Chapter 8
European Educational Systems and Assessment Practice

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Introduction

As described in the introduction to this book, this project explored the fit between inquiry-based education (IBE) and the use of formative assessment. One hypothesis was that formative assessment has the potential to facilitate both teacher and student work with IBE since it can provide some assurance and direction during the challenging environment of inquiry. As part of a review done to establish the context of formative assessment in inquiry-based education, this chapter explores possible links between educational systems and teachers' practices with respect to assessment. To examine these connections, the first of the two sections uses a survey of characteristics of eight European educational policies that may have an influence on assessment practices. It produces a typology of two country groups based on degree of centralization of administration as well as teacher and school autonomy. This first section also provides four models of education in the eight countries (Cyprus, Czech Republic, Denmark, France, Finland, Germany (state of Schleswig-Holstein), Switzerland, and the United Kingdom (England)), based on comparative curricula, teacher education, and professional development and assessment practices.

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The second part of the chapter then surveys the relevant formative and summative assessment research of the same eight European countries. It builds on the first section's survey of system characteristics by examining the resulting assessment practices in each country. Given the degrees of centralization and autonomy of the countries, their assessment practices are discussed. The diversity of their existing practices shows the relative importance of summative and formative assessment in each case, the current extent of the use of formative assessment, and the challenges faced in the uptake of formative assessment methods. It concludes with the role of assessment in supporting inquiry-based education.

The goal of both parts of the chapter is to provide generalized insights into the alignment of formative and summative assessment with educational practices. The overall Pan-European affordances and challenges of assessment practices in the given contexts provide an insight into the multiple variables that account for the assessment practices in these European countries.

Links Between European Educational Systems and Assessment Practices

The possible linkage between educational systems and teachers' practices with respect to assessment was addressed by Cohen and Hill (2000) who examined the influence of assessment, curriculum, and professional development on teacher practice and student achievement. They analyzed 1994 California surveys on teachers' practices (including their formative and summative assessment practices) and students' achievement and showed that policies can affect teacher practice and student performance. As educational policies interact with national educational systems, we used their work to build the model in Fig. 8.1 that presents the relationships between educational policies, teaching practices, and learning outcomes (Lima et al. 2015).

This model proposes that the relationship between educational policies and teacher practice is mediated by:

- The curriculum (students' curricula, teachers' own curricula, and student and teacher knowledge about students' curricula)
- In-service professional development programs (which could be extended to teacher education in a broader model)
- State-wide or standardized student assessments for they allow teachers to think about the alignment among their teaching approach, the contents of the tests, and students' performances

Testing this model, Cohen and Hill (2000, p. 327) concluded that "both our practice and policy measures positively relate to student achievement. State efforts to improve instruction can affect both teaching and learning." As shown by Cross and Lepareur (2015) and Grangeat and Hudson (2015), other factors that are independent from educational policy factors, like the nature of teacher collaboration or the

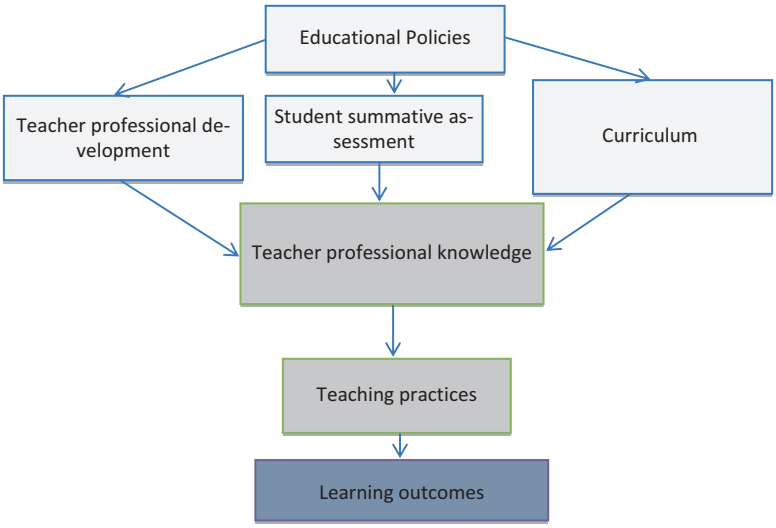

Fig. 8.1 Model of the relationships between educational policies, teacher practices, and student performance (Lima et al. 2015) (The different shadings correspond to different levels of description: *in light gray*, the education system level; *in medium gray*, the teachers' level; and *in dark gray*, the students' level)

opportunities to talk about subject matter, teaching, or students learning (Wilson and Berne 1999), influence teachers' professional knowledge and practice. However, this contribution focuses on the impact of educational systems on teacher professional activity.

In the first step of the research, educational policies and system characteristics that might influence student performance were identified. The study of Hanushek and Woessmann (2014), by focusing on macro-level variables that play a role in international evaluation of student performances (PISA, TIMSS), elicits the main characteristics of educational systems that influence performance differences at an international level. The same characteristics are not necessarily relevant in explaining differences at a national level because each educational system has its own coherence and is included in a broader social system. Keeping in mind that this contribution focuses on the comparison among the national systems, it is drawn on these characteristics. Of the five main characteristics identified in the literature, three are used in this contribution for characterizing the educational systems participating in the sample (the remaining two are not relevant here):

- Accountability: The existence of an external exit exam or teacher use of regular standardized tests to monitor student performance is associated with higher student performance.
- Autonomy of schools: Students perform significantly better in schools that have autonomy in organization and personnel decisions (budget allocation, hiring teachers, choosing textbooks and instructional methods, etc.).

- Tracking, streaming, or ability grouping: In countries with early tracking (academic vs. vocational), inequality of performances linked to social background increases systematically from fourth grade to the age of 15, whereas it decreases in countries without tracking (Hanushek and Woessmann 2014, p. 167).

The two other characteristics of educational system that are of some influence on student performance concern preprimary education and the competition from private schools. They are out of range of our study that focuses on science teaching in primary and secondary schools.

The data of an online survey conducted through ASSIST-ME allows identification of some characteristics of European educational policies that might influence teachers' assessment practices as a part of their teaching practices: system organization and management, school organization and management, teacher education and professional development, science education, and forms of student assessment (see introduction to this book). This survey was conducted in eight European countries: Cyprus, Czech Republic, Denmark, France, Finland, Germany (state of Schleswig-Holstein), Switzerland, and the United Kingdom (England). A group of researchers and experts of education (three in each country chosen by the head of the national research teams involved in the research program) answered a total of 111 questions about the educational system of their national school system (including school autonomy, accountability, and tracking), teacher education and professional development, science education curriculum, and the form of student assessment at primary, lower secondary, upper secondary, and vocational secondary levels. All the questions were close ended except for three that were open ended in order to grasp the fine details of each educational system and to moderate the results from the close-ended questions. In each country, the experts had to reach a consensus before all their answers were submitted to a panel of national stakeholders. The group of stakeholders (representatives of educational institutions, head teachers, politicians, and administrators in charge of the local, regional, or national education system) was asked to react to and comment on all answers. That ensures that this information reflected both researchers and partners' views about their own educational system.

The exploration of the consortium educational systems has been conducted through multiple correspondence analysis (MCA) and cluster analysis. This type of analysis of the answers to the questionnaire allows elicitation of the main dimensions (Le Roux and Rouanet 2010) that characterize the educational systems. The analysis of the three characteristics of educational systems (accountability, autonomy, and tracking) produces a typology consisting of two groups (see Fig. 8.2). This typology is mainly based on the differences in autonomy and accountability as tracking did not seem to differ significantly among the countries involved in the analysis. First, this analysis identifies a group of centralized countries (France and Cyprus) in which the independence of schools and individual teachers is weak and the main decisions are made by the central administration. Second, this analysis identifies a group of more or less decentralized countries where the system is rather teacher centered (Finland and Denmark), rather school centered (Czech Republic)

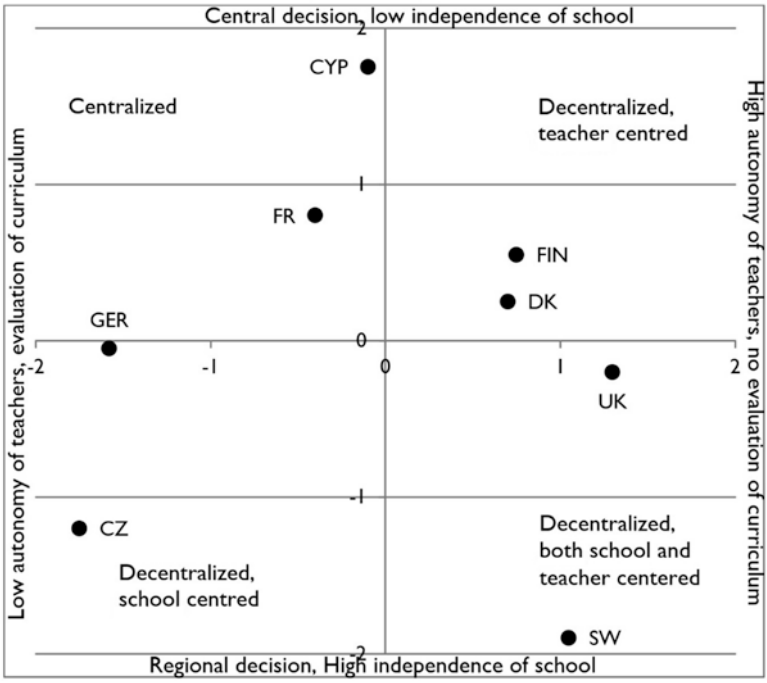

Fig. 8.2 Results of the MCA analysis on educational systems' characteristics

or represents a kind of balance between school and teacher autonomy (United Kingdom and Switzerland). For example, in centralized countries, central authorities are in charge of teacher hiring, while in decentralized countries, local authorities or schools are in charge of teacher hiring. In decentralized countries, schools and sometimes teachers have some autonomy in the implementation of the national curriculum, when it exists, but they don't have any autonomy in the centralized countries. In addition, one country is in an intermediate position between centralization and decentralization (Germany) (Lima et al. 2013, p. 6–11). Even though the position of Germany might be surprising, it is consistent with the data of the OECD (2013) that show that, in Germany, the percentage of decisions taken at the central as well as those taken at local level are at the average of OECD countries. Those taken at the regional level (länder) are a lot more common than the OECD average, and those taken at the school level are a lot less common than the OECD mean. Such contrasts between low level of school decisions and high level of regional decisions place Germany in a balanced position between fully decentralized and highly centralized countries.

Answers to the eight country questionnaire were analyzed through a quantitative method. The analysis was based on MCA with countries as subjects and questions as variables. Because the model of the relationships between educational policies and teachers' practices (including teachers' assessment practices) focuses on the

curriculum, and on teacher education and professional development, the concentration of the analysis was on these three domains:

- Curriculum: Does the competence model of the students' curriculum, if it exists, specify competencies related to formative assessment? Do the curriculum's guidelines require student day-to-day assessment? Do resources for teachers exist in order to support the uptake of day-to-day assessment related to STEM?
- Teachers' education and professional development: Since when did formative assessment/summative assessment appear in initial teacher education? What is the amount of formative assessment/summative assessment in continued professional development (CPD) programs? Since when did formative assessment/summative assessment appear in CPD programs?
- Teachers' assessment practice in the classroom: How is student achievement communicated to the students? How common is it that students are involved in the assessment of their own (and others) performance? Are there dedicated meetings for helping students and parents to make sense of the assessment information and decide strategies for improving their learning?

The MCA results detected variables that distinguish the national educational systems and identified proximities between some systems on these variables. Table 8.1 illustrates the results of this analysis that shows the existence of four models in the sample. The first model depicts countries in which the introduction of formative assessment in teacher education and professional development took place more than 15 years ago, even if the practice was not important. In these countries, formative assessment practices were implicit in the official recommendations; however, they are not explicitly cited as a competency in the curriculum and not supported by formal meetings with students to discuss their assessment results. This "long-term and implicit" model comprises Denmark and Finland. The second model is also characterized by an implicit practice of formative assessment and a long-term presence of formative assessment in teachers' education but with a more recent introduction of formative assessment as an important object of teacher professional development. This "middle-term and implicit" model comprises Germany and the United Kingdom (England). The third model, "middle term and explicit," comprising France, Czech Republic, and Switzerland, is characterized by a middle-term introduction of formative assessment in teacher education and professional development (between 5 and 15 years ago), by an explicit presence of evaluation competencies in the curriculum and by the use of formal meetings with students to make sense of their assessment results. The last "short-term and explicit" model, the model of Cyprus, presents also explicit evaluation competencies in the curriculum and the use of formal meeting with students to make sense of their assessment results, but the introduction of formative/summative assessment in teachers' education and professional development is recent (less than 5 years ago). These four models are mainly defined by the older or recent introduction of formative assessment in in-service teachers' professional development and an explicit or implicit implementation of formative assessment in the classrooms.

Table 8.1 The four models of the combination among teacher education, nature of curriculum, and assessment

Models	Introduction of formative assessment in teachers' education	Introduction and amount of formative assessment in professional development CPD	Explicit presence of evaluation competencies in the curriculum	Formal meeting with students to make sense of assessment results
Implemented for long and non-explicitly (Denmark, Finland)	Long-term introduction in TE	Long term but with little amount in CPD	No	No
Implemented for some years and non-explicitly (Germany, United Kingdom)	Long-term introduction in TE	Middle term with an average to important amount in CPD	No	No
Implemented for some years and explicitly (France, Czech Republic, Switzerland)	Middle-term introduction in TE	Middle term with an average to important amount in CPD	Yes	Yes
Implemented recently and explicitly (Cyprus)	Middle-term introduction in TE	Short term but with little amount in CPD	Yes	Yes

The first and second model (long term and implicit, middle term and implicit) are associated with decentralized educational systems (Denmark, Finland, England, and Germany to some extent), while the two other models (middle term and explicit, short term and explicit) are associated with centralized (France, Cyprus) or school-centered (Czech Republic, Switzerland) educational systems (Lima et al. 2013).

These results are consistent with the model presented in Fig. 8.1 that links educational policies (in our study, the level of centralization of the system and, because of policies, curriculum specification) to teacher practices of formative assessment directly or by the means of both teacher education and teacher in-service professional development programs. However, these results come from a sample of only eight European educational systems and from teachers' practices that are indirectly described. Accordingly, they provide only some indications for a better understanding of the link that may exist between national policy and teachers' practice. The direct identification of teachers' practices through teacher interviews or classroom observations and the study of other educational systems may strengthen these results. More information about the organization of in-service professional development in each country may also specify the link between educational policies and teachers' practice.

However, our results allow us to envision possible ways to enhance the combination of formative and summative assessment in teacher practice through educational policies:

- Promoting day-to-day formative assessment in combination with summative assessment through teacher education and in-service development. As stated in the OECD report about effective teachers, teacher quality is the main factor of influence on student performance, which is potentially open to policy influence. As teacher quality is partly dependent on their education (OECD 2005, p. 26), teacher professional development seems to be a key factor for implementing formative assessment and its combination with summative assessment in teacher practice. Informal use of formative assessment and its integration in day-to-day assessment practices (Lima et al. 2015) promoted by the long-term presence of formative assessment as an object of teacher education and in-service teacher professional development seem to be favored in teacher-centered educational systems (as in Finland or Denmark).
- Providing teaching resources and guidelines for the implementation of formative assessment and its combination with summative assessment. Resources (e.g., textbooks) which help teachers in the implementation of formative assessment in their classrooms also seem to be an important means for the adoption of formative assessment practice, particularly in educational systems with a shorter-term promotion of formative assessment in schools (Lima et al. 2015).

Surveying European Use of Formative and Summative Assessment

The aim of this second part of this chapter is to complement the educational system-based perspective presented in the first part of the chapter by specifically addressing national research conducted in the ASSIST-ME partner countries with respect to the formative and summative use of assessment in science, technology, and mathematics education (STEM) (s. Chap. 3). In alignment with the objectives of the ASSIST-ME project, a specific focus thereby lies on inquiry-based teaching and learning approaches within the three domains (s. Chap. 2). The underlying assumption is that the potential success of any attempt to change the assessment practice within a country will not solely depend on the characteristics of the educational system. Of equal importance is how these conditions are implemented in practice. Results from educational research can provide helpful information not only about the challenges but also the opportunities of these implementations across different national contexts.

In order to illustrate country-specific characteristics regarding the assessment of inquiry-related competences, a survey was carried out by asking national experts from the fields of science, technology, and mathematics education. The survey con-

sisted of ten open-ended questions that asked the national experts to summarize national research findings related to five overarching topics:

1. The role of formative and summative assessment for the teaching and learning of STEM
2. The relation between formative and summative assessment
3. Formative assessment practice
4. Challenges for the uptake of formative assessment
5. The role of assessment in supporting inquiry-based teaching and learning

As the experts were all involved in the ASSIST-ME project (see book introduction), a shared understanding of the terms formative and summative assessment could be assumed. In the following, the major findings from the reports from the eight European countries Cyprus, Czech Republic, Denmark, England, Finland, France, Germany, and Switzerland are summarized. Since the amount of available research varied considerably between countries, the intention of this section is to present spotlights of country-specific research that give a general sense of the situation of formative and summative assessment in European countries rather than to provide a comprehensive summary of the situation in each separate country. A complete description of the results can be found in Rönnebeck, Bernholt, Ropohl, Köller, and Parchmann (2013). The most interesting and striking similarity across countries is that in almost all countries, there has been little to almost no national research on formative assessment in general – or on inquiry competences in particular. For topics where no research findings existed in countries, some of the experts provided informed hypotheses regarding possible reasons for the lack of research. In Cyprus, for instance, a possible reason was seen in the fact that educational policy and teaching practice do not prioritize evidence-based research in their decisions. As a consequence, the potential of assessment data to inform policy and practice (and support learning) is often not considered. The centralization of the educational system as described in the first part of this chapter (see Fig. 8.2) was regarded as another possible cause. Teachers often lack the motivation to improve the quality of their teaching since such efforts are not rewarded by the system (e.g., teacher appointment and salaries are independent of qualifications and the quality of teaching).

The Role of Formative and Summative Assessment for STEM Teaching and Learning

With respect to the role that formative and summative assessments play in and for the teaching and learning of STEM, in almost all countries, summative assessment is considered to be predominant compared to formative assessment. In some countries like Switzerland or Germany, long traditions of summative assessment and grading exist. The same is true for Finland where students complete up to 50 tests

per year, and the test results often provide the major source for grading. The character of the tests differs (e.g., from nationwide to statewide or even school-/teacher-based tests) in relation to the centralization of the educational system and, e.g., the school autonomy as described in the first part of this chapter (see Fig. 8.2). Within the last decade, however, even in systems where the authority lies with individual states or cantons, like Switzerland and Germany, a trend has been observed to establish a nationwide comparability of assessment tasks and results. The educational system in Germany, for instance, has shifted from an input to an output orientation. Nationwide, competence-oriented educational standards were implemented, and their attainment is monitored in regular intervals by national large-scale assessments. However, similar to Switzerland, the purpose of these large-scale assessments is to survey the system and not the individual student.

With respect to formative assessment, results from France show that the majority of teachers and students favor formative assessment or at least consider formative and summative assessment equally important (e.g., Issaieva et al. 2011). In Switzerland, mandatory guidelines exist in many cantons that explicitly mention formative assessment; however, no systematic surveys of formative assessment practice exist (which seems to be characteristic for the situation in many of the participating countries).

Following the seminal review by Black and Wiliam (1998) reporting on the positive effects on learning where formative assessment had been used in classrooms, several projects in England investigated the opportunities and challenges of implementing formative assessment in regular teaching practice. The results showed that such practices could be established in schools (e.g., Black et al. 2003; Wiliam et al. 2004); however, they required radical changes on the side of the teachers (e.g., Harrison 2013). A specific challenge that teachers encountered was to promote autonomy and self-regulated learning in their students (Marshall and Jane Drummond 2006). Moreover, teachers felt that the formative assessment often provided so much scaffolding that it was difficult to decide whether the learners could have been successful without this additional support.

The Relation Between Formative and Summative Assessment

In most countries, there is not much research or information about the interaction between formative and summative assessment available. Grades are regarded by some countries as a form of summative assessment that also has a potential for formative assessment purposes (see Chap. 3). A study in Germany comparing classroom-based assessments and standard-based tests found that thematically focused assessments – as needed for formative assessment – led to additional and specific information that could not be provided by summative assessments (Klieme et al. 2010). A research tradition investigating the relationship between formative and summative assessment, however, exists in England. In this tradition, formative and summative assessments are not regarded as two different types or forms of

assessment. “In general terms, assessment is simply the production and interpretation of evidence of achievement. If this evidence is used to guide the next steps in progress, it is for learning [formative]; if it is used to sum up, judge, make decisions about progress so far, it is of learning [summative]” (Rönnebeck et al. 2013, p. 80). Teaching, learning, and assessment all need to be closely interlinked in the planning and implementation of any teaching program – otherwise tensions might be created or opportunities for improvement missed. One negative impact of the higher profile given to test-based results in England’s national curriculum assessment system has been shown to be not only a loss of assessment skill on the part of teachers but also a loss of confidence in their ability to make sound assessments of their students (Black et al. 2010, 2011). The given balance between school and teacher autonomy as described in the first part of this chapter (see Fig. 8.2) would seem to provide teachers with the opportunities to develop and practice formative assessment strategies. However, this affordance may be overwhelmed by this English national curriculum assessment system.

Formative Assessment Practice

Formal formative assessment seems not to exist in the investigated countries. A recent study in Denmark, however, found that when teachers assess their students, they have “an outspoken focus on learning and learning potential” and that most teachers assess “continuously and after the individual activity” (Rönnebeck et al. 2013, p. 26) – the most common forms of assessment are whole class conversations and written tests. A similar hypothesis in Finland assumes that opportunities for formative assessment exist in daily teaching practice where teachers might especially use short-term, informal formative assessment in teacher-student interactions. In Switzerland, where student and teacher attitudes toward different assessment methods have been investigated (Vögeli-Mantovani 1999), a high acceptance by teachers for oral feedback instead of grades, learning reports on progress, and student self-assessment has been observed. The acceptance among parents and students was also comparably high. The relatively high autonomy of teachers in Denmark, Finland, and Switzerland (see Fig. 8.2) may allow these teachers to individually include formative assessment strategies in their teaching.

With respect to the existence and research into the use of specific tools for formative assessments, countries differ significantly. Whereas in Finland and the Czech Republic, no such tools exist at all, in Denmark, many are available but very little research-based knowledge on how they are used exists. In Switzerland, formative assessment is systematically gaining in importance and has been supported by regulations (Vögeli-Mantovani 1999). Examples for formative assessment formats are rubrics, portfolios in mathematics, and textbooks fostering inquiry that include assessments. However, the gain in importance is not yet reflected in the daily practice in schools. Similar to Denmark, tools for formative assessment exist in Germany, but there is little research about their use. Recently, however, several studies inves-

tigated the use and effect of feedback in mathematics instruction (e.g., Rakoczy et al. 2013). The authors found no significant total feedback effects on interest and achievement development. There were, however, indirect effects on the development of interest via the perceived competence support and usefulness and on achievement development via the perceived usefulness. A mastery-approach goal orientation mediated the impact of feedback on the perceived usefulness.

In contrast, a Danish formative assessment instrument aimed at supporting students in performing inquiry processes has been used in physics. It was shown to increase the motivation, especially of girls, dramatically (Dolin 2002). Parallel to the ASSIST-ME project, a PhD thesis addressed the impact of formative assessment on students' self-regulation in the context of IBSE in France. The research aimed at analyzing the assessment practices of teachers and their effects on their students' self-regulatory process. Two approaches were compared. The first corresponded to formative assessment methods implemented by teachers in their daily practices without training. The second concerned the assessment practices implemented by these same teachers after a series of three workshops where they collaborated for designing teaching units comprising formative assessment tools and for gradually improving them. The results showed a better balance in the use of different formative assessment methods in the second situation, especially with respect to a greater empowerment of the students and a better account taken of peers as resources. Students also demonstrated more efficient self-regulation since they spent more time in elaborating problem-solving strategies and in being committed in the task (Lepareur 2016).

Challenges for the Uptake of Formative Assessment

Countries regarded different factors as impeding the uptake of formative assessment. These factors are mostly in line with results found in the international literature (Bernholt et al. 2013). A serious impediment in many countries is seen in teachers' beliefs about assessment as an instrument for generating grades and ranking students. Moreover, teachers often seem to have reservations toward formative assessment because they consider it laborious and difficult to implement (e.g., in Finland). A study in Germany points out that a dilemma between alternative assessment methods that aim at the contemplation of learning (like learning diaries) and student evaluation exists (Winter 2007). Students might not openly express their ideas, opinions, and problems if they know they will be evaluated. On the other hand, students might be demotivated if they put much effort into a portfolio, and this work does not contribute at all to their grades.

In Cyprus, research shows that although teachers seem to appreciate assessment as an integral component of teaching and a powerful means of enhancing the quality of teaching and learning, they nevertheless exhibit an inclination toward traditional assessment approaches that yield overall scores (Rönnebeck et al. 2013). Other aspects mentioned, for example, in a study from Switzerland, are a lack of time and

a lack of teacher competence to differentiate between different levels of proficiency within a class (Smit 2009). In England, results from the assessment for learning (AfL) initiative provided insights into the challenges of a widespread implementation of formative assessment. While at the school level competing priorities, for example, demands for summative data and other issues of accountability, were found to be a major obstacle, the main drawback for teachers was in fully developing the dialogic classroom (Rönnebeck et al. 2013).

With respect to support that teachers need in order to implement formative assessment into their daily teaching practice, almost all countries agree on a general need for pre- and in-service teacher training. The historic variations in teacher education and professional development for the introduction of formative assessment provide some understanding of its current use (see Table 8.1). This training should address different aspects related both to learning and to assessment. Research from England indicates that teachers need to develop an in-depth pedagogical knowledge of how children learn and of their own pupils' learning needs (e.g., Watkins and Mortimore 1999). With respect to assessment, teachers need support to increase their assessment literacy. Research from Germany shows that a high diagnostic competence of the teacher positively influences his or her formative assessment practice (Klieme et al. 2010). Another important issue is the assessment of progress against personal rather than normative frameworks. Moreover, teachers need support to change their beliefs about assessment. Teacher perceptions about formative assessment are strongly influenced by how they were formed, the particular school contexts, and how they may affect practice (Sach 2012).

In this context, the importance of a strong relation between educational research and assessment practice is stressed by, for example, Denmark and the Czech Republic. An urgent need for concrete assessment tools is expressed in a study from Switzerland (Jundt and Wälti 2011). They found that ready-made mathematics units including rubrics for assessment encouraged teachers to assess complex (and therefore often neglected) competences. In Finland, a possible way to support teachers could be to involve textbook writers in the process because of the central role textbooks play in Finnish teaching and learning. From studies on school effectiveness, eventually, Cyprus concludes that mechanisms for internal evaluation need to be established and activities implemented that aim at improving teaching practice and the corresponding learning outcomes (e.g., Creemers and Kyriakides 2006).

The Role of Assessment in Supporting Inquiry-Based Teaching

No studies investigated whether assessment methods influence the uptake of inquiry in the respective countries. Switzerland, Finland, and the Czech Republic, respectively, state that inquiry is not used frequently, is uncommon, or is not a part of the regular instruction. One major reason for this is seen in the fact that inquiry is often not assessed in examinations (e.g., in Denmark and Finland) and is thus perceived as auxiliary to core teaching. However, it is assumed that with more broad support

for teachers in formative and summative assessment through both preservice and continuing teaching education (see Table 8.1), inquiry could gain significance. In Denmark, there has been some research on how summative and formative assessment could be used to promote learning in inquiry education (the "assessment dialogue" Christensen 2004). In Germany, the implementation of educational standards (which include inquiry competences) required the development of competence models – and thus assessment items – for inquiry for monitoring purposes. In Denmark, a new examination for lower secondary includes attention to inquiry processes.

Overall

The diverse use and relationship of formative and summative practices in the eight European countries provide an overview of irregular connections in the Fig. 8.1 model of the relationships between educational policies and teacher practices. The lack of a European-wide standard for using formative and summative assessment along with inquiry-based STEM teaching and learning provides both challenges and opportunities. The diversity between and within countries gives us a number of "natural experiments" where various uses of assessment tools and teacher training can be compared and contrasted for insights into research-based changes. Our research is useful in identifying some of these "experiments" which might be worthwhile exploring with further research.

The next chapter moves from this general overview of Pan-European perspectives of assessment to a deeper focus on teacher perspectives collected from teacher questionnaires as well as interactions with teachers in eight countries.

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