LESSON STRUCTURE IN DIFFERENT SCHOOL SUBJECTS IN THE CZECH REPUBLIC

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Abstract: *The paper presents the results of an analysis that was carried out within the CPV Video Study research project. It aimed to investigate differences in lesson structure in the every-day teaching of different school subjects in Czech lower-secondary schools. Video recordings of 249 lessons of physics, geography, English and physical education were analysed with respect to two dimensions: the organisation of classroom activities and the nature of the content. The findings show that there are manifest differences in teaching in the school subjects analysed. In classroom organisation, teacher-centeredness was found to be significantly greater in English than in geography and physical education. Concerning the purpose of lesson segments, the focus lay on developing new content in geography but on practicing the content in English and on applying the content in new situations in physics. Due to methodological limits inherent in the approach used, these findings must be interpreted with caution.*

Key words: *video study, lesson structure, learning and instruction, lesson signature, classroom research*

Introduction

Formal education in different academic disciplines has been shown to produce different effects on everyday reasoning. Lehman, Lempert and Nisbett (1988) investigated the effects on reasoning of graduate training in different disciplines. They found that training in psychology and medicine (representing probabilistic sciences) had a positive effect on statistical, methodological and conditional reasoning about problems of everyday life, while training in chemistry (representing deterministic sciences) did not seem to affect any of these kinds of reasoning.

If academic disciplines indeed require and therefore enhance different ways of reasoning then it is only reasonable to expect these different ways of reasoning to be reflected in the school subjects that represent these disciplines in schools. Stodolsky (1988) noted that "it is likely that certain types of knowledge and goals are associated (or even require) particular instructional approaches" (p. 4). She claims that school subjects differ from each other in perceived or inherent sequentiality, in their scope and coherence, and in their status within the school and larger community. Mathematics, for example, being a structured and sequential

discipline, is also – unlike many others – a highly structured and sequential school subject. She found evidence that *how* teachers taught depended on *what* they were teaching.

This paper presents the results of a video-based analysis of how teaching differs in different school subjects in Czech lower-secondary schools.

Theoretical background – Lesson structure

We see school subjects as complex phenomena the natures of which reflect the natures of their parent academic disciplines. We claim that differences between academic disciplines influence not only what is taught within the respective school subjects but in particular how teaching is organised. We seek to understand the aspects of teaching that are common to the whole range of subjects in the curriculum (domain-general aspects) as well as those that are specific to each school subject (domain-specific aspects).

Towards the end of the 20th century, many researchers began to abandon the strictly behaviourist perspective of concentrating on the form of instruction. Rather, they sought a balance between the form and the content of what happens in the classroom, investigating both of these dimensions (e.g. Kuusinen, 1991); the resulting analyses built on the concepts of *teaching patterns, teaching scripts, lesson patterns* or *lesson structure*. What is implicitly inherent in different approaches summarised below is that it is by analysing the structures of lessons that we come to understand the patterns of teaching.

Recent attempts to capture the complexity of classroom processes tend to focus among others on two distinct observable dimensions: 1) the way teaching is organised and 2) the nature of content being processed. Pointing out the complex nature of classroom processes, Průcha (1989) investigated 82 lessons taught in Czech lower-secondary schools with respect to a number of aspects of teaching. He measured the time pupils spent working individually to find great variability among the classes investigated (41% – 73%). To illustrate the findings concerning various temporal aspects of lessons, Průcha introduced the so-called lesson profile to summarise individual lessons. He also focused on the *kinds* of content processed, distinguishing *old content* (i.e. content introduced in previous lessons) and *new content* (i.e. content introduced in the particular lesson). He found that in regular basic schools 42% – 45% of lesson time was dedicated to *old content* while 21% – 28% of lesson time was spent on *new content*.

Hiebert, Stigler and their colleagues advocated a range of concepts at the turn of the century, from *lesson scripts* via *lesson patterns* to *lesson signatures* (Clarke et al., 2006c). The TIMSS 1999 Video Study, within which an international comparison of teaching was carried out, considered *structure of the lesson* as concept that comprised the coincidences of lesson length, time spent studying mathematics/science, role of mathematical/science problems and two important dimensions: grouping (whole-class, independent activities) and instructional purpose of

lesson segments (reviewing old material, introducing new material, practising new material) (Roth et al., 2006; Hiebert et al., 2003). The authors claimed that they identified significant culture-based differences in the structure of lessons between American, German and Japanese teaching scripts. In later work members of the team sought ways of quantifying these differences (Givvin, Hiebert, Jacobs, Hollingsworth, & Gallimore, 2005).

> "We focus on the purpose, classroom interaction, and content activity of lessons. Lessons were coded with respect to each of these three dimensions, and shifts were noted during the lesson sequence. This methodology allows us to examine the points in a given lesson when a particular feature had occurred and how many lessons exhibited this same pattern. We define the resulting 'pattern of teaching' as the duration and sequence of particular kinds of activities and events during daily classroom lessons" (Givvin et al., 2005, p. 316).

Some researchers however thought that this approach to international comparison was flawed in some respects. Clarke et al. (2006c) rejected the identification of nationality with culture and argued that variations within the teaching of individual teachers and within individual lessons make it very difficult for general patterns of teaching to emerge unless further aspects are addressed, such as the location of the lesson within the instructional sequence of topics, the independence of the dimensions of lesson structure and greater sensitivity in defining analytical categories. Moreover, the purpose of the comparison ought to be inspiration rather than evaluation.

Other researchers build on the approaches inherent in TIMSS Video Studies, often carrying out other large-scale video-based surveys of classroom practices. Within the IPN Video Study, for example, the stability of teaching patterns in teaching physics was investigated (Seidel & Prenzel, 2006). The authors considered three dimensions within a teaching pattern: 1) organisation of classroom activities (as an example of sight structures), 2) quality of teacher-student interaction, and 3) the students' perception of supportive learning conditions.

Building on these approaches, attempts have been made to justify the concept of teaching patterns by analysing the effects of particular teaching patterns on student achievement. Hugener et al. (2009) pose a question as to whether teaching patterns follow geographical boundaries or whether they are part of what they refer to as *pedagogical cultures of teaching*, which are independent of country boundaries.

However, analysis of teaching patterns – especially those based on video studies – have been so far carried out almost exclusively in mathematics and natural sciences (physics) classrooms. We feel that in order to develop the concept of teaching patterns, a wider perspective should be introduced. This paper draws on those analyses carried out within the *CPV Video Study* project that were aimed on the similarities and differences in lesson structure (in the sight structures) in different school subjects (physics, geography, English as a second language and physical education). In these analyses, lesson structure was considered as comprising two

main dimensions: 1) organisation of classroom activities and 2) the purpose of lesson segments with respect to the content.

Research aims, design and methods

The aim of the study presented here is to identify similarities and differences in lesson structure across the four school subjects analysed. The data presented here was gathered within the CPV Video Study project, which aimed primarily to document and describe the teaching of four school subjects – physics, geography, English as a second language and physical education – as taught in Czech lower-secondary classrooms. It also aimed to develop our understanding of the nature of similarities and differences in the teaching of different school subjects. Between 2004 and 2009, the Educational Research Centre (Centrum pedagogického výzkumu – hence CPV) at the Faculty of Education, Masaryk University carried out the *CPV Video Study of Physics*, *CPV Video Study of Geography*, *CPV Video Study of English* and *CPV Video Study of Physical Education* (Figure 1).

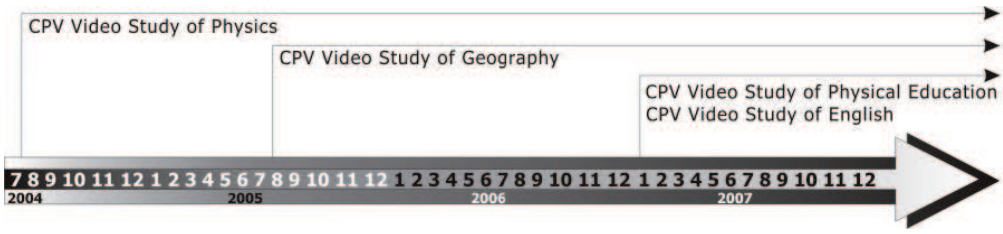

Figure 1: the CPV Video Study time line

CPV Video Study projects employ the video study approach to capture the complexity of teaching and learning processes in a classroom context. With recent advances in technology that have brought new ways of collecting, storing, managing and analysing data, video has become a powerful tool in large-scale classroom research (Ulewicz & Beatty, 2001; Najvar et al., 2009). The large-scale video study approach was introduced to a wider audience in the TIMSS 1995 and 1999 video studies (Stigler et al., 1999; Hiebert et al., 2003; Roth et al., 2006), which sought to analyse teaching practices in mathematics and science in different countries. A number of further research projects based on video studies followed – notably in the field of mathematics and science education (Seidel & Prenzel, 2006; Clarke, 2006ab; Klette, 2007; Labudde et al., 2007; for a review see Janík, Seidel, & Najvar, 2009).

To carry out analyses of such complex phenomena as classroom processes, the video study approach seems suitable and appropriate. Jacobs et al. (1999) show the advantages of using video data as opposed to direct observation techniques, especially when combining qualitative and quantitative approaches. The main advantage of video data over other types of data lies in the cyclic nature of analysis. While the conventional research is linear in nature, video data allow for cyclic

reanalyses, the reformulating of objectives and the applying of new codes which build on previous analyses (cf. Najvar et al., 2009).

In order to compare selected aspects of teaching in four different school subjects (physics, geography, English and physical education), an expert group was established, with one expert representing each school subject under analysis. Negotiations within the expert group were based on the observing of lessons in the four subjects and led to the establishing of a shared language to describe the phenomena observed. Only after a consensus on a particular aspect of teaching was reached could comparative analyses be carried out. The key principle that guided the work of the expert group was the combining of the comparative and the multi-perspective approaches (Najvar et al., 2009). The purpose of the negotiations was to describe, explain and justify inter-subject similarities and differences that occurred as results of the analyses (Figure 2).

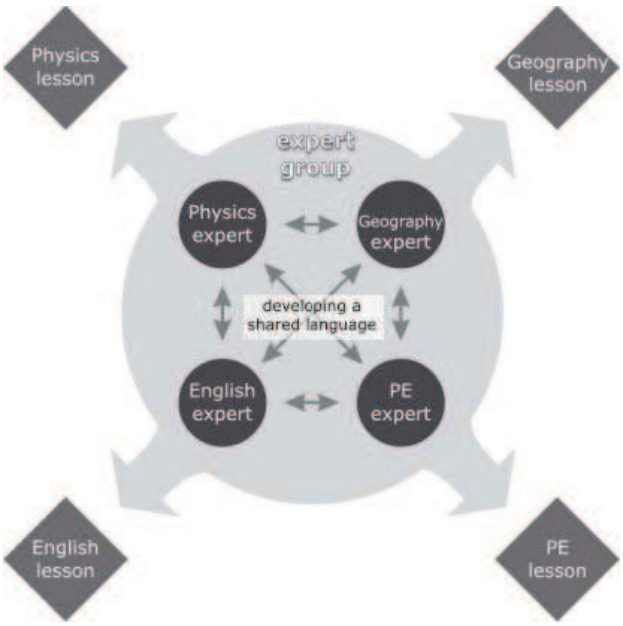

Figure 2: CPV Video Study Expert Group

Sample and data collecting

The research sample comprised a total of 249 video recordings of lessons taught in lower-secondary schools between 2004 and 2007. 62 lessons of physics were video-recorded in the school year 2004/05; these were taught by 13 teachers in Brno, Czech Republic who volunteered to participate in the *CPV Video Study of Physics* project. 50 lessons of geography were recorded in the school year 2005/06 taught by 6 teachers in Brno, Czech Republic who volunteered to participate in the *CPV Video Study of Geography* project. 79 lessons of English as a foreign language (taught by 25 teachers) and 58 lessons of physical education (taught by 20 teachers)

were video recorded in the school year 2006/07 in 21 randomly selected schools in the Jihomoravský, Zlínský and Olomoucký regions of the Czech Republic within the *CPV Video Study of English* and *CPV Video Study of Physical Education* respectively.

Employing experience obtained from the TIMSS and IPN video studies (Jacobs et al., 2003; Seidel et al., 2005), the lessons were taped using the standardized two-camera procedure. One camera (trained on the pupils) was placed on a tripod next to the board, so as to record what was happening in the classroom as a whole. The other camera (trained on the teacher) was operated by a trained cameraman, and it recorded the teacher and the zone of his/her close interaction with the pupils.

In the next step, video recordings were transcribed using Videograph software (Rimmele, 2002) according to standardized procedures (Seidel, Prenzel, & Kobarg, 2005). Various coding procedures developed in the Leibniz Institute for Science Education (IPN) at the University of Kiel in Germany (Seidel et al., 2005) were adopted and used to analyse the video recordings (Janík & Miková, 2006). The observation schemes relevant for the present analysis covered two areas: a) modes of classroom organisation; b) purpose of lesson segments. Video coding was carried out by trained coders on the basis of time sampling (analysis unit = 10 sec). Inter-coder reliability (Cohen's Kappa: Min = 0,6; Max = 1,00; percent direct observer consistency: Min = 71%; Max = 100%) met international standards.

System of categories – organization of classroom activities

Modes of classroom organisation are an important element in the organisational structure of the lesson. They represent an organisational framework within which the activities of the teacher and pupils take place with regard to the teaching goals. The responsibility for some organisational aspects of dealing with the content (such as pacing) may rest with the teacher or may be distributed differently. Wragg (1995) notes that "*if the class is being taught as a whole, then the teacher can take direct control over the speed at which material is covered; ... when individuals and groups are working separately, the determination of pace is to some extent in the hands of the children themselves, and the teacher's role changes*" (Wragg, 1995, p. 209). Different classroom settings therefore provide different learning opportunities for students.

For the coding of organisation of classroom activities, a coding system introduced by Seidel, Prenzel, and Kobarg (2005) was adopted (Janík & Miková, 2006). For the purposes of the present analysis, four modes of classroom organisation were considered[19] (see Table 1).

19 Other modes were coded (such as *more modes at the same time, transition, other*) but they were infrequent.

Table 1: Categories of organisation of classroom activities (P-C: pupil-centred; T-C: teacher-centred)

T-C	***lecturing by the teacher***	the teacher talked, dictated or demonstrated to the class
	teacher-class discussion	the teacher spoke with individual pupils in a whole-class setting
P-C	***individual work***	the pupils worked on a given task individually
	group work	the pupils worked on a given task in pairs or in groups

For the purposes of further analyses, lesson segments coded in the *lecturing by the teacher* and *teacher-class discussion* categories were sometimes referred to as *teacher-centred* lesson segments; segments coded in the *individual work* and *group work* were sometimes referred to as *pupil-centred* segments. This distinction reflects the distribution of responsibility for the speed at which material is covered.

System of categories – purpose of lesson segments

Different lesson segments are used by the teacher for different purposes (Hiebert et al., 2003, p. 49). In the TIMSS 1999 Video Study, three such purposes were distinguished: reviewing, introducing new content and practising new content. We think that such a set of distinctions fails to include one important purpose which teachers may have in mind and which aims to support pupils' learning in the cognitive as well as metacognitive dimensions. For the purposes of the present analysis, we therefore considered four categories of lesson segment purpose (see Table 2).

Table 2: Categories of lesson segment purpose

reviewing	included lesson segments in which content was reviewed which had been introduced in previous lessons; the aim was very often for the pupils to recall factual information
developing new content	comprised lesson segments in which new content was introduced, developed as well as motivational lesson segments
summarising	comprised lesson segment in which new content was summarised in an organised manner, often using summarising dictation or visual aids (e.g. the over-head projector)
practising	comprised lesson segments in which content was practiced, strengthened, intensified or applied to new contexts, and lesson segments devoted to testing

The original coding system that had nine categories and was based on a system for coding lesson phases introduced by Seidel et al. (2005) was later adopted by Janík and Miková (2006) for the purposes of the *CPV Video Study*. It distinguished for example two types of summarising: that of content, and that of the learning process. For the present analysis, these data were aggregated.

Findings

Below, the average percentages of 1) organisation of classroom activities and 2) purpose of lesson segments are given in overview. Lesson signatures are then composed for each of the school subjects under analysis.

Organization of classroom activities

For the purpose of presenting the results, the average percentages of the categories were calculated[20] for each subject and juxtaposed in stacked column graphs (Figure 3).

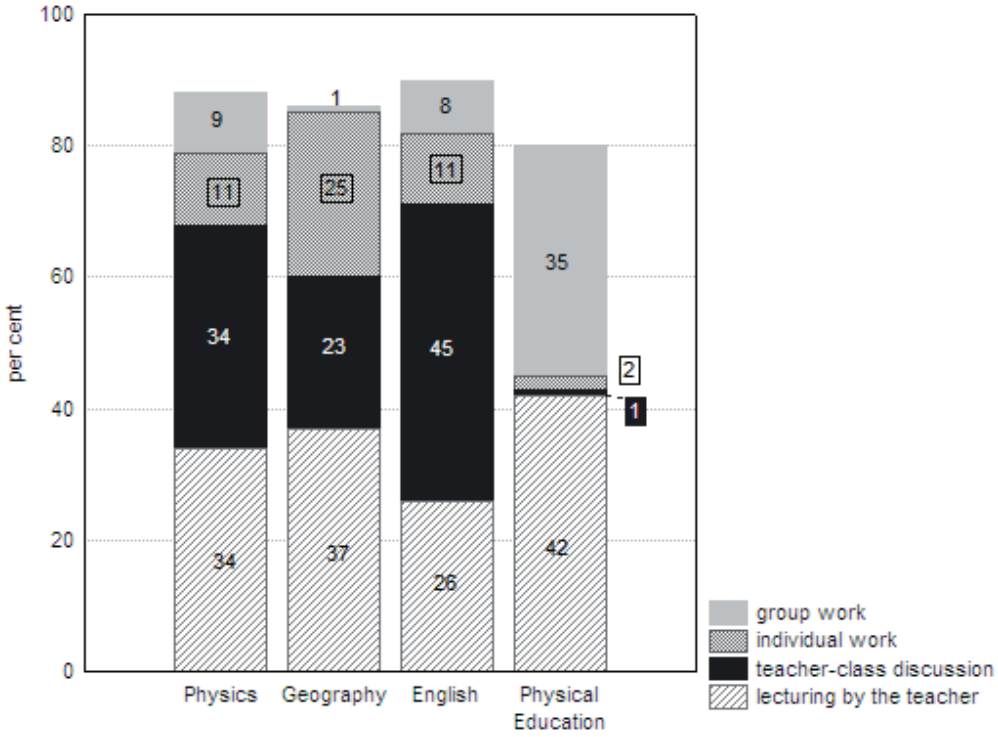

Figure 3: Organisation of classroom activities in the CPV Video Study

20 All differences proved statistically significant for $p \leq .05$; the Bonferroni test was used to determine the significance.

Comparisons such as the one presented here help reveal similarities and differences in everyday teaching practices in different subjects. The analysis of organisation of classroom activities presented produced some expected findings, such as that which indicates that teacher-pupil discussion is rare in physical education while it is an important component of the teaching of English as a second language. Nevertheless other findings suggest more subtle differences, such as that which indicates that in geography, emphasis is laid on individual work – with maps and atlases, as other analyses show – whereas in the other school subjects, a group work setting is regularly introduced. There is the suggestion that physical education is exceptional in the sense that it provides pupils with significantly more time to work independently of the teacher than the other school subjects. The degree of teacher-centeredness found in English lessons was significantly higher than in physical education and also in geography lessons.

The purpose of lesson segments

For the purpose of visualising the findings, the average percentages of the categories presented above were calculated[21] for each subject and juxtaposed in stacked column graphs (Figure 4).

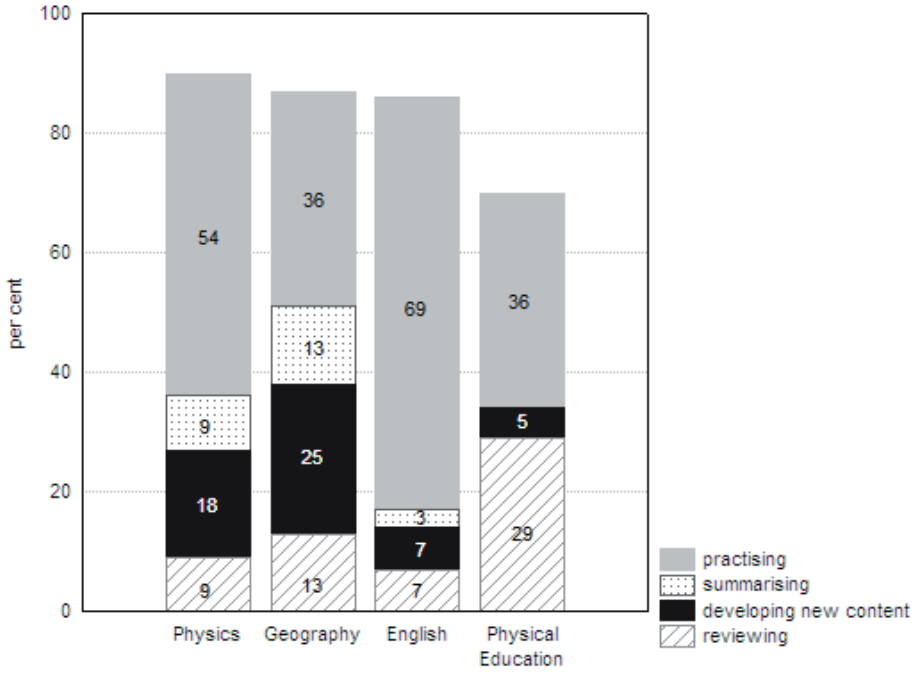

Figure 4: The purpose of lesson segments in the four school subjects

21 All differences proved statistically significant for $p \leq .05$; the Bonferroni test was used to determine the significance.

The results show (Figure 4) that different purposes are given different emphases in the school subjects under analysis. In geography and also in physics, a greater emphasis is laid on introducing and developing new content than is the case in English or physical education, whereas practising is the dominant purpose in English lessons.

Lesson signature: a complex view on the lesson structure

In an effort to illuminate the lesson structure typical of each of the school subjects under analysis, coincidences of the two dimensions of lesson structure were examined. Studying the coincidences of modes of classroom organisation and the purposes of lesson segments makes it possible to identify similarities and differences between the structures of lessons as they appear in every-day teaching across different school subjects. Overlaying the analysed lesson features of all the lessons of the school subjects on a timeline, lesson signatures (cf. Dalehefte et al., 2009; Hiebert et al., 2003) were acquired for the individual school subjects (Figures 5 to 8).

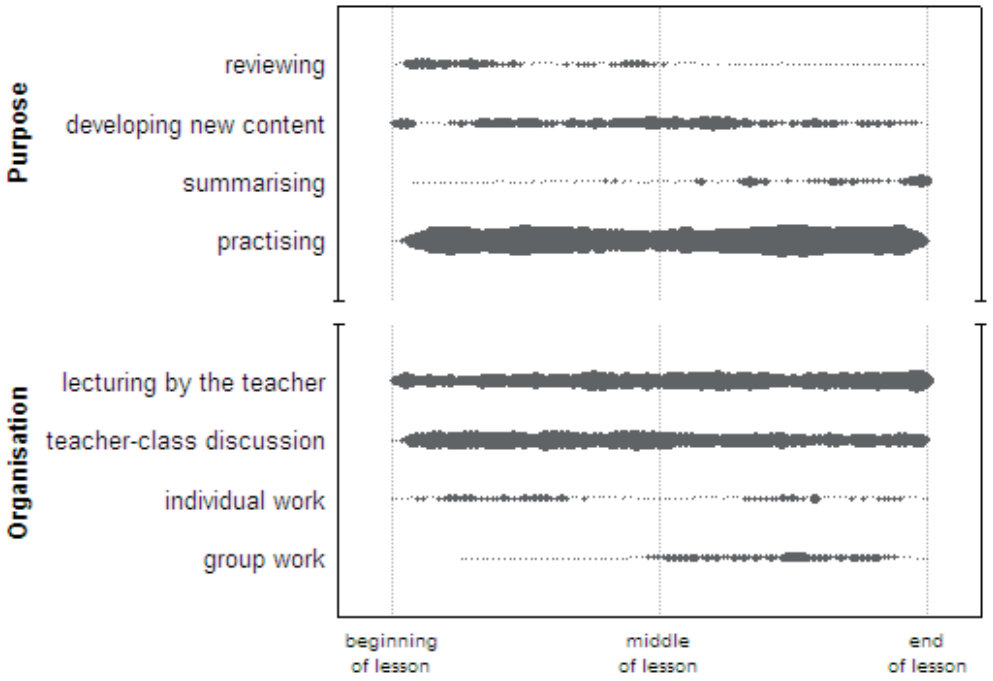

Figure 5: Lesson signature for physics teaching

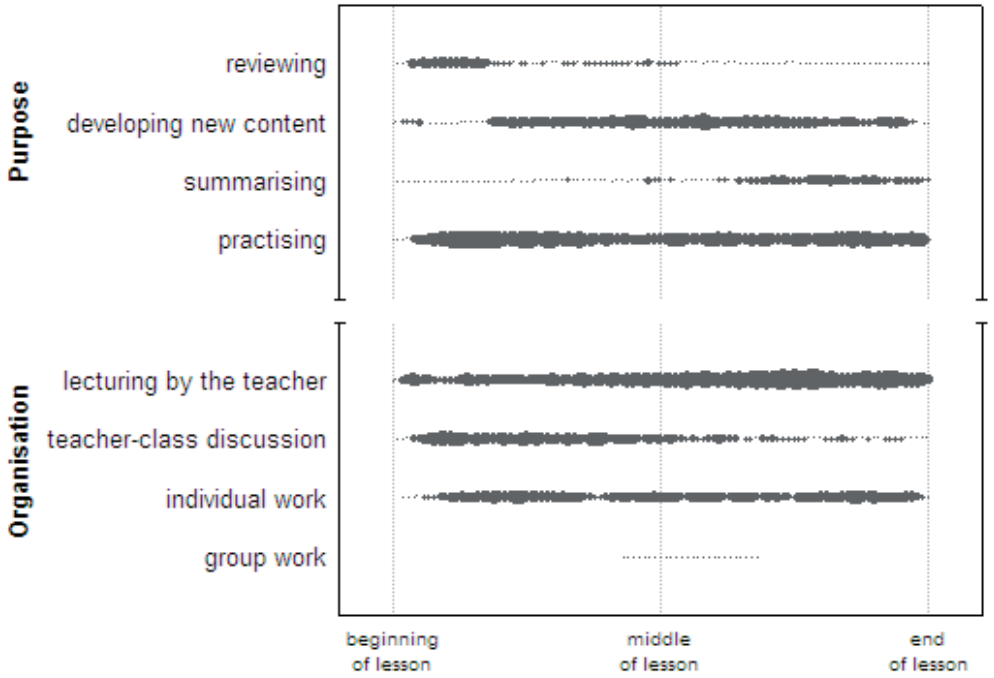

Figure 6: Lesson signature for geography teaching

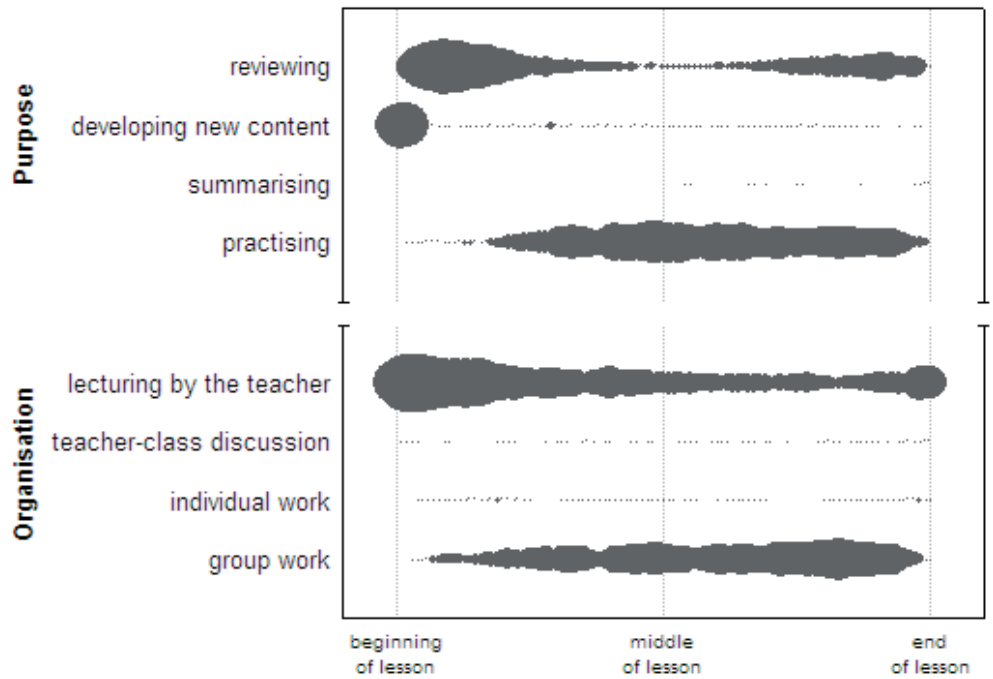

Figure 7: Lesson signature for physical education teaching

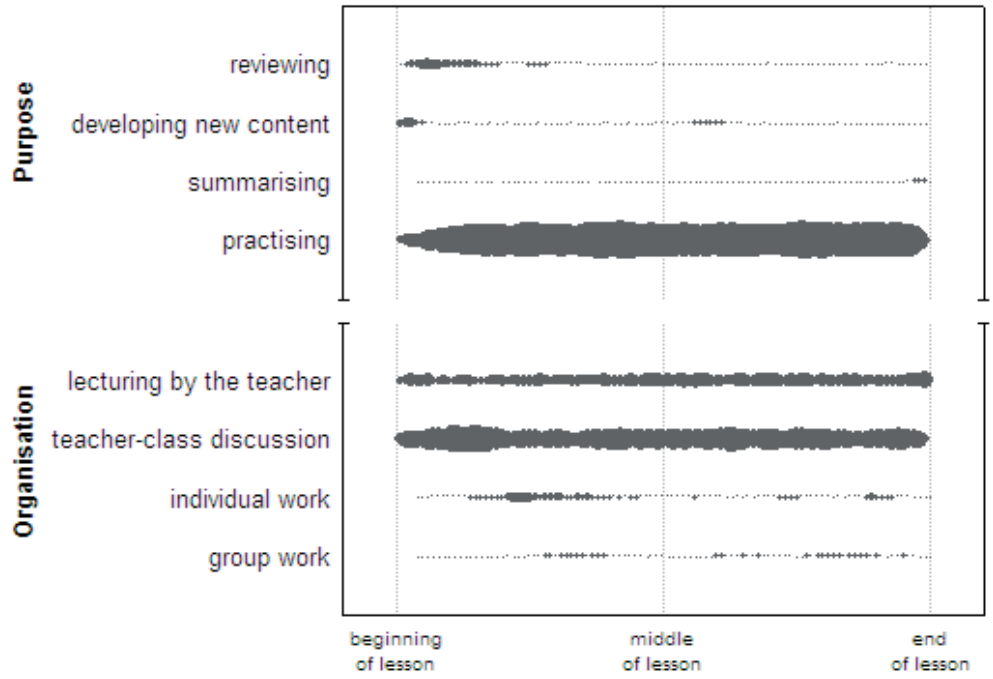

Figure 8: Lesson signature for English teaching

The findings reveal manifest differences among lessons of the different school subjects under analysis. In physics and geography a coincidence was observed in the summarising of the content (purpose) by means of lecturing by the teacher (classroom organisation), which tended to happen towards the end of the lesson. The first third of a lesson was often devoted to reviewing (purpose) through teacher-class discussion (classroom organisation) or to testing (purpose) through individual work (classroom organisation). The dominant purpose of lesson segments in English was practicing in correlation with teacher-class discussion as an organisational mode.

Discussion and perspectives for the future

Using the concept of *lesson structure*, the practice of teaching physics, geography, English and physical education at lower-secondary schools in the Czech Republic was analysed within the *CPV Video Study* research project. The results indicate that teaching at lower-secondary schools in the lessons under examination is to a large extent teacher-oriented. This is in accordance with other analyses carried out on this sample which show that teachers speak on average four to six times more than all the pupils in the class put together. Due to methodological limits inherent in the approach used and the nature of the sample, however, these findings must be interpreted with caution.

Nevertheless, the results of the CPV Video Study are in conformity with the findings of other research projects (e.g. Roth et al., 2006), which point out the dominating role of lesson phases focused on work with subject matter already taught (practising, application) in lessons taught by Czech teachers. In contrast to this, German teachers of physics have been shown to spend most of their teaching time on work with new subject matter (M = 31.5; SD = 7.7), dedicating much less time to revision, practice and applications (Seidel & Prenzel, 2004). The comparison shows quite a number of similarities and differences. One of the similarities is the relatively strict control of the lesson exercised by the teacher both in Germany and in the Czech Republic.

Methodological discussions concerning the concept of *lesson structure* point to several issues that need to be resolved before any decisive arguments are accepted. Clarke et al. (2006c) argue for the interpreting of *lesson structure* in three senses: at the level of whole lesson, at the level of topic and at the level of constituent lesson events. They also call for an appreciation of the variation within the lesson of an individual teacher in order to understand variability in general *teaching patterns*.

It remains to be solved whether and how *patterns of teaching* translate from one school subject to another. It may be that there are *general didactic* aspects of teaching that take different forms in different *pedagogical cultures of teaching* (see Pauli & Reusser, 2003) and that are manifested across the boarders that separate school subjects in the curriculum. If content indeed serves as context of teaching (see Grossman & Stodolsky, 1995) then addressing these issues remains an important challenge for future research.

Acknowledgements

The study was carried out within financial support from the Ministry of Education, Youth and Sports of the Czech Republic, by Grant No. LC06046: "Centre for Basic Research on Schooling"

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