TEACHING AND TRAINING

inverting the large lecture class: active learning in an introductory international relations course

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Abstract
The inverted classroom model (ICM) is an active learning approach that reserves class meetings for hands-on exercises while shifting content learning to the preparatory stage. The ICM offers possibilities for pursuing higher-order learning objectives even in large classes. However, there are contradicting reports about students' reactions to this kind of teaching innovation. With the ICM making inroads in political science teaching, this paper discusses how students evaluate this method. We report results from an application of the ICM to an introductory international relations course. In our course, students' reactions to the ICM varied greatly. Using a regression analysis of student evaluation scores, we find that students' preference for collaborative learning best predicted their preference for the ICM over the traditional lecture format.

Keywords inverted classroom; flipped classroom; lecture; active learning; blended learning

The scholarship of teaching and learning (SoTL) and the changing context of higher education have sparked discussions about the efficacy of the traditional lecture format.[1] A frequent critique of this format holds that while lectures have some value for lower-order cognitive learning objectives, they are

unsuitable for more complex aims. Much of this effect is attributed to the 'passive learning' nature of the lecture: Students sit quietly while the instructor talks and presentation slides go by. This passive form of learning is verifiably less useful for a deep, sustainable and long-term development of knowledge (Bligh, 1998: 40; Cooper and Robinson, 2000: 8–9) and higher-order cognitive skills (Niggemann, 1977). Higher-order analytical skills such as application, analysis, evaluation and creation are better acquired through active learning. As Bligh puts it, 'if students are to learn to think, they must be placed in situations where they have to do so' (Bligh, 1998: 10).

However, shifting from lecturing to active learning creates two obstacles for the teacher: The first is how to make active learning possible in a large lecture class, a frequent setting in contemporary higher education. Many techniques of active learning are geared towards smaller, seminar-style classes and are not easily scaled up. An unstructured discussion that is suitable for 15 to 20 students works very differently for 150 students in a large auditorium (Pollock *et al*, 2011). Fixed seating in lecture halls further limits possibilities for student interaction and group work.

The second obstacle is student resistance to active learning. Anecdotal evidence suggests that teachers implementing active learning techniques for the first time face some pushback from students unfamiliar with such an approach (e.g. Felder, 2011; Talbert, 2011). At the same time, several studies suggest that most students evaluate active learning positively when asked about their experiences afterwards, with a majority of students actually preferring them to the traditional lecture format (e.g. Lage *et al*, 2000; Smith, 2013; Wilson, 2013). Students' attitudes are a crucial determinant for the successful implementation of active learning and also have an impact on learning outcomes (Ambrose *et al*, 2010; Jenkins, 2015: 608).

The aims of this article are twofold: First, we present the Inverted Classroom Model (ICM, also known as Flipped Classroom, see Margulieux *et al*, 2014) as an approach that facilitates active learning in large classes. Compared to the traditional lecture model, the ICM 'inverts' the classroom by swapping the phases of knowledge acquisition and application. In inverted teaching, the students first study a topic by themselves, typically using online resources provided by the instructor. In class, students then apply their knowledge by solving problems, discussing the material and doing practical work, either alone, in pairs or in larger groups. There have only been a few documented reports of ICM implementation in political science (Goerres *et al*, 2015; Jenkins, 2015; Touchton, 2015) and we wish to add further data to this emerging body of literature.

Second, we present results from a survey of students in an undergraduate-level introduction to International Relations (IR) course that the first author taught in the winter semester 2014/15 using the ICM. In our survey, students presented starkly different opinions about whether they prefer the ICM over the traditional lecture format. While 45 per cent of respondents would like to see future classes taught using this model, 40 per cent disagree. Why do students react so differently to this approach?

In this paper, we first present the ICM in some detail, situating the method within a discussion of active learning approaches and students' responses to pedagogical innovations. We then present the environment and framework of our ICM application in an introductory IR course. Afterwards, we discuss possible explanations for the ambivalence in students' attitudes towards the ICM. Finally, the paper summarises our findings and formulates theses and questions about the

application of ICM in political science teaching and the relevance of students' learning styles.

ACTIVE LEARNING AND THE INVERTED CLASSROOM MODEL IN POLITICAL SCIENCE

Active learning techniques are well established in political science teaching and a substantial body of literature has developed around the topic (e.g. Lantis *et al*, 2000; Powner and Allendoerfer, 2008). Most contributions focus on specific methods, for example, case-based (Golich, 2000) or problem-based learning (Burch, 2000), but the majority discusses the use of simulations (e.g. Andonova and Mendoza-Castro, 2008; Starkey and Blake, 2001).

Despite this breadth of knowledge, few articles discuss active learning in large classes. Furthermore, the literature tends to focus on students' learning outcomes rather than students' responses to active learning. Two exceptions are Omelicheva and Avdeyeva (2008) and Huerta (2007) who describe the challenging task of implementing active learning strategies in large lecture environments. Omelicheva and Avdeyeva present debates as one method of active learning to generate a more engaging learning environment. Huerta presents several techniques – e.g. question-based lecture outlines, small group discussions – and evaluates their impact on learning outcomes. These are important contributions but a comprehensive strategy for implementing active learning in a large lecture setting is still missing in political science teaching.

THE INVERTED CLASSROOM AS AN ACTIVE LEARNING STRATEGY

The inverted classroom is a teaching method that was developed over the last 15 years, building on insights from scholarship on active learning. It was motivated by the weaknesses of conventional lectures and first described by Lage, Platt and Treglia (2000). It shares several features with *Peer Instruction* which was developed in physics education by Crouch and Mazur in the 1990s (Mazur, 1997; Crouch and Mazur, 2001). The core innovation of the ICM is that the passive absorption of

Traditional Lecture		**Inverted Lecture**	
Phase	**Activity**	**Phase**	**Activity**
1. In-class time/attendance phase 	Knowledge delivery and comprehension	1. Individual Phase 	Knowledge delivery and comprehension
2. Individual phase 	Consolidation and deepening of knowledge (application, discussion, etc.)	2. In-class time/attendance phase 	Consolidation and deepening of knowledge (application, discussion, etc.)

Figure 1 Traditional and inverted lecture format in comparison.
Source: Own compilation.

Table 1: Assigning learning objectives to the phases of the learning unit

	Preparatory phase	Attendance phase	Follow-up phase
Knowledge/remember	X	(X)	
Comprehension/ understand	X	(X)	
Application/apply	(X)	X	(X)
Analysis/analyse	(X)	X	X
Synthesis/evaluate	(X)	X	X
Evaluation/create		X	X

Source: The learning objectives categories are based on Anderson and Krathwohl (2001: 67–68).

content is moved from the lesson to the preparatory phase (see Figure 1). In terms of Bloom's revised taxonomy (Anderson and Krathwohl, 2001: 67–68), students pursue lower-level cognitive learning objectives (accumulating and comprehending knowledge and information) on their own. This frees up class time to pursue higher-order learning objectives through active learning techniques.

An inverted class consists of a series of learning units. A unit is comprised of a preparatory phase, an attendance phase and (potentially) a follow-up phase. These phases are suitable for different learning objectives which become more challenging as students progress through a unit. For our course, we assigned learning objectives to the three phases as depicted in Table 1.

In the preparatory phase, students start with the guided reception of videos, texts and other sources prepared by the teacher and offered through a course management software. Engagement with this material is interspersed with quizzes and other exercises to help students check their level of understanding. At the end of this phase, students can indicate their 'muddiest point', i.e. which aspect of the material they found it most difficult.

In class, students focus on higher-order cognitive learning objectives, i.e. analytical skills such as application, analysis, evaluation and creation, with the help of the teacher and their peers. The phase is divided into two sections. The first part briefly addresses questions from the preparatory phase (*Just-In-Time Teaching*, see Mazur and Watkins, 2010). The second part uses active learning techniques like *Think-Pair-Share* (Lyman, 1981), group work, debates, simulations or role-playing exercises to apply and consolidate the knowledge gained in the preparatory phase by working on concrete examples and problems.

In the follow-up phase, students get more practice questions and tasks focusing on the development of competences to synthesise, develop an independent opinion and formulate critical statements. Questions are similar to those students will later encounter in the exam. The follow-up phase is usually undertaken individually, but collaborative exercises are also possible, either in person or electronically.

A multitude of studies has demonstrated the efficacy of ICM and peer instruction in comparison with traditional lecturing (e.g. Carlisle, 2010; Crouch and Mazur, 2001; Smith *et al*, 2009), although Jensen *et al* (2015) question whether the learning gains from ICM differ measurably from other active learning techniques. Knowledge delivery during the preparatory phase becomes a much more individualised process and is better able to accommodate different

learning styles, as students can set their own pace and use the materials provided in ways that work best for them. In class, students have to apply and transfer abstract knowledge, benefitting from the interaction with their peers and the instructor who assists the students in an advisory capacity. So, ICM solves the 'attention problem' of conventional lectures because students are no longer passive listeners but active participants. Furthermore, knowledge gained through application lasts longer and is qualitatively deeper than knowledge acquired by listening to a lecture. Studies have even found improved learning effects in large classes with more than 100 participants (Bates and Galloway, 2012; Moravec *et al*, 2010).

If ICM is carefully implemented, it offers several advantages over the conventional lecture format. First, students have more autonomy in their learning processes because they get to decide about their pace for the delivery of knowledge. Second, students gain deeper knowledge when they work on challenging tasks in collaboration with their peers and teachers, getting immediate feedback on their level of mastery. Third, by freeing up class time instructors can be more creative in their course design which also tends to increase teacher satisfaction. Fourth, by observing their students working on problems, instructors can provide assistance where it is most needed.

THE INVERTED CLASSROOM IN POLITICAL SCIENCE TEACHING

ICM is being utilised in different disciplines, particularly in STEM fields like biology, mathematics, computer science and physics, as well as in economics (for an overview, see Rammel *et al*, 2015). While these disciplines' educational traditions and epistemologies differ from political science, there is no intrinsic reason why the ICM cannot be applied in our field.

In fact, we believe that it offers great educational potential by challenging the prevalent lecture-based model. To become political scientists, students require not just factual knowledge but also the competence to develop, analyse and discuss arguments. Learning outcomes of political science degree programs are usually oriented towards higher-order cognitive competences such as analysis, synthesis, comparison and critique. Given the limitations of the lecture as a pedagogical format, we believe that the ICM is an alternative option that is better suited to the pursuit of these learning outcomes.

Despite the innovative potential of the ICM, there are only a few documented and published applications of ICM in the social sciences (outside of economics) and the humanities. Examples from political science include several statistics courses (Goerres *et al*, 2015; Touchton, 2015), a partially inverted introductory American politics class with 140 students (Jenkins, 2015) and an upper-level political science course (Roscoe, 2012). Touchton reports that students indicated a preference for the ICM over a traditional lecture format at the end of the course. He also notes that the students' performance verifiably and significantly improved in terms of higher-order competences (Touchton, 2015: 38 f.). Goerres *et al* (2015) present similar results, stating that students achieved better results on application-oriented questions of the exam. Jenkins (2015) reports that her students indicated a preference for the partially flipped format over a traditional lecture. Roscoe (2012) found no significant difference in learning outcomes between students who regularly attended the attendance phase and those who watched lectures online in a blended version. These examples support results

from other ICM evaluations (Cieliebak, 2014: 6 f.) and emphasise the possible advantages of the format in political science teaching. There may be more instances of ICM use in political science and related disciplines, but if they are, instructors are not writing about them. As a result, ICM is much less visible in political science than it is in science education.

STUDENT ATTITUDES TO THE INVERTED CLASSROOM

Much of the existing literature consists of studies covering the deployment of ICM in single courses. Evaluations typically focus on the effectiveness of ICM (and related techniques), comparing test scores with those of similar, non-inverted classes. Similar to higher education research in political science in general (Blair, 2015: 179–181), there are very few studies of students' attitudes and perceptions towards the ICM as a whole or aspects of the ICM.

Some studies include general measures of student engagement and reactions, and arrive at similar findings (Bates and Galloway, 2012; Lage *et al*, 2000; Moravec *et al*, 2010). First, students tend to prefer ICM to traditional lectures after they have completed an inverted course. Second, students tend to be more engaged in ICM courses than in traditional lecture classes, i.e. they devote more time to them, attend classes more frequently and complete a larger number of exercises. These findings are consistent with other research on educational techniques such as active learning or the use of videos (Simkins, 1999).

A few studies, such as Smith (2013), Touchton (2015) and Wilson (2013), take a more detailed look at the underlying reasons for particular student attitudes towards active learning. They find that while their courses tended to get better evaluations than other classes, student responses to the introduction of an active learning pedagogy were not universally positive. For instance, Welsh (2012) finds that 'fourth- and fifth-year students were more likely to view in-class active learning techniques as a waste of lecture time, whereas third-year students and females perceived these techniques as instrumental to improving their understanding and their interactions with professors and peers' (Welsh, 2012: 80). Based on the comments from her students, Welsh surmises that students take an 'it depends' approach to active learning – they understand the theoretical appeal, but their judgment depends on what the teacher is trying to achieve and how active learning is implemented. Active learning 'for the sake of it' is seen as a waste of time and resources (Welsh, 2012). Yet these questions are not explored further, noting that more research is necessary to explain the different reactions towards the format (Touchton, 2015: 40; Wilson, 2013: 198).

Researching student attitudes to the ICM and other active learning techniques is a challenging task for several reasons. Experimental controls are often prohibitively difficult to arrange. Applications vary widely in their scope and context. Many variables cannot be held constant, e.g. the teaching experience of the instructor, the institutional setting, disciplinary and national cultures of assessment, the size and composition of the student body as well as students' prior skills and previous experiences with active learning. Thus, 'evaluating teaching results is an extremely challenging task, and each possible endpoint for evaluations can be easily (and also unintentionally) distorted' (Möller, 2013: 32). That notwithstanding, gaining a better understanding of student perceptions of the inverted classroom remains critical for evaluating the utility of the strategy in political science (Jenkins, 2015: 607).

IMPLEMENTATION OF THE ICM IN AN INTRODUCTORY IR COURSE

The Bachelor of Arts political science programme at the University of Duisburg-Essen is – like other European higher education settings – characterised by high undergraduate enrolment rates. It needs to utilise its teaching capacity as efficiently as possible and the traditional lecture model is widely used. Out of the 'core' courses (i.e. not counting electives) that aspiring political scientists have to complete, more than 50 per cent are lectures, usually taught in the conventional way.

One of the core modules that students have to complete is 'Policy-Making and Conflict Transformation in a Globalised World'. It consists of a lecture 'Introduction to International Relations and Global Governance' and a seminar 'Introduction to Peace and Conflict Research'. The lecture is a fairly standard IR survey course, covering prominent theories of international relations, concepts of global and transnational governance, and focusing on major issues of IR like war and globalisation, illustrated through contemporary political problems. The seminar looks at different aspects of peace and conflict from an international or transnational perspective. Every year, some 150–200 students, most of them in their third or fifth semester, attend the lecture and one of the six to eight seminars on offer. The lecture has four ECTS credit points (=120 hour total workload) and the seminars have five credit points each (=150 hour total workload). Students complete the module by passing a competence-oriented, group-based oral exam that covers both courses (Kärger and Lambach, 2015).

In our inverted lecture for each learning unit, the class continued to meet for the usual 2 hours per week. This was augmented by a 2 hour preparatory phase and a 1 hour follow-up phase. In planning the course, we used *Constructive Alignment* (Biggs, 2014), a method for student-centred, competence-, and outcome-oriented lesson planning that aligns learning objectives, examination formats and teaching/learning methods.

Based on the most influential taxonomies of learning objectives (Anderson and Krathwohl, 2001), we formulated competence-oriented learning objectives that we wanted our students to achieve. These objectives also guided our decisions which teaching/learning methods to use, based on the *Universal Design for Learning (UDL)* (Meyer, 2014) which follows the premise that students should be provided with multiple means of (1) presentation, (2) action and expression and (3) engagement.

Putting the UDL into practice had several implications. First, we prepared different learning materials for the preparatory and attendance phases. In each preparatory phase, students were supposed to acquire basic knowledge about a topic using learning videos hosted on an online learning management system. The videos were complemented by one or two sets of questions and assignments covering the material presented in the video lecture. To meet the needs of different learning types in all phases, we provided further material like academic articles, newspaper articles, charts and figures which were also linked to specific learning activities.

Second, during the preparatory phase, students were assigned different tasks to provide them with options for expression and communication. These ranged from single choice/multiple choice questions via tasks that required matching, drag and drop, analysis and application, to brief essays where students were asked to synthesise and evaluate information. During class, students could express themselves and communicate in different

ways – for example, through participating in plenary discussions or by taking up different roles in group work. We also used a web-based classroom response system for some tasks to involve all students in a large-group setting.

Third, we employed different activities to engage students during class. After the warm-up phase, we frequently used collaborative learning strategies like *Think-Pair-Share* (*TPS*), *Peer Instruction* and different kinds of group work to engage students in conversation, to practice their social skills as well as their analytical, evaluative, synthesising and creative competences. For example, in one session, students had to formulate hypotheses explaining the Democratic Peace (DP), even though they had never been exposed to DP theory. Drawing on knowledge from the preparatory phase (on liberal IR theories) and other courses, students first had to come up with hypotheses on their own. They then had to discuss their ideas in small groups. Each group then nominated their best hypothesis. These were collected by the instructor and collated on a PowerPoint slide. Even without previous instruction about DP, the results were quite close to the various explanations that can be found in the academic literature on DP.

Fourth, students received feedback on every activity (Hattie, 2009; Möller, 2013: 23). Each self-guided preparatory phase was linked to repeatable, non-graded tests where students answered questions and completed tasks to demonstrate their knowledge and skills. Most tests were implemented as single/multiple choice questions in our learning management system, Moodle, which provided automatic feedback. Some tasks included short-answer questions which had to be assessed by the instructor. At the end of each preparatory phase, students were requested to self-assess if they had achieved the learning objectives. During class, the instructor commented on the student's results of the preparatory phase and also provided feedback on in-class activities.

DATA

First, we analysed the official exam results for this module between 2013/14 (non-inverted) and 2014/15 (inverted) with the help of a proxy as data access is restricted. Second, we administered two surveys to get information about students' attitudes towards the ICM. The pre-class survey in the very first session was completed by 87 participants; the post-class survey in the last session had 42 respondents (out of whom 33 had taken part in the first survey).[2] Most of the students were undergraduate political science students (>80 per cent) and attended the course in their second (39 per cent) or third year (43 per cent). In both surveys, more than 65 per cent of the participants were male. The surveys were paper-based questionnaires containing single/multiple choice questions and open questions. Because the surveys were conducted in-class, participation was self-selected.

Compared to the number of students who took the exams (157 students), the number of respondents was relatively low, limiting the scope of our results. It is safe to assume that the students taking part in the lecture are more active than the overall group of students taking the exam. But inherently, the survey is about people being physically present in class, so that we are not so worried about the degree of representativeness of the student population attending class. However, we know little about those who have selected themselves out of attendance. In the very first lecture, 87 students had been present, a number dwindling down to around 30–45 in later sessions. At the same time, the number of students taking the exam was similar

to previous years, so ICM did not 'scare' any visible proportion of students out of taking the exam.

EMPIRICAL RESULTS

EXAM RESULTS

We compared the exam results of the 'ICM cohort' in 2014/15 (160 students) with the results from the previous year where the course had been taught by the same professor as a conventional lecture (230 students). We employ OLS regression with robust standard errors and check results with bootstrapped standard errors.[3] In sum, there is no evidence of an overall association between exam results and the course format.

In more detail, the mean marks for the ICM cohort are slightly worse (2.22) than the previous year's (2.10), on a scale of 1 (very good) to 5 (inadequate), but the difference is not statistically significant.[4] Turning to a multiple regression, we use the following control variables: gender, age at final exam in this module, the number of days that the student had been enrolled in the program before taking the last exam in this module, German citizenship (yes/no), mean mark obtained in the first study year and a dummy variable indicating whether a student was in the ICM cohort or not. We can thus estimate whether, after controlling for a variety of factors, being a member of the ICM cohort has an effect. The effect remains numerically positive .08 as to the point estimate, but again, the effect is not statistically different from zero ($p = .31$), suggesting that there is no evidence for a direct effect on the mark.

Looking at two-way interactions between the ICM dummy and all control variables, we find only one clear pattern. Taking the exam in the ICM year was 0.62 mark units worse for those with non-German citizenship compared to those who took it in the year before. For those with German citizenship, the participation in the ICM year brought zero difference compared to the year before. This may be hypothesised to be due to language or milieu issues among those with non-German citizenship and can be explored in further research.

Overall, the results are sobering since we cannot replicate findings that show a higher learning effect in an ICM class. This has been similar to some ICM applications (e.g. Love *et al*, 2013; Roscoe, 2012) which found that students in inverted courses performed better in the exercises of the preparatory and attendance phases, although final exam results were not different than that of students in the traditional format. However, we should not overstate the validity of our results – the module mark is determined through a comprehensive oral exam covering both the lecture and the seminar that the students attend. Differences in the exam results could be down to differences between seminars, to markers using different standards in the oral exam or to the fact that the group of markers changed slightly from one year to the next.

STUDENT EVALUATION OF THE ICM

Our students were well acquainted with the traditional lecture format. More than 75 per cent had completed eight or more courses taught as lectures in the previous semesters and were reasonably content with the traditional lecture as a pedagogical format. To our knowledge, none of these lectures had been taught as an inverted class[5] even though some of the lectures used interactive elements such as classroom response systems.

Interestingly, students did not change their attitudes towards the traditional lectures after being exposed to the ICM

for one semester. On the German marking scale from very good (1) to inadequate (5), the other lectures series were rated 2.7 before the semester with the distribution  and 2.6 after the semester with the distribution  . No student, before or after, rated the conventional lectures with the highest or lowest mark.

In contrast, our class was rated somewhat higher in the post-class survey, with a mean score of 2.2 with the distribution  , with 15 per cent of students rating this course with the highest mark and none with the lowest two. In other words, the average rating of our ICM course was better than the average rating of the conventional lectures. This result may reflect a genuine satisfaction with the course, or it could be driven by students who did not like the format having de-selected themselves from attending the lectures (and thus not participating in the survey). Recall that less than 50 % of those who took the exams had been attending the lecture and even fewer ended up in our sample. In case of the former, the higher rating could also be a function of the extra care and resources invested in this course.

The relatively high level of satisfaction is also mirrored by a majority of students attributing a high (45 per cent) or very high (15 per cent) learning effect to the ICM format on a 5-step scale with another 33 per cent in a medium category and only 8 per cent attributing a low effect (). However, this effect is tempered somewhat when directly compared to lecture-based approach: When students were asked if they believe to have learned more about IR in the ICM format than in a traditional lecture 42 per cent agreed or fully agreed, 16 per cent neither agreed nor disagreed and 42 per cent disagreed or fully disagreed (table not reported). When asked whether they prefer ICM to traditional lectures, the answers were similarly distributed with some students (fully) agreeing (45 per cent) and others (strongly) disagreeing (40 per cent).

EXPLAINING THE PREFERENCE FOR ICM OR TRADITIONAL LECTURES

Clearly, students are split over their preference for the inverted classroom model. This split is so pronounced that survey responses produce a flat distribution of results. But why do students react so differently to the ICM?

One possible explanation is that the students' extensive experience with the traditional lecture format has socialised them into a learning culture that is characterised by memorisation and that is highly focused on succeeding in written exams. Students seek to acquire factual knowledge and may be unaccustomed to the high priority we had given to higher-level competences and active learning. However, we find no evidence of this socialisation argument. Of those students who had completed 8 or more lecture series before this class, 47 per cent prefer the ICM format compared to 53 per cent who take an indifferent or pro-conventional format view. Among those with less experience, the supporters of the ICM format are less frequent (40 per cent).

Another possible explanation is that students found our class to be much more time and work-intensive than a traditional lecture and thus developed a preference for the seemingly less demanding conventional lecture.[6] This seems to be supported by the results that students who did not prefer the ICM format were more likely to agree with the statement that the ICM approach was more work-intensive than a traditional lecture (mean rating of 4.5 on a 5-point scale, compared to 4.3 among students who preferred ICM). But in terms of *actual* rather than *perceived* workload (measured in self-assessed

hours that respondents spent in preparation for class), the opposite is true. Students who preferred the ICM format spent an average of 4 h preparing, compared to 3.5 for those who did not prefer it. While this may also be attributed to reverse causality (students who like the format invest more time in preparation), we are not convinced that workload has a decisive influence in students' preferences.

Instead, our findings indicate that students' learning styles influence their reactions to active learning techniques. Based on the categorisations from and Reichmann and Grasha (1974), we drew questions from the Grasha–Reichmann learning styles questionnaire which categorises students as 'dependent', 'collaborative' or 'independent' learners. Dependent learners require more direction from the teacher, collaborative learners learn best as part of a team and independent learners achieve the highest gains on their own. We do not see these categories as exclusive but believe that each student represents a hybrid of these styles. Therefore, our survey did not seek to classify students as dependent, collaborative or independent but asked them to express their degree of agreement with the following six statements, representing dimensions of the three different styles (Grasha, 1984: 49):

1. I prefer to learn by myself.
2. I need assistance from the teacher to learn.
3. I like to compare my performance with others.
4. I learn best when collaborating with others.
5. Participation in class as well as the teaching of content in it is very important for me.
6. When in class, I prefer to learn through activities and discussion with my peers.

Despite the relatively small N, there are two intriguing indications of a relationship between the students' (non-)preference of a learning style and the preference of the ICM (see Table 2).[7] First, more than one third (16 students of $N = 38$) of the students prefer to learn through activities and discussions with peers when in class. 63 per cent of these students prefer the ICM to the classic lecture format, 31 per cent do not prefer the ICM. Second, students who like to compare their

Table 2: Learning Style and Preference for ICM (Row Percentages)

		For future lectures I would prefer the Inverted Classroom rather than a traditional format…			
		(strong) Disagreement (%)	Neutral (%)	(strong) Agreement (%)	
I like to compare my performance with others	(strong) Disagreement	29	18	53	100
	Neutral	50	8	42	100
	(strong) Agreement	56	11	33	100
When in class, I prefer to learn through activities and discussion with my peers	(strong) Disagreement	70	10	20	100
	Neutral	25	33	42	100
	(strong) Agreement	31	6	63	100

performance with others are less likely to express a preference for the ICM. More than one third of the students (17 students of $N = 38$) do not prefer to compare their performance with others, but a majority of these students (53 per cent) prefers the ICM over a traditional lecture. In contrast, 56 per cent of the students who prefer to compare their performance competitively do not prefer the ICM to the classic lecture format. Taken together, these results indicate that the ICM creates a learning space that is more favourably received by students who prefer collaborative learning, and that is less attractive to more competitive students.

To analyse the determinants of ICM preference (as a dichotomous variable), we employed a multiple regression analysis. The independent variables were whether students have attended eight or more lecture-based classes (yes/no), average hours spent in preparation for each ICM class, students' attitude towards a competitive learning environment (from 1, strong preference against, to 5, strong preference for), and their attitude towards peer collaboration (from 1, strong preference against, to 5, strong preference for). The regression analysis[8] yields that the preference for a collaborative peer environment is the strongest predictor for preferring ICM over the traditional format (standardised beta $= + .37$, $p = .02$ of a two-tailed test). This supports our initial impression that the ICM is viewed more favourably by collaborative learners due to its emphasis on interaction and peer learning. The second strongest predictor is the average hours of preparation, with every additional hour increasing the estimated preference of ICM over a conventional format by 9 percentage points (standardised beta $=+.28$, $p = .10$). Third is the attitude towards a competitive learning environment (standardised beta $= -.24$, $p = .12$), meaning that students who prefer a competitive environment are more likely not to prefer ICM over the traditional format. The fourth predictor, experience with lectures, was not significant (beta $= -.16$, $p = .32$).

These preliminary results show the potential explanatory power of 'softer' factors like attitudes and perceptions for student reactions to active learning, especially the ICM. Furthermore, the analysis has highlighted the need for further research to better understand different perceptions of and attitudes towards the ICM.

CONCLUSION

Our results indicate that students react to teaching innovations in different ways which are influenced by students' learning styles. Further research in this direction seems warranted in future iterations of the course and in other settings. Another line of inquiry is how students adapt their learning strategies to an inverted classroom and how this impacts their learning and exam scores. Clearly, a longer-term perspective that compares different cohorts of students can provide depth to this investigation and put our findings on a sounder empirical footing.

Based on our experience, we believe that ICM can be an effective tool in political science teaching. However, it should not be reproduced rigidly but needs to be adapted carefully to its audience and the course's learning objectives (Sams, 2012). When deciding on whether to use ICM, the essential factors to consider are its compatibility with the course content, forms of assessment and learning objectives, and the skills and teaching philosophy of the instructor.

The workload for the instructor exceeds that of a traditional lecture. We were able to invert an entire class through the generous support of the *Stifterverband für die deutsche Wissenschaft* which

funded a teaching assistant position for the duration of the course. *Just-in-Time Teaching* requires a few hours of feedback to student work, although this can possibly be delegated to tutors or teaching assistants. An inverted classroom also needs some infrastructure, e.g. a learning management system, classroom response systems, suitable classrooms, etc. To mitigate the workload, the ICM can also be applied selectively, i.e. as individual units within an otherwise traditional course, without compromising its efficacy. Using pre-existing materials, such as video recordings of lectures, is also a great time-saver. It is easier to invert an existing course than to design an ICM class from scratch.

So was it worth it? Students responded positively to the ICM but were ambivalent whether they would like to see it implemented in further courses. Their subjective assessment was that they learned a lot but were unsure whether this method was more effective than a traditional lecture. Given the limitations of our survey, specifically the issue of self-selection, we would like to stress the need for further research to substantiate these results. Exam results were basically unchanged.

Nonetheless, we believe that the ICM has made a difference – it enabled us to focus on higher-order competences that are impossible to train in a traditional lecture setting. The students frequently came up with creative and high-quality answers to difficult tasks and did well on the exams, although this is not reflected in their marks (for various reasons set out above). We will continue to use the ICM in this course. Feedback from the first iteration has already allowed us to make changes that will, hopefully, lead to improved student responses over time. We wish to note that instructors should reflect on their role within the classroom when using ICM. In contrast to traditional approaches, ICM is learner-centred. The instructor needs to flexibly support students in their individual learning processes while maintaining control over the content and the learning objectives. While this can be a challenge, it makes for a much more engaging teaching experience than a lecture. Instead of being at the centre, trying to keep everyone's attention for a 90-minute show, the instructor becomes a facilitator who sets the stage, decides on the program and provides brief input and feedback to stimulate learning among students. It is a joy seeing students engaged and active in class, and observing their way of approaching a problem. Therefore, we think that inverting the classroom is not just good for students, but also for their instructors.

Finally, we also argue that ICM can be good for the discipline. There is no reason to doubt that ICM can be just as effective for teaching political science as it is in other disciplines. In fact, the ICM and the active learning pedagogy on which it is based are particularly appropriate for political science. If we want our students to learn how to construct arguments, to engage in discussion and critique, and to apply their knowledge to a diverse set of empirical phenomena, then this requires higher-order cognitive skills which are best developed through active learning. Therefore, class time that is freed by shifting from lecturing to the ICM should be used for discussion, arguing, role-playing and problem-based learning rather than knowledge acquisition or problem-solving.

Of course, inverting large lecture classes offers particular challenges because not all activities can be easily scaled up to an auditorium of 100+ students. In these cases, various forms of group work, classroom response systems and 'back channel' options (chat, etherpads, wikis and Twitter) can all be employed. Where tutors are available, they can answer students' questions or

supervise discussions. Giving appropriate feedback is a crucial element in any learning activity. Most importantly, teachers can – and should – be creative about how they use the inverted classroom.

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Notes

1 A 'traditional lecture' is defined by the continuous exposition of material by the teacher, with students passively listening and taking notes. Consolidation and application of knowledge take place in the individual follow-up phase which is possibly augmented by homework.

2 Students were informed that completion of the survey was confidential, that participation was not a course requirement, that the collected data would be used to improve the lecture for students in the future and that data might be used for publication purposes.

3 Regression models for other dependent variables, such as whether the student passed or not, whether he or she took the exam in study year two as requested (but not enforced) and the time it took to take the exam since enrolment are available on request.

4 We use the mean mark across all exam attempts for this module, meaning that we look at student data and not multiple exam results from the same students. Someone is a member of the ICM cohort if he or she took the last exam attempt in the academic year 2014/15.

5 The first-year lecture by the third-named author replaced one session with the IC format, meaning that the students in these surveys here could have had one personal experience with that kind of format for one session (see Goerres *et al.*, 2015).

6 The actual amount of work needed to get the same mark is, of course, not necessarily bigger in the ICM format. It just means bringing out-of-class work into the semester, making it difficult for students to wait until exam time before engaging with the material.

7 For the other questions, there seems to be no clear indication that the students' (non-)preference for a specific way of learning leads to the (non-)preference of the ICM. First, the majority of the students ($N = 38$) prefers to learn independently (questions 1 and 2). These students' opinions are widely distributed with almost equal proportions of students preferring or not preferring the ICM compared with the traditional lecture format (not reported). Second, those students who learn best through collaboration have a similar range of (dis)agreement (question 4). There are similar proportions of students (not) favouring to learn when collaborating with others who prefer or not prefer the ICM over the classic lecture format (not reported). Third, for the majority ($N = 25$) of the students ($N = 38$), the participation in class

as well as the teaching of content in it is very important (question 5), of those, 44 per cent prefer the ICM to the classic format, 36 per cent do not prefer it.

8 The results do not differ depending on whether we use ordinary least regression or binary logistic regression or on whether we bootstrap standard errors or not. We report the simple OLS inferential results of a model with 36 observations, four predictors and an R^2 of 30.5 per cent. Collinearity diagnostics were checked.

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