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Data Use in Schools – A Cross-Country Study

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Abstract

The EU Comenius project Using Data for Improving School and Student Performance aims to develop professional learning communities within schools and qualify them in their use of tools that support effective data use for the improvement of educational outcomes. To plan a pilot course to reach this goal, a survey has been administered to piloting schools in the five project partners' countries UK, Poland, the Netherlands, Lithuania, and Germany to determine the current types and the extent of use of educational data and to build. This paper presents and discusses the results of an exploratory factor analysis with specification search and structural equation modeling. Key factors for change in educational data use were identified across countries and for individual countries.

Data Use in Schools

Research about using data to support classroom-level decisions or building-level planning to improve learning is just beginning to emerge. While countries such as the United States, Canada, and the United Kingdom have already implemented educational data systems, other countries including Germany are just starting their initiatives (i.e., Breiter & Light, 2006; Breiter, Lange & Stauke, 2008; Tatnall, Visscher, Finegan, & O'Mahony, 2009). Nevertheless, most research studies mainly focus on administrative data for school management. Less emphasis is given to the role of data for teachers in their instructional decision-making (e.g. Brunner & Light, 2008; Mandinach & Honey, 2008). Hence, a cross-country research can help identifying patterns of use and requirements for successful implementation. If we refer to data-driven instructional decision-making on a school level, Breiter & Light (2006, p. 208) have identified three core elements:

> "(a) Decision-making is a highly complex individual cognitive process influenced by various environmental factors. The classroom may be the example par excellence of an inter-subjective decision-making environment. Teachers constantly make decisions, which may affect 20 or more children. (b) Decision-makers often are not fully cognizant of the specific data they rely on for each decision. […] When making instructional decisions, teachers may need to consider their students' intellectual and physical abilities, developmental stages, personalities and their interpersonal skills. (c) […] Schools are challenging organizations to work with: they lack professional staff for data processing and distribution; and teachers are often isolated in their classrooms, unable to absent the classroom to retrieve information."

It is common sense in educational research, that data could be used for instructional decision-making. The open question remains how teachers and head teachers can build up the necessary skills to make informed decisions. Current research on statistical literacy (e.g., Gal, 2002; Garfiel & Ben-Zvi, 2007) shows that there is a gap between understanding statistics and using it for decision-making on the classroom level.

The EU Comenius project *Using Data for Improving School and Student Performance* aims to develop professional learning communities within schools and qualify them in their use of tools that support effective data use for the improvement of educational outcomes. Two schools from each of the project partners' countries (i.e. United Kingdom, Poland, the Netherlands, Lithuania and Germany) have been selected to participate in a pilot course to achieve this goal. The paper introduces the overall concept of the project and introduces the results of a cross-country study of the current state of data use. In the conclusions, we will reflect organizational patterns of usage that emerged and we will outline further research questions.

The Data Use Survey

In order to determine the current status of the project partners' pilot schools and fit the program to their individual strengths and weaknesses (i.e. enablers and barriers), a survey (Comenius Project, 2011b) has been developed to assess the types and the extent of use of educational data.

In a preliminary study – a replication from the study by Schildkamp & Kuiper (2010) – documents (e.g. policy plans, OECD reports, etc.) and interviews with teachers and (assistant) school leaders from each country were compared and contrasted. As a result of this comparative

analysis (Comenius Project, 2011a) of the state-of-the-art of educational policy and data use in the project partners' countries the *Data Use Theory of Action* (see Figure 1) was created.

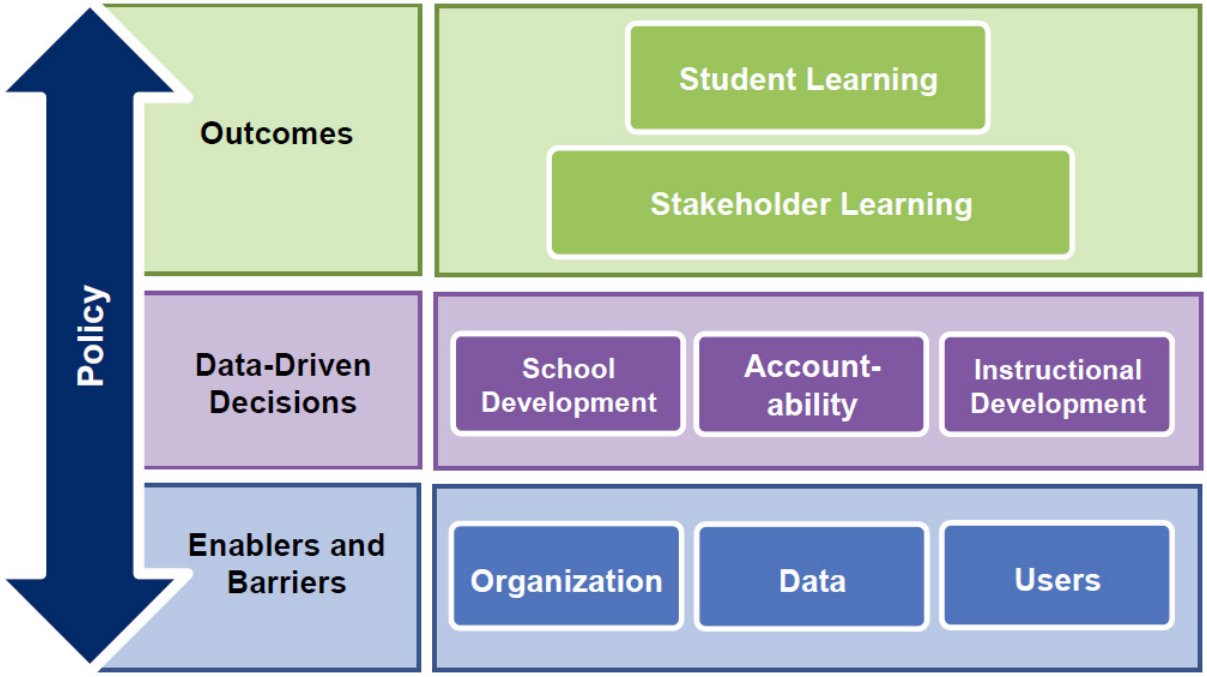

Figure 1.The data use framework.

It describes various factors which can act as *enablers* or *barriers* for data use in schools: *data* itself (i.e. its availability, accessibility and quality), its *users* (i.e. their knowledge, skills and attitudes) and the *organizational context* (i.e. availability of data use expertise, collaboration time, governance structures, etc.). The shape of these enablers and barriers influences the kinds of decisions that can be informed by data. The domains in which these decisions are made are: *school development*, *accountability purposes* and *instructional development*. The quality of these decisions depends on a maximization of enablers and minimization of barriers. Decisions that are well informed by data ultimately lead to *stakeholder learning* (i.e. teachers, school leaders, parents) and thus to an improvement of *student learning*, because educational improvements would be based on students' specific needs and grounded in best practices drawn from a variety

of sources. Finally, the comparative analysis has shown that *policy* is a major influence across all elements of the data use theory of action on outcomes that are attained by the use of data

Based on the Data Use Theory of action, the survey addressed various aspects including data characteristics, user characteristics, organizational characteristics and the current use of data in 78 items. The focus was on data access as well as organizational development procedures in place. Participants were asked to rate items (e.g. “I have access to student data within an information technology system” or “How often do you use student learning data to set learning goals for individual students?”) by their accuracy (on a 4-point Likert scale from 1=“strongly agree” to 4=“strongly disagree”) or frequency (on a 6-point Likert scale from 1=“several time a week” to 6=“rarely or never”). The survey was piloted in a pre-test, translated and then sent out to the participating schools. In four countries (i.e. United Kingdom, the Netherlands, Lithuania and Germany), the survey was administered online, in Poland the survey was distributed as a paper version.

Data Use Survey Analysis

The analysis of the responses from teachers (n=398) was divided into three steps. First, after collecting the survey results from all countries and data cleaning, the data were pre-analyzed for trends and patterns in each of the countries and across countries. Datasets and displays were created, which displayed the results as distribution in percentages and visualizations as clustered bar charts for international comparison. A look at these displays revealed recurring answering patterns throughout questions within distinct sections of the survey. This led to the assumption that the questions could be transformed into new parameters representing these eleven survey sections: (1) Data Accessibility, (2) Data Quality, (3) User

Attitudes, (4) User Skills, (5) School Leadership, (6) School Cooperation, (7) School Vision and Norms, (8) School Training and Support, (9) Using Data for Accountability, (10) for School Development, and (11) for Instructional Development.

Thus, the second step of the analysis was the transformation and validation of these new parameters for each country as well as for a cross-country analysis. This was done by the use and interpretation of *Cronbachs-α* as a measurement for reliability (Cronbach, 1951). *Cronbachs-α* was throughout high suggesting that items coherently measure the latent constructs (see Table 1) and that they could be used for further statistical analyses.

Survey item	**Latent construct assumed**	**Number of indicator variables**	**Cronbachs-α for reliability**
01-05	Data Accessibility	5 manifest / observable	0.87
06-12	Data Quality	7 manifest / observable	0.85
13-17	User Attitudes	5 manifest / observable	0.89
18-22	User Skills	5 manifest / observable	0.85
23-28	School Leadership	6 manifest / observable	0.91
29-34c	School Cooperation	10 manifest / observable	0.86
35-40	School Vision and Norms	6 manifest / observable	0.89
41-45	School Training and Support	5 manifest / observable	0.84
46-56	Using Data for Accountability	11 manifest / observable	0.87
57-65	Using Data for School Development	9 manifest / observable	0.93
66-78	Using Data for Instructional Development	12 manifest / observable	0.92

Table 1. Results of the Cronbachs-α reliability test.

As a third step, statistical correlations between the newly created parameters were analyzed. The great majority of them correlated significantly positive making for 2^{11} correlations for each country to analyze. All parameters seemed to be interdependent: If one of these scales scored low, the others would be low as well. Nevertheless, the *regression analysis* (e.g. Wonnacott, & Wonnacott, 1990, pp. 355) revealed that there was a significant difference between countries. While results within groups were rather homogeneous, results for in-between groups indicated that there were manifest differences between countries.

Hence, a further reduction of dimension was necessary to efficiently analyze and display the information. For comparing the five countries to each other an approach that would combine simplicity and fit and which would be graphically conveyable was necessary. To meet all these needs, a multivariate analysis, i.e. a cross-country and country-wise *exploratory factor analysis* by *specification search* seemed most reasonable (e.g. Anderson, 2003). The results were displayed in a *structural equation model* created with *AMOS*. Due to the significant correlations between all new parameters, the basic model consisted of 2^{11} variables. To reduce the complexity, we had only the best ten models computed, which still made for 110 (i.e. 10*11) models to find the best fit to our data. To further reduce complexity, a stepwise search was used, which works with the priority to reduce discrepancy between parameters. While calculating, a new model is only included if it has a smaller discrepancy than any previously encountered model (e.g. Arbuckle 2007, pp.351). This procedure of backward and forward calculation wears on until no further explanatory improvement for the model is detectable.

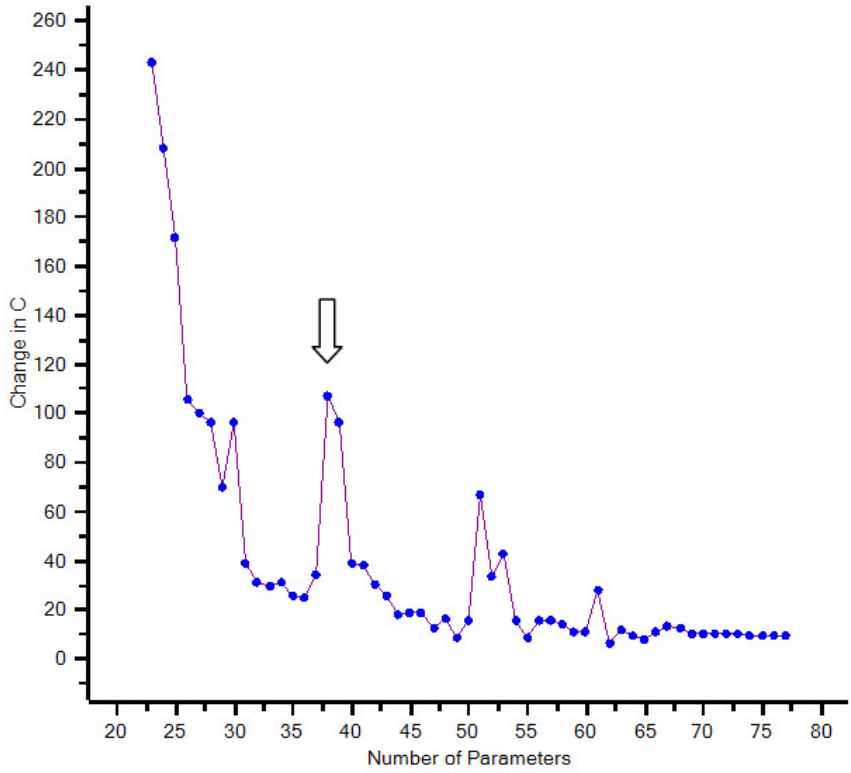

Figure 2. Scree-plot for step-wise search for cross-country models.

Figure 2 gives an impression of this process in the cross-country analysis and shows how the addition of some parameters produces shifts in the discrepancy between models. As more parameters are added the explanatory power of models increases. If responses of a sample are very homogenous, the scree-plot will take a logarithmic shape, if responses are rather heterogeneous, the scree-plot will show peaks and lows like the one above. This is because it shows the differences in C[1] for brevity when adding a parameter to the model. For example, the

[1] C is a commonly used and well validated fit measure on which many further measures for fitting a model depend. Since the aim is to compare models and watch out for complexity of interpretation all calculations are done with C.

best 38 parameter model from the calculation across all countries and factors which is marked with the arrow has a smaller discrepancy C than the best 39 parameter model. Including 38 parameters for explanation provides a substantial reduction in discrepancy. Adding parameters beyond 38 provides only slighter reductions. Thus, the 38 parameter model offers the right balance between including a graspable number of significant parameters (i.e. those that define the correlations between factors) and depicting a meaningful shift in explanatory power.

This process was repeated for the responses from all five individual countries as well as for the cross-country sample. The possibility of a bias by the comparatively large sample of Lithuanian teachers (n=173) in the cross-country analysis was statistically eliminated.

Results

The analysis shows that the intention of the Comenius project is targeting an area that is both valued as of high importance by the survey respondents and at the same time significantly underdeveloped.

Key questions were answered considerably positive by teachers from all countries (i.e. more than 50 per cent answered with “strongly agree” or “agree”) and thus show that the project meets the needs of the schools. The majority of the respondents (strongly) agreed that “it is important to use data to diagnose individual student learning needs” and that “data can offer information about students that was not already known”. Moreover, more than half of the respondents stated that their “principal or assistant principal(s) encourage data use as a way to support effective teaching”. And finally, the cooperation level seems also promising: Most “would like to collaborate more with other educators about using data”, their school “effectively

communicates school improvement goals" to them, and the respondents "share and discuss student performance data with students, parents and other teachers".

The factor analysis reveals important correlations. In the cross-country structural equation model (see Figure 3) that was selected as a result of the factor analysis, the factors *Data Accessibility* and *Data Quality*, for example, have a very high correlation of 0.7 (on a correlation scale from "0" to "1" where "1" is the maximum).

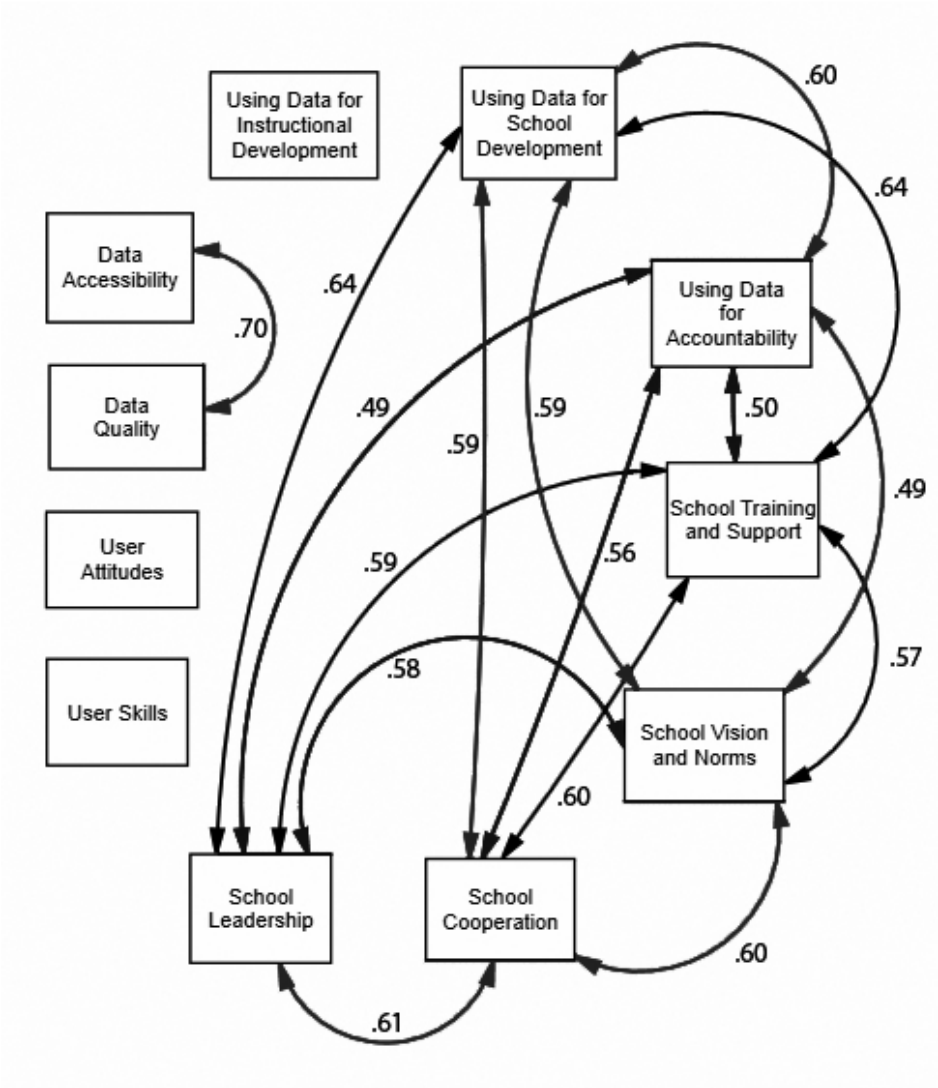

Figure 3. Cross-country model with correlation values between factors.

In the early steps of the analysis, it was proven that all scales are reliable and correlation between scales is high. As a result, it can be deducted that the factors *Data Accessibility* and *Data Quality* are highly interdependent.

It could also be observed that certain parameters are linked to others very often and others are not linked at all in this model. The factor *School Leadership*, for example, is linked to five other categories with high correlation values. Also, most of these categories are interlinked. This means that these categories have the highest influence on each other and thus on aspects of data use in all countries. This reflects the results of nearly all empirical studies on school improvement in which the role of the school leader is regarded as a necessary condition for change (e.g. Fullan, 2001; Hattie, 2009).

The factors that are not linked at all in this model are (a) *User Skills*, (b) *User Attitudes* and (c) *Using Data for Instructional Development*, which are the key elements in the goals of the Comenius project. But from the early steps in the analysis we know that everything is in fact correlated – just not significantly enough to be included in this model of best fit. At this state, the skills and mindset of EU teachers in this cross-country sample to use data for instructional development are significantly underdeveloped.

Country Highlights

Although all countries share some commonalities, there are country-specific differences which need to be considered on the way to establish informed data use in schools. For a comprehensive illustration of the current state of data use in all five countries, the model selected in the factor analysis and the mean values (see the Likert scale in *Data Use Survey*) of the new parameters were interpreted together.

Results for the United Kingdom

Overall, the English respondents (n=63) gave rather positive ratings for each of the factors. *User Attitudes* and *School Leadership* received the best ratings with a mean of 1.5. The area which seems to be lacking most is *School Training and Support* with 2.2. Also, *Data Quality* and *School Vision and Norms* have potential for improvement with 2.0.

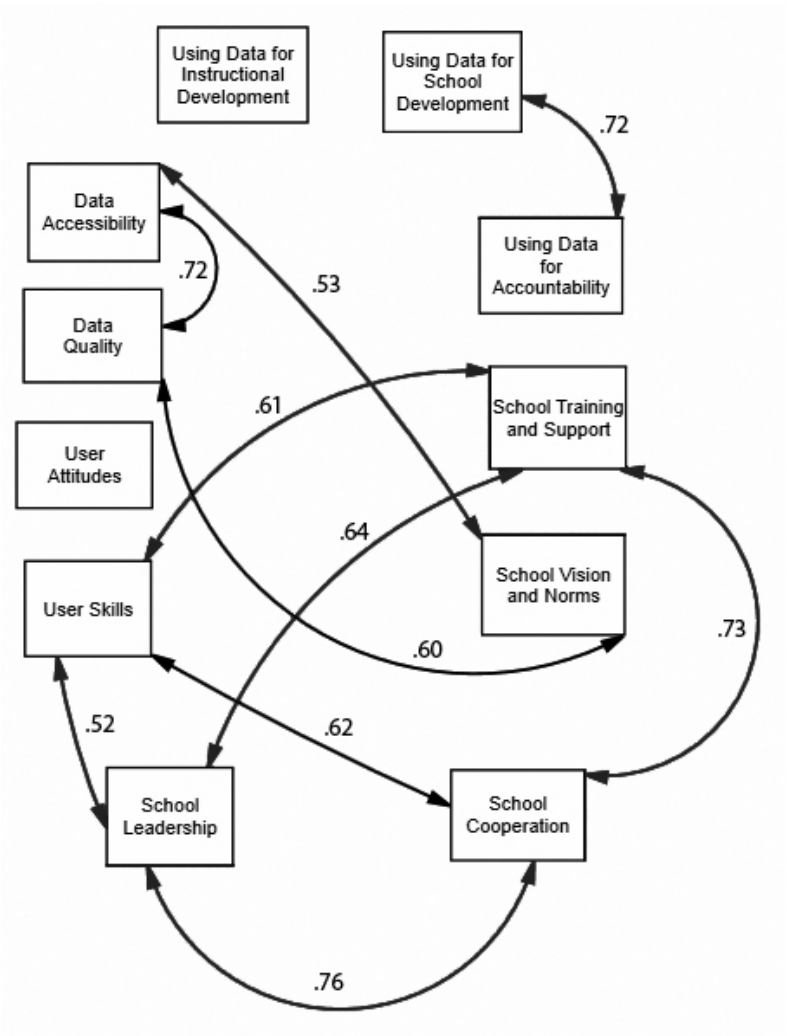

Figure 4. English model with correlation values between factors.

Two of those categories that received comparatively low ratings with regard to the overall very high mean values in the English sample are included in the model and they are linked with each other: *Data Quality* and *School Vision and Norms* (see Figure 4). It is likely that if clear visions and norms for data use in those schools were communicated, the quality of their data might improve. *School Training and Support* which ranked lowest is linked to a number of factors: *School Cooperation*, *School Leadership*, and *User Skills* (which correlates with the previous two as well). All these factors ranked very well which suggests that *School Training and Support* is a challenging area.

Results for Poland

The Polish respondents (n=64) gave good ratings in throughout all factors. *School Leadership*, *User Attitudes*, *Using Data for School* Development and *Using Data for Accountability* received the best ratings with a mean of 1.7. Also, one of the key factors (i.e. *User Skills*) is rated very well with 1.8. The areas with the lowest rating are School Cooperation with 2.0 and *School Training and Support* with 2.2.

Those two factors that received comparatively low ratings are included in the model and they are strongly interdependent: *School Cooperation* and *School Training and Support* (see Figure 5). They are both also linked with *School Leadership* – the factor with the highest mean value. Since all of these factors change together, it might prove to be a challenge to improve *School Cooperation* and *School Training and Support*.

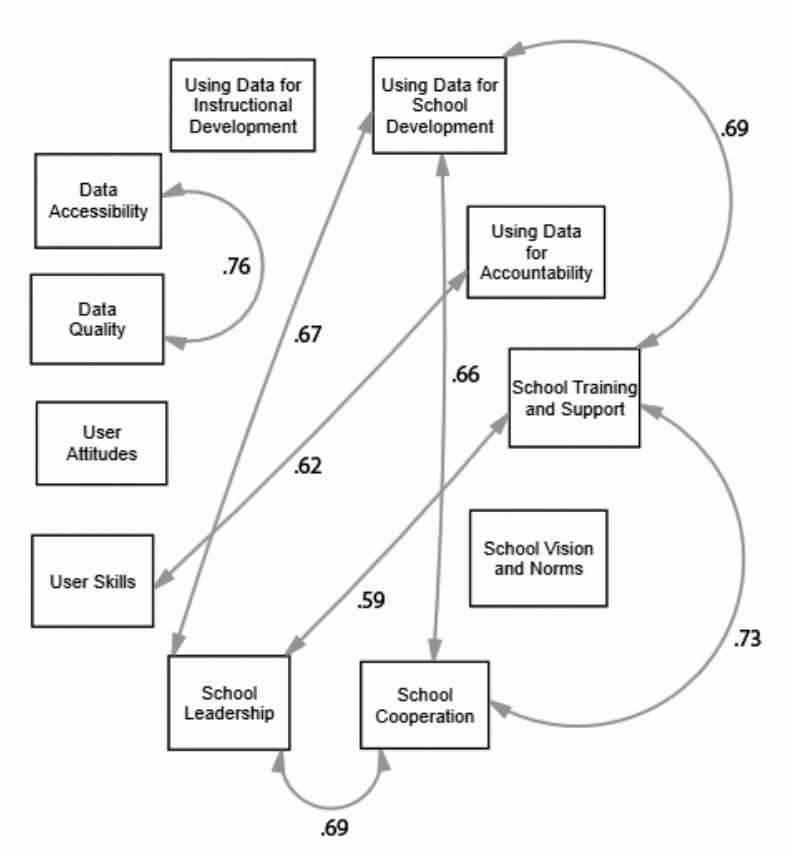

Figure 5. Polish model with correlation values between factors.

The key might lie in the correlations with *Using Data for School Development* – another factor with a very good rating – which strongly correlates with them. If School Leadership and *Using Data for School Development* both changed in a way that works towards focusing issues of cooperation, improvements might be possible.

Results for The Netherlands

The Dutch respondents (n=46) gave only average ratings in each of the factors. None of the factors reach a mean value above 2.0. The areas which ranked highest are *User Attitudes* with 2.0 as well as *User Skills* and *Using Data for Accountability* with 2.1. The factors with the lowest

ratings are *School Vision and Norms* and *School Training and Support* with 2.8 and *Using Data for School Development* with 2.6.

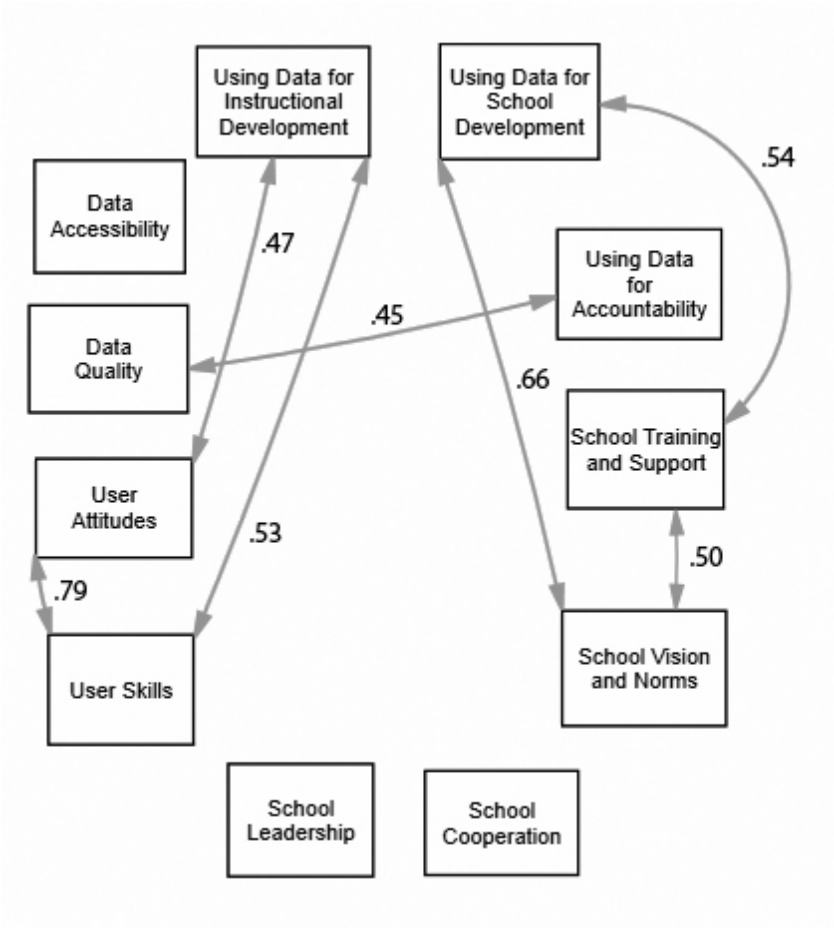

Figure 6. Dutch model with correlation values between factors.

The two factors that correlate the strongest in the Dutch model are also those that received the highest ratings from the Dutch teachers (see Figure 6). They are also linked with a rather weak factor: *Using Data for Instructional Development*. If users were to improve both *User Attitudes* and *User Skills* the result might be a positive change in *Using Data for Instructional Development*. The factors which received the lowest ratings are all connected to each other in a circular way with solid correlation values. *School Vision and Norms* correlate with *School Training and Support* which correlates with *Using Data for School Development*

which again correlates with *School Vision and Norms*. None of these factors have any other correlation in this model. This might change as other factors grow stronger during the pilot course. To bring about change in these areas, the Dutch teaches would have to establish action plans on school-level.

Results for Lithuania

Overall, the Lithuanian respondents (n=173) gave good ratings in each of the factors. The areas which ranked highest are *User Attitudes* with a mean value of 1.6 and *School Leadership* with 1.7. *User Skills*, *Using Data for School Development* and *School Cooperation* are ranked high with a mean of 1.8. *School Training and Support* is ranked lowest with 2.2 followed by *School Vision and Norms* with 2.0.

The first observation that can be made for this model is that categories are not as interlinked as in the two other countries with a similar response pattern – the United Kingdom and Poland (see Figure). But there still are some interesting correlations. Two of the highest rated factors, i.e. *School Leadership* and *School Cooperation*, correlate quite strongly. They also both correlate with *School Vision and Norms* – which is one of factors with the lowest rating. It appears that to improve *School Vision and Norms* significant changes have to occur in *School Leadership* and *School Cooperation*. *School Training and Support*, which was rated lowest, correlates with the highly rated *Using Data for School Development* as well as with *Using Data for Accountability* which in turn correlate strongly with each other.

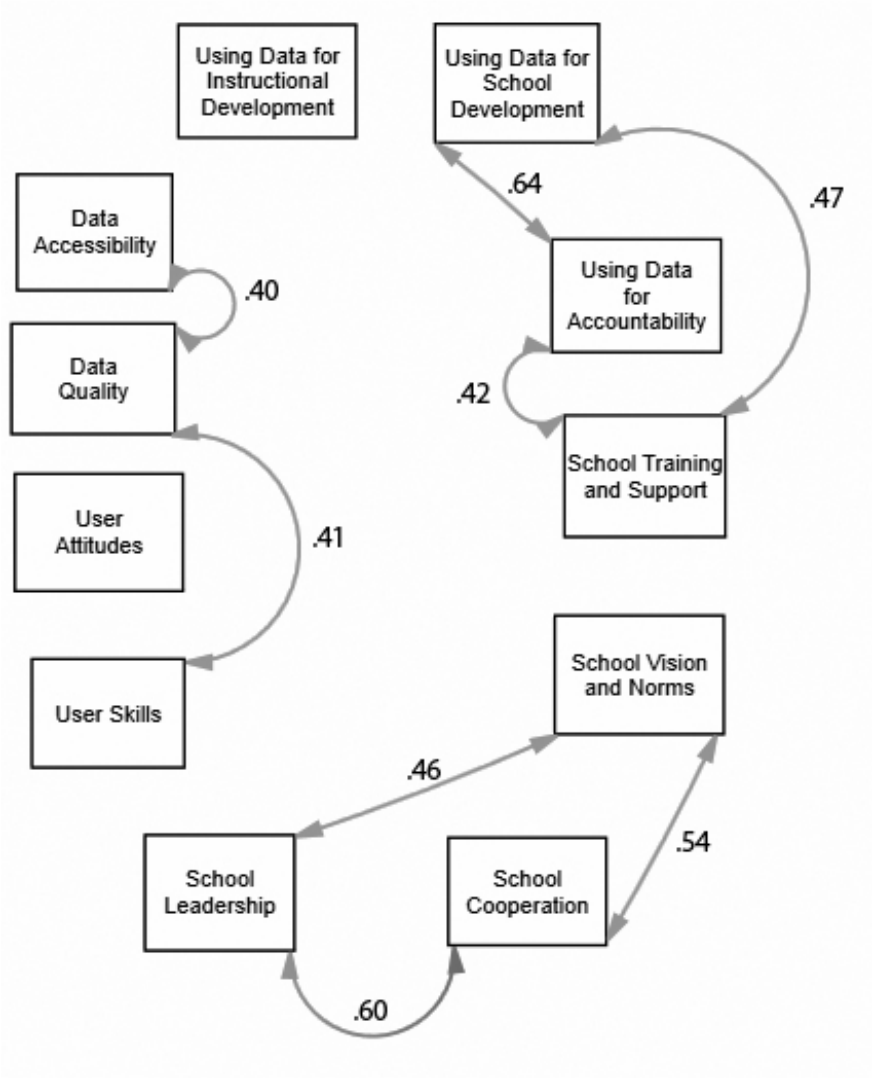

Figure 7. Lithuanian model with correlation values between factors.

From the state-of-the-art research that preceded this survey (Comenius Project 2011a) we know that *Using Data for Accountability* plays a big role in Lithuania and thus the correlation with *Using Data for School Development* is a logical consequence. To advance in this area even more, focusing on the area of *School Training and Support* might be relevant.

Results for Germany

Similar to the Dutch teachers, German respondents (n=52) gave average ratings in each of the categories, except for two outliers. The category which ranked highest is *User Attitudes* with a mean value of 1.6. The next best mean values are much lower with 2.2 for *User Skills* and 2.3 for School Cooperation. The category which ranked lowest is *School Training and Support* with 3.3. Two more categories with particular need are *Data Accessibility* with 2.9 and *Using Data for School Development* with 2.7.

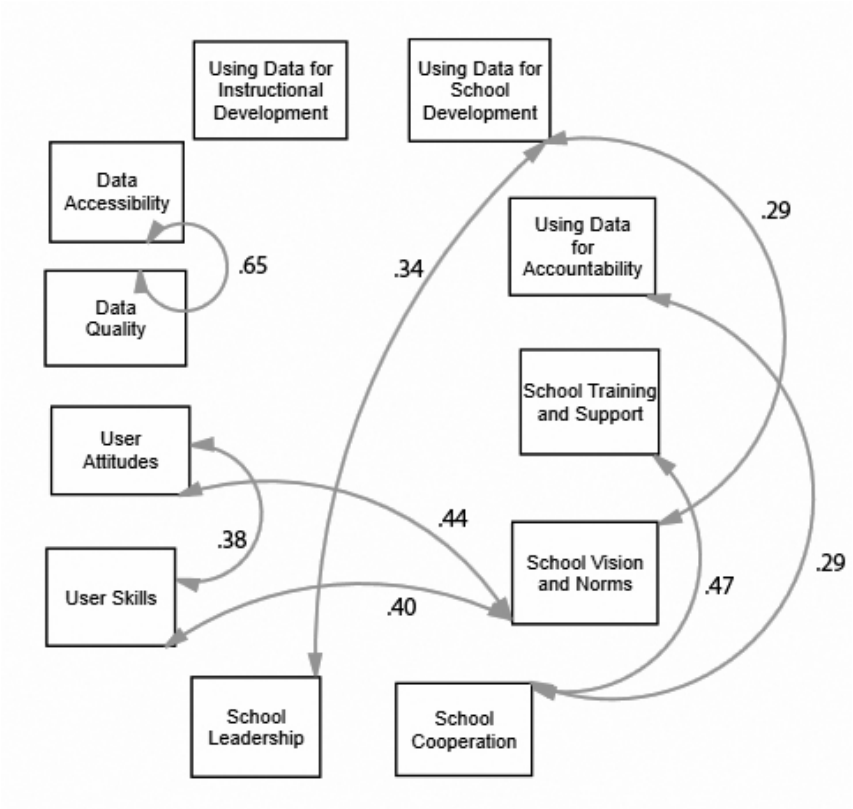

Figure 7. Lithuanian model with correlation values between factors.

The two best rated categories *User Skills* and *User Attitudes* are included in the model and they correlate with each other (see Figure 8). Interestingly, both *User Attitudes* and *User Skills* are also linked to *School Vision and Norms*. One of the weaker categories is *Using Data for School Development* which correlates with School Vision and Norms as well. Another

stronger correlation can be found with School *Leadership*. To improve Using Data for School Development it appears that both *School Leadership* and *School Vision and Norms* will have to change and that the latter will be a challenge since good results in *User Attitudes* and *User Skills* apparently are not enough to facilitate such a shift. The cross-country model suggests that a link between *School Cooperation* and *Using Data for School Development* could occur as well, so changes in *School Cooperation* which is also one of the well rated categories in Germany might lead to a correlation with and improvement of *Using Data for School Development*. Additionally, *School Cooperation* also strongly correlates with *School Training and Support* which is the most challenging factor.

Discussion

The survey analysis was an important first step in the process of establishing a school-wide culture of data use. It captured the schools' areas of strength as well as areas for improvement under key data use categories. According to the survey results, schools in Poland, Lithuania and the United Kingdom take the lead in the practice of data use while the schools from The Netherlands and Germany show lower activities in many areas. But the results for each country still show individual barriers for data use.

In the United Kingdom, the quality of data as well as the schools' visions and norms concerning data use are rated comparatively low. Additionally, school training and support were identified as areas for improvement. In Poland, cooperation, training and support in schools are on the lower end of the scale and strongly linked to each other, which makes them identified change areas. One potential key to this might lie in changes within school leadership and the use of data for school development. In Lithuania, school visions and norms are one the most

challenging factors as they correlate significantly with the very strong fields of school leadership and cooperation. Another area to focus is school training and support.

The Netherlands and Germany revealed lower ratings throughout all factors and revealed some specific challenges. In the Netherlands, skills and attitudes of teachers are rated very high, they correlate with one another and thus hold potential for improving in the field of using data for instructional development. Specific areas of need were mostly identified on school level with low ratings in school visions and norms, training and support and the use of data for school development. This continues with a lack of influence for data accessibility, school leadership and cooperation. In Germany, a particular challenging area is school training and support. A key factor seems to be cooperation within the school which might positively influence the use of data for school development. From the perspective of the teachers, data accessibility and quality are the most difficult factors for their low rating and connection to each other.

Reflecting the result of the survey, we can identify two limitations to any generalization: (1) The sample of two schools per country, and only a sub-sample of teachers in each school is too small to draw general conclusion. Currently, the results give us a first indicator about the state-as-is in selected schools from very different school systems. (2) The survey was answered by teachers and is based on their subjective perspective. As we know from quantitative research, there are limitations due to social desirability, individual interpretations of the questions and understanding of the scales. Nevertheless, this cross-national study is the first attempt to capture school-wide practices as well as norms and beliefs of teachers towards data-driven decision-making. It delivers useful results, which will be further processed and analyzed.

All countries show difficulties with the provision of training and support. The Comenius project is trying to provide this during the next phases. To determine whether the pilot course

was successful in changing the culture of data use in a positive way (and whether the non-influential factors have become part of the future model of best fit) , the survey will be administered again at the end of the course.

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