos of attendance" as key in terms of integrating first-year students into academia.

In Dutch higher education the first year is of particular importance. Students will normally have to pass a minimum number of credits to be able to continue into the second year of their studies, the so-called Binding Study Advice (BSA). This also applies to students enrolled in Maastricht University's Bachelor in European Studies (BA ES). This programme resolves around problem-based learning (PBL), a student-centred approach to teaching and learning. Active student engagement is key to the success of PBL and, hence, one could argue that attendance is deemed to be crucial for effective student performance in PBL-based programmes (cf. Loyens, Kirschner & Paas, 2012, p. 419; Maurer, 2015, p. 372). Therefore, the BA ES employs minimum attendance requirements.

Interestingly, despite an ample body of literature on attendance and study success, there is hardly any specific research into the PBL context (the single exception: van Berkel & Schmidt, 2000; cf. Bevitt, Baldwin & Calvert, 2010, p. 8; Eisen et al, 2015, p. 814). Our research is aimed at addressing this gap in the literature by assessing in how far (non-) attendance matters for students' achievements in terms of first-year study success in the BA ES. In this paper we focus on the cohort of 2014/2015 which enrolled 331 students. In our research project, we aim to include five first-year cohorts in the BA ES (2011 /2012, 2012/2013, 2013/2014, 2014/2015, 2015/2016), totalling up to about 1,500-1,750 students.

As we are still in the process of adding four cohorts to the dataset, the current paper presents the results of an analysis of the cohort 2014/2015 (331 students).[1] The paper starts with a brief overview of the literature on first-year experience, study success and attendance.

[1] Please note that the number of students included in the models below include less than 331 students because some did not show up at all whereas others dropped out during the academic year or did not participate in all examinations.

Next, we will introduce the BA ES and PBL. This is followed by an overview of our research design. Subsequently we will present our first, tentative findings. As we will show below, these findings suggest that attendance is even more important than expected.

First-year study success and attendance

The literature on teaching and learning generally identifies the first year of studies as a crucial formative year. In the words of Bruinsma and Jansen (2009, pp. 100-101), "[t]he first year is especially important as it serves as an orientation to the remainder of the study and selects those students who are willing to persist." The range of factors that comes into play when first-year study success is concerned is broad. Individual student characteristics such as age, gender, motivation, secondary school performance and study skills play a role, as do issues related to the programme of study, such as curriculum design, induction activities, social integration and educational environment (e.g. Briggs, Clark & Hall, 2012; Brinckworth et al, 2009; Trotter & Roberts, 2006).

Even though there are external factors beyond the control of universities (e.g. Leveson, McNeil & Joiner, 2013), they can take steps to create an environment in which students' chances of persisting increase and that fosters academic integration (e.g. Christie et al, 2008). This is, for instance, the case for active learning environments such as PBL, usually characterised by closer interaction with peers and academic staff (e.g. Loyens, Kirschner & Paas, 2012, p. 413). Jansen and Suhre (2010) argue that an active learning environment is important for students' persistence, especially in their first year. The same goes for student attendance and, hence, they recommend programmes in higher education "to consider the introduction of compulsory attendance of at least 90% of the tutorials during the first semester of the first year." (p. 578) Similarly, Georg (2009, p. 657) notes that 'limited class attendance' is one of the characteristics of students who might not persist and argues that universities should intervene as soon as possible. Finally, Assiter and Gibbs (2007, p.82) asked representatives from three UK institutions for reasons why students would be at risk of dropping out during their studies. Missing two or more sessions in a module or missing scheduled meetings with mentors were among the reasons mentioned most.

While these studies look at several factors related to first-year experience, there is also dedicated research on the influence of attendance on study success. This research has looked at different disciplines, ranging from economics to nursing. Many of these studies have also

looked at first-year courses. And even though some question the effects of attendance on study results (e.g. Eisen et al, 2015), many others have concluded that there is a clear relationship between attending or not attending classes and study results (e.g. Bevitt, Baldwin & Calvert, 2010; Moore et al, 2003).

Several of these studies have commented on the fact that attendance may also be linked to other forms of motivation and commitment (e.g. Gump, 2005; Marburger, 2001). Yet, Romer (1992) discerned a statistically significant relation between attendance and results, even when controlling for other possible factors – including motivation, which he took into account by also only looking at students who completed all course work. Credé, Roch and Kieszczynka (2010) argue along similar lines in their meta-study on the influence of attendance on study results. They look at different models which may explain this relationship. For instance, in the 'mediated effects model' student characteristics (such as motivation and conscientiousness) play a role, whereas in the 'unique effects model' there is a strong relationship between attendance and grades with only a weak role for student characteristics. The authors argue that the latter model offers better explanatory value and that "the benefits of better attendance in college classes are likely to be substantial." (p. 286)

While attendance seems to matter, this does not necessarily mean that there is agreement on how to decrease absenteeism. One of the key points of debate concerns the potential contribution of minimum attendance requirements. Studies report that students do not object to interventions; they actually perceive it as a sign that university cares about them (Bevitt, Baldwin & Calvert, 2010; Bowen et al, 2005). Yet, scholars are not always keen on such measures. St. Clair (1999) has argued against compulsory attendance. She believes that existing studies do not provide enough justification for such policies, also because they would ignore other factors that influence study success. Instead, she argues that students should want to attend, instead of being forced to. This way they feel in control and will be better motivated.

Rodgers (2002) did in fact experiment with an incentive scheme, but while attendance did increase, it did not lead to better performance (cf. Eisen et al, 2015, p. 815). Marburger (2006) tried a mandatory attendance policy that did have an effect on course performance, even though this effect was not huge. Finally, based on a study of attendance and study results of students in undergraduate economics classes at three universities, Romer (1992) argues that it is certainly worth considering mandatory attendance.

Yet, there may also be other ways of improving attendance. Moore et al. (2003; cf. Credé, Roch & Kieszczynka, 2010, pp. 286-287) also found that attending class has an influence on results. They showed these findings to students, which resulted in higher class attendance. However, the authors also note that such efforts will probably not have an influence on students who are less concerned about their education. Considering the fact that government funding of universities nowadays is partly dependent on higher retention and completion rates, publishiung the effects of missing tutoriuals may not be realistic. In fact, Trotter and Roberts (2006) present evidence that shows that the best retention rates are achieved by universities where attendance is required and is strictly monitored.

Problem-based learning in the BA ES

Issues such as first-year experience, retention and completion rates, and class attendance have also been at the centre of debate in Dutch higher education, including in relation to Maastricht University's BA ES. This three-year, interdisciplinary undergraduate programme focuses on Europe in its broadest sense, including European integration, cultural and religious fault lines, and European history. Courses are jointly developed and taught by an international staff team, representing several departments, ranging from Arts & Literature to Political Science. Due to the fact that the programme is fully taught in English, it attracts students from all over Europe and even from outside Europe, with approximately 325-350 students enrolling for the first year on an annual basis.

All programmes at Maastricht University are developed in accordance with the principles of PBL. This approach was first developed at the McMaster University Medical School in Hamilton, Canada, during the 1960s, but has since been implemented in many other disciplines and programmes across the world (e.g. Loyens, Kirschner & Paas, 2012). PBL relies on an active construction of knowledge in the context of specific, sometimes very practical, problems. It is a student-centred approach that presumes self-directed learning: based on prior knowledge and interests, students identify the content of the process and shape that process by actively participating, but also by, for instance, chairing meetings. Learning is a collaborative process in which students discuss problems and literature, and exchange ideas and arguments.

To facilitate students' learning in PBL, Maastricht University developed the 'seven-jump' or 'seven-step' approach. The first five steps constitute the pre-discussion, which takes

place in the group. In the BA ES these groups consist of maximum 15 students, guided by a tutor (a member of the teaching staff). Students start the pre-discussion by clarifying any difficult concepts in the assignment text. Next they decide on an overarching problem statement to guide their learning. During the subsequent brainstorm they discuss possible answers, partly relying on their prior knowledge. This brainstorm is then ordered and should eventually cumulate in learning objectives. The sixth step is the self-study, during which students independently answer the learning objectives – actual contact hours are limited to around 10 hours per week. Normally the group meets again two days later for the last step, the post-discussion, during which students discuss their answers and findings (Maurer, 2015; Maurer & Neuhold, 2014).

Moust, van Berkel and Schmidt (2005) argue that throughout the years, PBL has seen 'erosion' of its original premises, including decreasing student engagement with the pre-discussion, increasing group size, and course coordinators that prescribe literature. The authors claim that a holistic approach should be taken to tackle such challenges, yet the focus tends to be on partial solutions that only tackle specific issues. One of these issues is students' attendance and participation, which is of key importance for a fruitful application of PBL (e.g. Loyens, Kirschner & Paas, 2012, p. 419). In the words of Maurer (2015, p. 372) "PBL builds upon collaborative learning by assuming that deliberation and discussion advance knowledge and understanding."

Also within the BA ES' home Faculty of Arts and Social Sciences (FASoS) there have been several discussions on the role of attendance. Should we continue to rely on minimum attendance requirements or rather let go of these requirements altogether? Perhaps there is an in-between solution? And what would all of this mean in terms of curriculum design? Our research was also initially inspired by these discussions, which often were opinion-driven, rather than evidence-based. Considering the fact that educational scientists have done research into the matter, in particular when it comes to attendance in the first year of undergraduate programmes, we believed that these discussions needed a more solid basis. Yet, as mentioned before, there is hardly any research on attendance in PBL, a gap that we try to address through our research.

Research design

Our research is aimed at assessing the importance of (non-) attendance on the study success of first-year BA ES students of five cohorts (2011/2012, 2012/2013, 2013/2014, 2014/2015, 2015/2016). The main reason for focussing on these cohorts is that the students in question have all had to complete the so-called Matching procedure, which is aimed at helping prospective students make the right study choice. Among other things this procedure stimulates reflection about motivation to study European Studies (Bijsmans & Harbers, 2014).

As already mentioned, we are still in the process of gathering and analysing part of the data. Therefore, this paper presents the findings from the cohort 2014/2015. Of the 331 students originally enrolled for this year, 274 students took all courses of the first year. The group consists of slightly more women (54%) than men (46%) and is highly international, though German students by far comprise the most substantial group (41%; 20% Dutch, 10% Belgians; 8% Italian; 5% UK, and 20% other countries; comparable figures apply to country of pre-education). The average age is 19.6 years (with a standard deviation of 1.5 years; minimum is 18 and maximum is 27 years).

Study success in our research takes two forms. First and foremost, it concerns retention. Consequently, the first question addressed in this paper asks whether we can discern differences in course attendance between students who passed the BSA threshold – 42 or more ECTS (European Credit Transfer System) – required to continue their studies and those who did not. We also look at the effect of attendance on the total number of ECTS obtained at the end of the first year. Second, study success can be defined in terms of grades. Therefore, for those students who achieved at least 42 ECTS, does course attendance effect their Grade Point Average (GPA) at the end of the first year? Not only will we address this issue by comparing end-of-the-year results, but we will also discuss whether attendance in one period is more important than in another period.

Below we further differentiate the group of students into students who passed the BSA threshold (N = 224) and students who passed the BSA threshold and attended the minimum number (= 64) of required meetings at the end of the first year (N = 146). The descriptive statistics remain the same for these groups of students. In addition, we present two course specific analyses to show that our analytical techniques can also be used to observe whether attendance for one course is more important than for another course and, within courses, whether attending one tutorial has a larger impact than attending another tutorial. Course descriptives for the first year of the BA ES are included in the appendix (Table A1). Some

skills courses are not graded in accordance with the 1-10 Dutch numerical scale[2], but with a fail, pass, or excellent. Attendance and ECTS for these courses are included in our attendance and ECTS measures, but these courses are excluded when we calculate GPA.

Our main independent variable of interest is attendance. We approach attendance as, generally, a "broad measure of active engagement" (Gracia & Jenkins, 2002) and, particularly, of commitment to PBL (van Berkel & Schmidt, 2000). In other words, our results may not measure the impact of attending *per se*, but attendance *is* a valid indicator for active participation and application of PBL. This is also the reason why we include attendance for skills courses which are not examined with the Dutch grading scale and one course which is technically not a PBL course.[3]

Tables A1 and A2 in the appendix presents the minimum and maximum number of tutorials students need to or can attend during a specific course, during a period, or at the end of the first year (period 5). A student who has met the minimum attendance requirements at the end of the first has attended 64 tutorials whereas a student who did not miss any meetings attended no less than 83 tutorials. In the statistical models presented below we include a number of control variables: gender (0 = men; 1 = women), age (number of years), nationality (country), and pre-education (country).

Findings I: The effect of attendance on meeting the BSA

The first question we take up is whether attending more tutorials increases the likelihood of passing the BSA threshold. In a nutshell, students are allowed to continue their studies into the second year when they have earned 42 or more ECTS during their first year. Table 1 presents the results of a logit regression model exploring the effects of the total number of attended tutorials at the end of the first year on meeting the BSA requirement (1 = yes; 0 = no). The model controls for gender, age, nationality, and country of pre-education. Attendance has a positive and statistical significant effect on meeting the BSA-requirement.

Substantive effects cannot be directly interpreted from the regression results presented in Table 1. Therefore, we have calculated the effects of attendance for a German women of 20

[2] Where a 10 is the highest possible grade and a 6 the minimum passing grade.
[3] During one English language course students of the first year meet in groups of 80-90 students for a seminar, but attendance is required and recorded.

years who received her pre-education in Germany.[4] Students who attended all meetings (83) have a 99 per cent probability of meeting the BSA of 42 or more ECTS whereas this probability is 63 per cent for students who attended the minimum number of meetings (64).

Table 1: Effect of attendance on meeting the binding study advice of 42 ECTS

	beta coef.	s.e.	sig.
Cumulative attendance period 5	0.206	0.032	*
Gender	-0.410	0.446	
Age	0.002	0.148	
Nationality	0.296	0.189	
Pre-education	-0.312	0.190	*
Constant	-11.892	3.629	*
N students	274		
Log Likelihood	-77.65		
McFadden R^2 (adj)	0.357		
Count (adj)	0.340		

Notes: * $p < 0.01$. Shown are the results of a logit regression model estimating whether students meet the binding study advice (N = 224) or not (N = 50).

Findings II: The effect of attendance on obtained ECTS

We also explore the effect of attendance on the total ECTS obtained at the end of the first year. Some descriptive statistics (Table 2) are already pretty revealing. Students who have earned at least 55 of the maximum of 60 ECTS have attended on average 76 tutorials. This is statistically significantly more than students who obtained more than 42 but less than 48 ECTS who attended on average 69 tutorials.

Table 2: Average attendance per ECTS-group

ECTS	Mean	SD	Sig.	N	Min	Max
< 42	57	17		50	1	77
42-48	69	6	a	39	54	80
49-54	72	6	a	36	60	82
55-60	76	4	a, b	149	63	83
Total	71	11		274	1	83

[4] This 'type' of student has been chosen because annual study progress data from our student advisors shows that they are the best performing students and often are present during virtually all meetings.

Notes: Differences in means statistically significantly different for a = < 42 ECTS, b = 42-48 ECTS (ANOVA, $F = 65.75$, $p < 0.001$)

In Table 3 we present the results of three ordinary least square regression models which allow us to explore the effect of attendance on the number of earned ECTS at the end of the first year for three different groups of students: all students (ALL; N = 274), students who met the BSA-requirement (BSA; N = 224), and students who met the BSA requirement *and* who also attended the minimum number (= 64) of required meetings at the end of the first year (BSA + MIN; N = 146).

Table 3: Effect of attendance on obtained ECTS at the end of the first year

	ALL			BSA			BSA+MIN		
	β	s.e.	sig.	β	s.e.	sig.	β	s.e.	sig.
cum. attendance p5	1.06	0.05	**	0.50	0.07	**	0.42	0.12	**
gender	0.22	1.22		1.17	0.75		1.64	0.86	
age	-0.46	0.40		-0.19	0.24		-0.56	0.27	**
nationality (dutch = base category)									
belgium	10.82	3.76	**	0.20	2.63		-1.39	2.82	
german	8.94	3.52	**	1.96	2.45		-0.39	2.61	
UK	0.72	3.84		-2.00	2.76		-5.50	3.20	
italy	12.39	4.31	**	-0.16	2.88		0.09	2.93	
other	8.75	3.24	**	-1.61	2.33		-2.30	2.47	
pre-education (dutch = base category)									
belgium	-11.23	3.69	**	0.67	2.62		3.30	2.72	
german	-8.46	3.89	**	-0.85	2.65		2.35	2.81	
UK	-11.91	3.59	**	-1.43	2.58		4.16	3.28	
italy	-12.27	4.70	**	0.35	3.15		2.85	3.25	
other	-11.05	3.40	**	0.06	2.36		0.22	2.44	
constant	-15.32	9.05		21.12	7.08	**	33.56	11.18	**
N	274			224			146		
Root MSE	9.44			5.26			4.78		
Adj. R-squared	0.63			0.25			0.23		

Notes: * $p < 0.05$; ** $p < 0.01$. Shown are the results (beta coefficients and their standard errors) of an ordinary least regression model on the number of ECTS obtained at the end of the first year. The model is run for all students (ALL), students who met the BSA-requirement (BSA) and for students who met the BSA-requirement and attended the minimum number (= 64) of required meetings at the end of the first year (BSA + MIN).

The beta coefficient of our main independent variable of interest, the total number of attended meetings at the end of the first year, is positive and statistically significant for all three groups of students. Yet, the size of the beta coefficient, and hence the impact of attendance, is declining. This is clearly shown when we look at the substantive effects. For each of the three groups we calculated the difference in earned ECTS for a student who attended the minimum number of tutorials (N = 64) to a student who has attended all tutorials on offer (N = 83). The difference is 20 ECTS for all students, 10 ECTS for students who met the BSA-requirement, and 8 ECTS for students who met the BSA-requirement *and* who also attended the minimum number of tutorials.

Findings III: The effect of attendance on GPA

Attendance clearly matters for earning ECTS and students who attend more tutorials tend to obtain more ECTS. But do these students also receive higher grades? In Table 4 we present the results of ordinary least square regression models to explore the effect of attendance on the Grade Point Average (GPA). We present five models, one for each period (see table A1 in the appendix). A period specific analysis also allows us to include the additional control variable GPA obtained for the courses in the previous period. The total number of students declines across the models because students who did not participate in an exam are excluded. We include the grade obtained at the end of the first year; this may be the first attempt result or the result following re-examination.[5]

Also for GPA we find a positive and statistically significant effect of attendance but the impact varies across periods. The impact is high(er) in periods 1 and 4 but low(er) for periods 2, 3 and 5. The substantive effects clearly reveal the differential impact of attendance across the periods. For each period we calculate the impact of attendance by comparing a student who participated in the minimum number of tutorials in a period to a student who attended all tutorials (see table A2 in the appendix). The effects are very large for period 1 and 5 where we find GPA differences of respectively 1.7 and 2.4. The effect of attendance is lower, yet still important for periods 2, 3 and 5 where we find GPA differences of respectively 1.1, 0.9 and 0.9. In other words, still approximately a 1-point difference on a 1-10 scale.

[5] During each academic year students have two chances to pass a course.

Table 4: Effects of attendance on the grade point average (GPA) for five periods

	Period 1			Period 2			Period 3			Period 4			Period 5		
	β	s.e.	sig.	β	s.e.	sig.	β	s.e.	sig.	β	s.e.	sig.	β	s.e.	sig.
Attendance	0.56	0.11	**	0.23	0.08	**	0.28	0.12	**	0.49	0.09	**	0.31	0.16	*
GPA previous period				0.56	0.07	**	0.39	0.07	**	0.31	0.07	**	0.56	0.10	**
Gender	0.20	0.21		0.00	0.22		-0.20	0.24		0.16	0.27		0.10	0.33	
Age	-0.07	0.07		0.02	0.07		0.02	0.08		-0.08	0.08		0.18	0.11	
Nationality (Dutch = base category)															
Belgium	-0.09	0.68		0.05	0.74		-1.45	0.80		0.43	0.92		-0.03	1.13	
German	1.45	0.60	**	-0.08	0.64		-0.67	0.68		1.03	0.80		0.18	1.01	
UK	1.16	0.65	**	-0.85	0.73		-0.42	0.79		0.18	0.88		0.58	1.23	
Italy	1.48	0.65	*	1.09	0.76		-0.86	0.83		1.01	1.15		0.16	1.26	
Other	0.85	0.56		-0.64	0.61		-0.59	0.64		0.30	0.77		-0.19	0.93	
Pre-education (Dutch = base category)															
Belgium	-0.77	0.67		0.32	0.73		0.58	0.79		-0.31	0.91		0.18	1.10	
German	-0.76	0.67		0.31	0.70		0.98	0.75		-1.09	0.87		0.23	1.08	
UK	-1.69	0.61	**	0.12	0.65		-0.34	0.71		-1.40	0.82	*	-0.71	1.26	
Italy	-1.66	0.69	**	-0.58	0.83		1.11	0.90		-1.58	1.22		0.40	1.33	
Other	-1.79	0.59	**	0.76	0.65		0.25	0.67		-1.09	0.79		0.00	0.93	
Constant	-1.40	2.34		-1.48	2.06		1.50	1.87		-2.72	2.48		-5.26	3.17	*
N	277			243			238			207			145		
Root MSE	0.23			1.62			1.75			1.78			1.83		
Adj. R-squared	1.68			0.29			0.20			0.22			0.21		

Notes: * $p < 0.05$; ** $p < 0.01$ (one-tailed). Shown are the results (beta coefficients and their standard errors) of an ordinary least regression model on the grade point average (GPA) at the end of each period. The models include only those students who met the minimum number of meetings for each course taught until and inclusive the period.

For us the differences between the periods do not come as a surprise because the first courses of the first year are crucial for students to get acquainted with the university and with a new way of studying. In period 4, first year's students follow intensive economic courses which are often considered difficult because of the required mathematical skills. Despite the differences across periods, the effect of attendance is substantive and important and is at least 0.9 points on a 1-10 scale (hence 10%) especially considering that the difference between the minimum and maximum number of attended tutorials is only three (periods 1, 3, and 5) or five (periods 2 and 4). In other words, an investment of six to ten hours in an eight-week course can earn a student an almost 1.0 higher GPA.

Findings IV: Course-specific analyses

Our data also allows us to look at course level, something which can be particularly useful for both course development and curriculum design. To illustrate this, we have already taken a more detailed look at two first-year courses that we coordinate ourselves during the academic year 2015/2016: an introductory course on academic research and writing (*An Introduction to Academic Research and Writing*; *R&W*) and a methods training course in which students learn how to analyse research designs (*Analysing Research Designs*; *ARD)*. The first takes a traditional approach to PBL, based on the 'seven jump' (see above); the second one also relies on active student engagement, but does not rigidly follow these steps. Both courses are aimed at students acquiring basic research skills and both are graded based on a fail-pass-excellent grading scale.

Both courses were substantially revised versions of previously existing courses; *ARD* was even moved from the start of the second year to the end of the first year. These courses are not just followed by first-year students, but also by students who did not pass the course during previous academic years. The latter have been excluded in this analysis. Each course consists of seven tutor meetings (one per week). Students can miss one meeting during *R&W*; they can miss two meetings during *ARD*. Students need to read background literature on academic research and writing, but also have to complete specific assignments and tasks (such as writing a literature review or analysing the research design of published research) which tend to be discussed in class.

The grade distribution is quite similar for the two courses. Out of a total of 254 students enrolled in *R&W*, 47 failed the course (19%), 156 passed (61%), and 51 (20%)

received the grade excellent. Of the 194 students enrolled in *ARD* 33 failed (17%), 129 passed (66%), and 32 (16%) received an excellent grade.[6] Since we are dealing with a fail-pass-excellent grading scale we estimate ordered logit models with the same control variables as for the models presented in Tables 3 and 4 (results are shown in tables A3 and A4 in the appendix).[7] As above (Table 1) we also estimate the effect of missing one or two tutorials for a German women of 20 years who received her pre-education in Germany. Through a bootstrap method with 1,000 replications we derive 95% confidence intervals for the change in probabilities between a student who misses no tutorial to a student who misses one or two tutorials.

For *R&W* our female German student of 20 years has a 9% chance to fail and a 61% to pass and 30% to receive the grade excellent when she misses no tutorial. When she misses one tutorial she has a 23% probability to fail whereas the probability to receive the grade of excellent declines to 13%. These differences in probabilities are statistically significant at the 5% level but we do not find a statistical significant effect of missing one tutorial for the grade pass. For *ARD* we find that with full attendance our German female student of 20 years has an 8% probability to fail, a 64% chance to pass, and a 28% probability to receive the grade excellent. Missing one tutorial has no statistical significant effect[8] but missing two tutorials increases the probability to fail to 17% and the probability to receive the grade excellent declines to 14%.

A course-specific analysis also allows us to assess the effect of missing a particular tutorial or a particular combination of two tutorials. We run a similar ordered logit model but we include seven dummy variables indicating whether a student has attended that particular tutorial (see Tables A5 and A6 in the appendix). We present the changes in probabilities for our German female student of 20 years in Tables 5 and 6. In line with the results presented in Table 4, the impact of attendance is larger for *R&W*, which is taught in the first period, than for *ARD*, which is taught in the fifth period. This result may indicate that study experience lowers the impact of attendance and that attendance is indeed of vital importance for the first semester of the first year but less so for later semesters.

[6] The actual number of enrolled students is substantially higher because students who did not pass the course in previous years are excluded and not all attendance sheets could be retrieved.
[7] The descriptive statistics on age, gender, nationality and country of pre-education are very similar to those for the cohort of 2014/2015 presented above.
[8] These are students who missed only one tutorial and does not include students who missed two tutorials.

Table 5: Effect of attendance in *An Introduction to Academic Research and Writing*

Grade	Missing no tutorial	Missing tutorial in week						
		1	2	3	4	5	6	7
Fail	8%	32%*	32%*	37%*	45%*	4%	10%	11%
Pass	61%	60%	61%	57%	50%	45%	64%	65%
Excellent	32%	7%*	8%*	6%*	4%*	51%	25%	24%

Notes: Shown are the predicted probabilities to receive the grade fail, pass or excellent when a student misses a specific tutor group meeting. The * indicates that the predicted probability is statistically significant ($p < 0.05$, one-tailed, bootstrap with 1,000 replications) from the predicted probability for a student who does not miss any tutorial.

Table 6: Effect of attendance in *Analysing Research Designs*

Week	Grade	2	3	4	5	6	7
1	F	+7%	+13%	+5%	+1%	-1%	+2%
	P	+2%	+0%	+2%	+1%	-1%	+2%
	E	-9%	-13%	-7%	-2%	+2%	-4%
2	F		+31%*	+20%*	+12%	+9%	+15%
	P		-12%*	-4%	+1%	+2%	+0%
	E		-18%*	-16%*	-13%	-11%	-14%*
3	F			+29%*	+20%*	+15%*	+23%*
	P			-11%*	-4%	-1%	-5%
	E			-18%*	-16%*	-15%*	-17%*
4	F				+11%	+8%	+13%*
	P				+1%	+2%	-0%
	E				-12%	-10%	-13%
5	F					+3%	+7%
	P					+1%	+2%
	E					-4%	-9%
6	F						+4%
	P						+2%
	E						-6%

Note: * $p < 0.05$ (one-tailed). Shown are the changes in predicted probability to receive the grade fail (F), pass (P) or excellent (E) when a student misses two specific tutor group meetings. For example, a student has a 7% higher probability to fail when she/he misses the tutorials of week 1 (column) and week 2 (row). A German female student of 20 years who attends all tutorials has a 10% probability to fail, 67% probability to receive a pass and a 23% probability to receive an excellent. When this student misses tutor group meetings in weeks 2 and 3 she has a 10% plus 31% is 41% chance to fail.

Study experience also seems to matter within courses. In both courses, missing the first tutorials lead to a higher probability of failing and a lower chance to receive the grade excellent whereas tutorials taught after mid-term of the course tend not to have a statistical significant impact.

The effects of missing a tutorial can be quite substantial especially considering that we predict probabilities for the type of student of whom we expect the least impact of attendance. Missing one or two tutorials can increase the probability to fail to almost 50%. The magnitude of the effect of attendance various across the tutorials which makes sense for us as coordinators. For example, missing tutorial 4 in *R&W* shows the largest impact. During this tutorial, students discuss what constitutes a good literature review and this discussion is important for their own final course paper, which heavily relies on answering a research question, based on a discussion of secondary literature.

It would be wrong to conclude that when there is no statistical significant effect that attending the tutorial is not important. First, predicted probabilities may vary for particular students and a comprehensive analysis should estimate the effect of attendance for various groups or types of students. Second, the course design may be such that tutorials appear to be redundant but they actually are not obsolete. For example, in the course *ARD* students apply a scheme to analyse research designs in published journal articles. This scheme is explained in the first tutorial but applied during the remainder tutorials and students who miss the first tutorial have ample of time to catch up in the other tutorials.

Discussion and conclusions

Readers may still raise the (valid) question of whether all of this does not generally depend on commitment – see our definition of attendance above – or whether certain rules create certain behaviour (cf. Romer, 1993). The data does allow us to look into this by differentiating within the group of students who did meet the minimum attendance requirements in all courses. As we have shown above, even within this group we see that higher attendance has a substantial impact on the amount of ECTS obtained and the end-of-year GPA. Note that this data is also controlled for severable other factors such as gender, age, nationality, pre-education, and GPA of the previous period. In addition, we estimate the impact of attendance for the type of student of whom we know are the most committed students and we still find substantial and statistical significant effects. Furthermore, we find an effect of attendance at various levels of

aggregation, from the end of the first year, for each period and even for specific tutorials within a course. Therefore, we think it is safe to conclude that attendance matters for study success, also for the committed, participating and well prepared student.

The data presented above does not necessarily help in deciding whether or not to use minimum attendance requirements in the BA ES. One of the main arguments underlying the discussions about attendance rules at FASoS is that it is deemed crucial for effective student performance in a programme based on PBL. As such, the data underline the importance of attendance. On the one hand, one could therefore argue along the lines of Moore et al. (2003) and show students the data rather than to opt for attendance requirements (and the accompanying paperwork and administration). After all, research on attendance and study success tends to look into programmes that did not have minimum requirements, yet attendance still matters. However, this would require the faculty to update data on a yearly basis. On the other hand, there still is the importance of integrating first-year students into academia which may be reason enough to apply minimum attendance requirements for first-year courses.[9] In the words of Bevitt, Baldwin and Calvert (2010, p. 12):

> A strong steer at the start of a university career may help to counter stereotypical assumptions about attendance and help to encourage good study and attendance habits from the start. A progressively lighter touch may then be used in subsequent years of study as the students' autonomy increases.

Our results indicate that attendance matters more for the first than for the last period in the first year and that missing tutorials before mid-term of a course leads to a higher probability to fail than for missing tutorials after mid-term of a course. This evidence suggest that study experience lowers the impact of attendance and thereby these results can serve as an argument to have a minimum attendance policy especially in the first year.

Last, but not least, as was discussed earlier, there are other factors that influence study success, ranging from learning environment to personal factors. Even when we cannot completely rule out the influence of other factors, the findings presented here do suggest a noticeable effect of attendance on study success. Therefore, we concur with other studies on this issue, which have stressed that it certainly worth emphasising the importance of attendance. As Gump (2005, p. 25) explains "attendance should be one of the easiest variable

[9] For suggestions for minimum attendance thresholds or tipping points for intervention, see: Bevitt, Baldwin & Calvert, 2010; Jansen & Suhre, 2010.

for students to control. Students who wish to succeed academically should attend class, and instructors should likewise encourage class attendance."

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Appendix

Table A1: Course descriptives

Course	Content	Period	Grade	ECTS	Meetings	
					total	required
EUS1000	Substance	1	1-10	5	7	6
EUS1001	Skills	1	1-10	5	6	5
EUS1002	Substance	2	1-10	9	12	9
EUS1003	Substance	3-4	1-10	5	6	5
EUS1005	Substance	4	1-10	6	7	5
EUS1006	Substance	5	1-10	9	13	11
EUS1007	Substance	3	1-10	4.5	7	5
EUS1008	Substance	4	1-10	6	7	5
EUS1500	Skills	1	1-10	1.5	4	3
EUS1501	Skills	2	1-10	2	7	5
EUS1504	Skills	5	F/P/E	4.5	4	3
EUS1505	Skills	3	F/P/E	2	3	2
EUS1507	Skills	1	P	0.5	0	0
EUS1508	Skills	1-5	-	0	0	0
			Total	60	83	64

Notes: all courses are included for calculating ECTS and attendance but EUS1504, EUS1505, EUS1507 and EUS1508 are not included when calculating GPA.

Table A2: Program descriptives

	ECTS	Meetings	
		total	required

Period 1	12	17	14
Period 2	11	19	14
Period 3	6.5	10	7
Period 4	17	20	15
Period 5	13.5	17	14
Cum. period 2	23	36	28
Cum. period 3	29.5	46	35
Cum. period 4	46.5	66	50
Cum. period 5	60	83	64