R4C

Reflecting for Change

Deliverable 1.2

School Profile and Analytics Framework

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Title	School Profile and Analytics Framework
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Abstract	This deliverable provides a detailed description of the School Profile and the Analytics Framework, namely it defines a) the types of educational to be collected and (b) the manner in which these data can be used (individually or in combination) in order to populate the school innovation profile. In order to populate school innovation profiles, the fields of Teaching, Learning and/or Academic Analytics will be utilized in order to propose an overarching School Analytics framework towards providing holistic decision support to school leaders across all school layers.
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Executive summary

This document focuses on (a) the design of the Innovative School Profile and (b) the School Analytics Framework. In order to populate school innovation profiles, the fields of Teaching, Learning and/or Academic Analytics will be utilized in order to propose an overarching School Analytics framework towards providing holistic decision support to school leaders across all school layers.

The design of the School Analytics Framework is based on the R4C School Innovation Model, and defines a) the types of educational data to be collected at different layers (with a focus on analyzing the teaching practice and the professional development of teaching staff competences and/or identity) and b) the manner in which these data can used (individually or in combination) in order to populate the school innovation profile. These educational data can be collected from different school layers from a) the two self-reflection tools to be used in the framework of the project (SELFIE and OSOS-SRT) and b) from the data of these schools (teachers' communities, students projects, teachers' competencies, students learning outcomes) that are available through the Open Discovery Space Platform. Thanks to the services of the platform the consortium will be able to monitor teaching staff competences within communities of practice and/or professional training, the development of the student's projects. The introduction presents the overall vision for the School Innovation Support Mechanism and its importance for students' future careers and community well-being. It highlights the importance and connections of the various components and its articulation with the School Innovation Model, with the pilot implementation actions, the validation structure, the School Innovation Academy, and its contribution for the School Innovation Map.

Chapter 1 presents the added value of educational analytics. Furthermore, it also presents the concepts of Teaching, Learning and Academic Analytics.

Chapter 2 presents the overall aim of a School Profile and Analytics Framework in the framework of the project.

Chapter 3 presents the various components and elements of the School Profile and Analytics Framework. It defines the specific educational data types to be collected from different layers of the school (student performance (**micro level**), continuous teaching innovation (**meso-level**), and institutional e-maturity and openness (**macro level**)).

Chapter 4 concludes the document with a summary of the School Profile and Analytics Framework and their importance for the R4C innovation vision.

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1 Added value of educational analytics

The use of data for decision-making in educational institutions is neither a new topic nor an unknown practice. Indeed, since a growing awareness dating back to the 1990s, school principals, teachers, parents, stakeholders and policy-makers started looking at quantitative data as an indispensable source for making decisions, formulating diagnoses about strengths and weaknesses of institutions, and assessing the effects of initiatives and policies, etc. The commitment to engage with a stronger use of data became quite widespread across schools, sustained by the evidence that the use of data can make an enormous difference in school reform efforts, by helping schools see how to improve school processes and student learning. This educational data can be defined as "Information that is collected and organised to represent some aspect of schools. This can include any relevant information about students, parents, schools, and teachers derived from qualitative and quantitative methods of analysis." Educational data analytics to support teaching and learning can be classified into three main types: **1. Learning Analytics, 2. Teaching Analytics and 3. Academic Analytics**.
The use of this data supports the transformation of the school into an open and e-mature learning ecosystem through a self-reflection process:

Gather Data: Where are we now (status) and where do we want to be?
Study/Analyze: What did the data/information we collected tell us?
Plan: How do we organize our work so that it aligns to our goals and resources?
Do: What strategies and action steps do staff members need to implement to meet the goals?
Gather Data II: Where are we now (status) and did we reach our goals? How effective were the strategies and action steps we implemented?

1.1 Learning Analytics

Learning Analytics have been defined as the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs.
Learning Analytics aims to support teachers build and maintain informative and accurate student profiles to allow for more personalized learning conditions for individual learners or groups of learners. Therefore, Learning Analytics can support both the collection of student data during the delivery of a teaching design and the analysis and report on student data.
According to a refence model for Learning Analytics (Chatti, Dyckhoff, Schroeder, & Thus, 2012), there are four dimensions that define the whole process:

- What? What kind of data does the system gather, manage, and use for the analysis?
- Who? Who is targeted by the analysis?
- Why? Why does the system analyze the collected data?
- How? How does the system perform the analysis of the collected data?

The "What" of learning analytics corresponds to the Data and Environments. The main issue regarding learning analytics is where the educational data comes from and the various sources of different educational data. These sources fall into two big categories: centralized educational systems and distributed learning environments. Centralized educational systems are well represented by learning management systems (LMS). LMS which are often used in formal learning settings to support distant learning or enhance typical teaching and learning methods, collect large settings of data of the users' activities and interaction data, such as reading, writing, accessing and uploading learning material and taking tests or filling in questionnaires.

On the other hand, the growth of user generated content has pointed the significance of learning analytics based on data from distributed learning environments. In this case, the data comes from formal as well as informal learning channels. It can also come in different formats, distributed across space, time, and media. As tools and solutions are getting more ubiquitous and easy to use, the challenge is how to aggregate and integrate different data from multiple, heterogeneous sources, often available in different formats, to create a useful educational data set that reflects the distributed activities of the learner; thus leading to more precise and solid learning analytics results.

The “Who” of learning analytics corresponds to the different stakeholders. The focus of Learning Analytics can be centered towards different stakeholders, including students, teachers, school heads, educational institutions. Learning analytics for students refer to the engagement to learning activities, adoption of learning styles, involvement and motivation and learning outcomes and results. Learning analytics for teachers refer to involvement in different teaching activities, creation of educational material and design of daily practices. Learning analytics for school heads and institutions refer to the management of school procedures, the planning and arrangement of systematic professional development for teachers, the formulation of a school culture and of a strategic vision. The integration of learning analytics in everyday school practice is of primary importance while on the same time ethics and data privacy issues need to be resolved

The ”Why” of learning analytics corresponds to objectives. The objectives in learning analytics are as varied as the views and needs of the different stakeholders. Some of the most common and important ones are:

Monitoring and analysis: here the objectives are to monitor the involvement in the different teaching and learning activities in order to support decision making by the teachers and the school organization. Monitoring and analysis can also refer to the educational design and the evaluation of the teaching and learning processes in order to improve the learning environment of the organization and make informed decisions on future activities.

Prediction and intervention: in this case the objective is to collect and analyse data so as that the school organization can intervene in the teaching and learning activities and suggest necessary actions to be followed as so as to help students to improve.

Assessment and reflection: The objective is to facilitate the self-reflection and (self)assessment of the learning activities and procedures. The related data is meaningful for all involved stakeholders, students, teachers and schools as they provide input about the user's interests and the learning context.

Recommendation: The objective of learning analytics in this case is to provide feedback and recommendation to learners and users regarding next steps of their processes (resources, ideas, activities) according to their needs.

The aforementioned categories are not always easy to measure and require specifically designed metrics and indicators, especially since learning analytics go way past grading and rates.

The “How” of learning analytics corresponds to the methods of collecting data. Four distinct methods and techniques can be distinguished here:

Statistics: This method provides information about the interactions of the users of learning system. Examples of usage statistics include time online, total number of visits, number of visits per page, distribution of visits over time, frequency of student's postings/replies, percentage of material read. These statistical tools often generate simple statistical operations such as average, mean, and standard deviation.

Information Visualization: Statistics in form of reports and tables of data are not always easy to interpret to the educational system users. Representing the results obtained with learning analytics methods in a user-friendly visual form might facilitate the interpretation and the analysis of the educational data.

Data Mining: Data mining is defined as "the process of discovering useful patterns or knowledge from data sources, e.g., databases, texts, images, the Web". Broadly, data mining methods fall into the following general categories: classification (supervised learning), clustering (unsupervised learning) and association rule mining. Classification is the process of finding (learning) a function (or model) that describes and distinguishes data classes or concepts, for the purpose of being able to use the function to predict the class of objects whose class label is unknown. Clustering is the process of organizing the data objects into groups or clusters, so that objects within a cluster are "similar" to each other and "dissimilar" to objects in other clusters. Similarity is commonly defined in terms of how close the objects are in space, based on a distance function. Association rule mining leads to the discovery of interesting associations and correlations within data.

Social Network Analysis: As social networks become important to support networked learning, tools that enable to manage, visualize, and analyze these networks becoming more important. This analysis is the quantitative study of the relationships between individuals or organizations.

Different techniques can be used depending on the objectives of the learning analytics. It is important to design and develop usable and useful statistical, visualization, filtering, and mining tools which can help learners, teachers, and institutions to achieve their analytics objectives.

1.2 Teaching Analytics

Teaching analytics refer to methods and tools that enable those involved in educational design to analyse their needs, processes and work in order to reflect on and improve them prior to and after the teaching activities. The aim of the collection of teaching analytics data is facilitate and support the reflect on the teaching activities (as a whole or specific elements) and finally to improve learning conditions for their learners. The study of teaching analytics data is highly related to insights from their implementation using Learning Analytics

Teaching Analytics can be used to support teaching planning:
Analyze classroom teaching design for self-reflection and improvement

- Visualize the elements of the lesson plan.
- Visualize the alignment of the lesson plan to educational objectives / standards.
- Validates whether a lesson plan has potential inconsistencies in its design.

Analyze classroom teaching design through sharing with peers or mentors to receive feedback

- Support the process of sharing a lesson plan with peers or mentors, allowing them to provide feedback through comments and annotations.

Analyze classroom teaching design through co-designing and co-reflecting with peers

- Allow peers to jointly analyze and annotate a common teaching design in order to allow for co-reflection.

1.3 Academic Analytics

Academic analytics is the process of evaluating and analysing organisational data from the systems of educational institutions for reporting and decision-making reasons. If a distinction is drawn with learning analytics, academic analytics are typically focused at the level of the institution or above, whereas learning analytics are typically focused at the level of the individual.
Academic analytics also, refer to data-driven decision making practices for informing operational purposes at the Institutional level. Academic Analytics are addressed at providing school leaders with support for managing the organizational development processes of the educational organization.
Academic Analytics take a strong standpoint in terms of the organizational processes, but also the educational level. It is of primary importance that academic analytics are studied in relation to the learning and teaching analytics so as more informed decisions can be taken.

2 Aim of the School Profile and Analytics Framework

Reflecting for change (R4C) aims at proposing an advanced support framework, as well as a set of core policy recommendations, to schools seeking to introduce a type of holistic change that will ensure a meaningful uptake of sustainable innovation, with an emphasis on achieving improved learning outcomes. In the **R4C** approach, innovation is understood in terms of a school's pathway to digital maturity (e-maturity) and its comprehensive relationship to the use of ICT, as well as a school's pathway to openness demonstrated in its relationship with external stakeholders, in parental engagement, in fostering the well-being of its community as a whole, in its ability to combine the delivering of the curriculum with a study of local challenges, in its willingness and capacity to share its achievements with other schools and in its engagement with contemporary Responsible Research Innovation (RRI) challenges

Furthermore, **R4C** looks at how schools can be supported in using these tools to understand the current position of the organisation and build on the results to define and implement suitable action plans by providing a step by step support mechanism for school heads and teachers. R4C will study the actual processes and unique pathways (rather than looking simply into variations in scores) from self-reflection results to concrete actions in the school as a learning ecosystem, in key areas such as Teacher CPD, school management, school openness, technology integration, innovation uptake, community engagement, social responsibility and others. This is a school's window to the world with info about the school, its areas of interest and expertise, information about how the school level of digital maturity (e-maturity) and openness and how this affects the learners and the perception of the external parties of the school as well. It is also an instrument to attract national and international collaborations, especially in the designing and delivering of RRI projects and on themes and challenges that are shared with other schools, but also with actors such as research institutions, universities, museums, businesses that may also be in the hunt for partnerships.

To do so, it is essential to create holistic School Innovation Profiles based on data from different layers of the school:

- **student performance** (micro level), which refers to the learning and assessment practices occurring either within or beyond the physical premises of the school. For example, indicative factors at this layer include the students of the school, as they engage in the learning process.
- **continuous teaching innovation** (meso-level), which refers to the monitoring and evaluation of the teaching staff skills and practices as well as the curriculum planning procedures of the school. For example, indicative factors at this layer include the teachers of the school, as they engage in the design of their daily practice.
- **institutional e-maturity and openness** (macro level), which refers to the organizational development processes of the school. For example, indicative factors at this layer include the principals of the school, as they orchestrate the management of school and arrange for systematic professional development for teachers, as well as the teachers of the school as they contribute in formulating a school culture and a strategic vision with the principals.

The educational data types that can be collected are:

- **Students' data** (could be potentially collected from the micro layer mainly as a school innovation benchmark means). This data type is mainly related to aggregated (e.g. with questionnaires) students' assessment scores.

  The purpose for collecting these data is:

  - *For the meso layer*, to assess and/or compare teaching strategies effectiveness, based on the aggregated assessment scores of their students. Furthermore, it may also facilitate the leadership team to engage in curriculum (or course) amendments to address recurring low performance incidents from students.

    - *For the macro layer*, to allow for overviews of aggregated student performance scores (e.g., aggregated level of educational objectives attainment) which are necessary for meeting external accountability mandates towards parents, district, regional, and/or national educational authorities.
- **Teaching staff demographics and competences** (meso layer). This data type is related to teaching staff individual information, such as age, gender, formal qualifications, years of teaching experience and most importantly, level of competence (e.g., digital competence) etc.

  The purpose for collecting these data is:

    - *For the meso layer*, to allow the leadership team to have an administrative overview of the teaching staff. Beyond mere administrative overview, this is potentially useful for better assignment of teaching staff to classes/courses, based on their (competence/experience/etc.) profiles. Finally, such data can be utilized for providing personalized recommendations of teaching practice (e.g., lesson plans, supporting digital tools, etc) to teaching staff, by taking into account their existing competences.
    - *For the macro layer*, to allow for the leadership team to have an overview of the workforce characteristics for administrative tasks. Furthermore, such data could also provide the baseline for performing analyses in relation to other school data so as to identify sources of potential shortcomings, such as low student performance attributed to a novice teacher or an adopted teaching strategy not well supported by the teacher's competence profile. Such knowledge might also facilitate the leadership team to effectively promote and support the teaching staff's professional development
- **Teaching staff educational designs** (teaching practice) (meso layer). These data are related to capturing (and analyzing) the teaching practice in a transparent and shareable manner, for example through lesson plans. The means to collect these data is usually manual, via authoring of the lesson plans and/or educational scenarios by the teaching staff. Furthermore, these can also be collected for re-use within the school from (online) communities of practice. In the context of the proposed project, an educational design analyzer will be designed and developed in order to enable analysis of teaching practice in terms of the use of ICT exploited.

  The purpose for collecting these data is:

    - *For the meso layer,* to potentially allow the leadership team assess and/or compare teaching strategies effectiveness (e.g., alignment to external mandates that possibly promote specific teaching approaches or educational tools). Furthermore, having a transparent depiction of teaching practice can also provide the means for comparing the effectiveness of different teaching practices adopted within the school (or even across schools).
    - *For the macro layer*, to allow for the leadership team to identify specific shortcomings in the teaching practice and, therefore, plan for targeted professional development
- **Teaching staff level of participation in (formal or informal) professional development** (meso layer). This data type is related to monitoring the level (and outcome) of teaching staff engagement in professional development opportunities. Examples of such professional development can include accredited formal training or informal participation in (online) communities of practice. The means to collect these data is usually manual, based on the teaching staff self-reporting of the professional development hours they have engaged with. Moreover, their participation (and level of contribution) in online communities of practice can also be monitored and exploited so as to potentially infer competence development data. In the context of the proposed project, an analyzer of teacher' community engagement (in professional development context) will be designed and developed in order to enable the analysis of the teaching staff participation in communities and academies of professional development, so as to infer their competences (and its development).

  The purpose for collecting these data is:

- *For the meso layer*, to have an overview of the professional development activities of their teaching and support staff and whether it is aligned to the overall school strategic plan. Additionally, the teaching staff competence profile could be automatically updated based on their level of engagement and completion of professional development courses.
- *For the macro layer*, to combine these data with other educational data (e.g., teaching staff competence profiles and their level of educational resources use) so as to identify specific competence-related shortcomings of their teaching staff and plan for targeted professional development activities. Moreover, from another perspective, these data can also be exploited by the leadership to automatically update their teaching staff (and potentially schools') competence profiles.

- **School Infrastructure and resources management** (macro layer). These data types are related to the planning and overview of the school infrastructural resources, both physical and digital. Examples of such data include the school physical lab equipment or the monitoring of the stock and quality of services of the school library. The means to collect these data is commonly manual, based on the administration's input. Furthermore, data related to the monitoring of the well-state of operation and levels of usage for digital infrastructures can also be collected automatically through integrated school intranet network.

  The purpose for collecting these data is:

  - *For the meso layer*, these data can allow the teaching staff to appropriately design their practice, by considering the contextual affordances of their school infrastructure. For example, the availability of lab equipment or digital infrastructure is a significant factor that should influence the design (and delivery) of the learning process.
  - *For the macro layer*, to have an overview of the school infrastructure so as to identify potential shortcomings (based on their strategic plan) and perform appropriate procurements/upgrades.
- **Institutional openness** (macro layer). These data are related to the level of openness of the school as an organization and the level of the adoption of an open school culture by the school community. Examples of such data include the number of the collaborations with non-formal and informal education providers, enterprises and civil society enhanced to ensure relevant and meaningful engagement of all societal actors with science and increase the uptake of science studies and science based careers, employability and competitiveness. Furthermore, data related to the effective parental engagement.

  The purpose for collecting these data is:

  - *For the meso layer*, these data can allow the teaching staff to appropriately design their practice, by considering collaborations with other stakeholders and the local community
  - *For the macro layer*, to have an overview of the school readiness to build partnerships that foster expertise and networking and that will facilitate the transformation of the school into a sustainable innovation ecosystem that acts as an agent of community well-being.
- **Institutional ematurity** (macro layer). These data are related to the digital maturity or e-maturity of a school. Examples of such data show evidence of a whole-school ICT policy that outlines a vision and strategy and conveys a positive attitude to the use of ICT in our school. Related data can also provide information on ICT integration across the curriculum in learning and teaching and on the level that staff understand how ICT can be used in the curriculum to improve student learning. Accordingly, data that provide an insight of the awareness of the school community that ICT has an impact on the quality of learning and teaching, pupils' attitudes and behavior and the wider school community. Data that provide information on the level of use of appropriate ICT resources to support particular learning environments and of the deployment of appropriate ICT resources that reflect the plan for future improvement and development of ICT as outlined in the whole-school policy.

Furthermore, data related to the level that the members of the school community 1) evaluate data, information and digital content, 2) collaborate through digital technologies, 3) manage their digital identity, 4) develop digital content and 5) protect their personal data and privacy

The purpose for collecting these data is:

- *For the meso layer*, these data can allow the teaching staff to appropriately design their practice, by making effective use of ICT in all levels of teaching and learning.
- *For the macro layer*, to have an overview of the school's pathway to digital maturity (e-maturity) and its comprehensive relationship to the use of ICT.

3 The R4C School Analytics Framework

The School Analytics framework (introduced by Sergis and Sampson, 2015), builds upon the different levels of educational data and proposes a holistic framework to support the complex tasks of school organisations as learning ecosystems. The elements of the proposed framework provide school leaders but also the whole school community with the capability to monitor and scan the performance of the different levels of the school and to have access to robust evidence on the outcomes that it delivers and how can it be adjusted to drive organizational progress.

The different tasks that the school analytics framework should monitor are:

Learning Process Monitoring. This task relates to the monitoring of the learning processes that occur at the student performance (micro) level. Data types related to this leadership task can include (a) types of instructional practices and processes designed and delivered and (b) method of utilized learning resources and tools

Learning process Evaluation. This task relates to the utilization of the data from monitoring the learning process and their analysis towards designing actions for improvement of the teaching and learning processes of the school. For example, this can include an evaluation of the efficiency of the adopted instructional practices (and/or learning resources and tools) using the learners' academic performance, feedback and level of participation/ engagement as a benchmark. A low level of the latter can assist school leaders to identify specific aspects of the teaching practice which were ineffective

Learner Performance Monitoring. This task relates to the disaggregated (for the student performance level), as well as aggregated (for the continuous teaching innovation level) data related to the learners' academic performance. These data can include among others, behavioral issues of the learners, absenteeism rates, level of participation within the learning activities and level/type of interactions with the teacher/leader/parents

Learner Performance Evaluation. This task mainly relates to the assessment of the learners' academic performance based on the data collected from monitoring their progress and actions during the learning process (both within and beyond the physical premises of the school). This evaluation could be diagnostic, formative and/or summative and generate corresponding feedback loops

Curriculum Planning. This task relates to the identification of issues related to the existing curriculum and the actions towards remedy. These issues are mainly elicited from the feedback loops of the previous tasks and can relate either to shortcomings identified at a micro level (e.g., general difficulty of learners to cope with a specific curriculum section) or to externally imposed mandates (e.g., new subject domain standards).

Teaching Staff Management. This task relates to the monitoring and management of the teaching staff of the school in terms of both teaching performance (e.g., through the monitoring of the teaching processes and the related competences of the teachers) as well as operations (e.g., attendance, demographics and payroll)

Teaching staff Professional Development. This task relates to the identification of potential shortcomings in the teaching staff's competences and the organization and promotion of appropriate professional development opportunities to alleviate. Moreover, it can refer to the tasks of selecting and recruiting of new teaching staff, more appropriate for the school System needs

District Stakeholder Accountability. This task relates to formulating and sustaining communication channels with interested stakeholders of the school in order to allow for capturing their own feedback loops towards capturing the level in which they affect the school System's level of emergence. Examples of such two-way feedback loops can include retention rate reports and financial reports of the school addressed at the policy makers, policy mandates from the policy makers to the school, as well as continuous two-way communication and collaboration between the teachers, students and the parents of the latter

Infrastructural Resource Management. This task relates to the monitoring and management (e.g., monitor, maintenance, procurement) of the infrastructural assets of the school, such as hardware and software equipment

Financial Resource Management. This task relates to the monitoring and orchestration of the financial aspects of the school, such as budget formulation, accounting tasks and external funding

Learner Data Management. This task relates to the overall management of learners' data, such as demographics, tuition fees and prior academic background. Apart from the strictly administrative need for record keeping, such data types (which, like staff management, are related to the characteristics of a set of System's agents) can be exploited as a means to explain the interactions of these agents with the rest of the System. Therefore, this information can facilitate in the (at least partial) understanding of the current level of System emergence

3.1 Institutional e-maturity and openness (macro level)

The key areas for monitoring the Institutional e-maturity and openness level are described in the following:

Organisational and Cultural Change: The Schooling Innovation Model proposes a change on how the schools should operate. Schools should integrate aspects that up to now in most cases were not included in their plans and strategies. These changes in the school organisational structure as well as the cultural change that is necessary to involve external stakeholders will be measured in order to monitor the impact the project's activities. A School Development Plan along with a self-reflection school instrument will provide direct feedback from school units.

Pedagogy: The activities of an open and e-mature school are based: Sparking Interest and Excitement; Understanding Scientific and Digital Content and Knowledge; Engaging in Scientific Reasoning; Reflecting on Innovation; Using the Tools and Language of Science; Identifying with the Scientific Enterprise. In this framework the aim is to study students' attitudes (interest and motivation) as well as the development of crucial skills (e.g. collaboration and problem solving).

Technology – tools, services and infrastructure: Quantitative and qualitative assessment of the teaching technology pedagogies and infrastructures, while not enforcing "tech-push", but to utilize Mark Prensky's (2005) cultures of tech innovation, with indicators of 1) Dabbling 2) Old things/old ways 3) Old things/new ways 4) new things and new ways. This is to include direct classroom tools, formal and informal processes, community-building and social media approaches

In order to collect meaningful data on the Institutional e-maturity and openness level, the focus should be on three levels of improvement of the school's organizational change (performance), the Management Level, The Process Level and the Teachers' Professional Development Level.

Management Level: This level refers to the school management. It describes how the school works or should work following the specific strategies, setting goals, developing a common vision, monitoring the overall process, introducing reflective procedures and adopting the strategy based on the feedback received as well as managing the resources available.

Process Level: This level refers to the processes and the activities that the school is implementing in the framework of the project and beyond. In this level the project team will monitor if the school is using the proposed pedagogical methods and the community building tools offered by the project. The outcomes of the assessment here could also inform the project team on how to develop services that could facilitate the school transformation process more effectively.

Teachers' Professional Development Level: This level refers to the opportunities for professional development (PD) that the school as an organisation is offering. The project team will examine if these PD activities are focused and systematic, if innovative approaches are used, if the school is taking advantage of external opportunities like the ERASMUS+ and eTwinning programmes to secure funding for teachers PD, if the knowledge gained through these activities is shared among the members of the school community and if the school has established mechanism to assess the impact of these activities to everyday teaching.

For each one of the above-mentioned levels a proposed R4C self-reflection tool will reflect upon 8 aspects.

	Management Level	Process Level	Teacher's Professional Development Level
1	Vision and Strategy	School Leaders and Teachers Shaping Learning Systems	Teacher Awareness and Participation
2	Coherence of Policies	Creating an inclusive environment	Setting Expectations
3	Shared Vision and Understanding	Collaborative environments and tools (co-creation, sharing)	Professional Culture
4	Education as a Learning System	Implementing Projects	Professional Competences, Capacity Building and Autonomy
5	Responsible Research, Reflective Practice and Inquiry	Parents and external stakeholders' involvement in school's activities/projects	Leadership Competence
6	Motivation Mechanisms	Reflect, Monitor, Debate	Collaborative learning (mobility actions)
7	Plans for Staff Competences	Learning Processes adaptation	Collaborative learning (ICT Competences)
8	Communication and Feedback Mechanism	Established collaboration with local, national institutions	Use and reuse of resources

For each one of the 8 aspects in each level the school has to choose one statement that correspond to the actual situation at the time. Each statement corresponds to a school typology, according to the school's readiness to adapt an open and e-mature schooling culture.

According to the response in each one of the aspects the school will be characterized as:

ENABLED	CONSISTENT	INTEGRATED	ADVANCED
Schools that are at an initial stage of incorporating educational innovation in the classroom and beyond	Schools that have achieved a certain level of innovation and openness through specific measures, educational ICT tools, best practices, CPD, but they still consist isolated cases without a network of other schools and external partners to facilitate the process	Schools that have achieved a high degree of innovation and openness and they have already established cooperation with community stakeholders and other external partners	Schools that are considered rather extreme cases of schools that offer a glimpse to the open school of the future

The use of the R4C self-reflection tool will give the opportunity to the schools to plan their own actual processes and unique pathways from self-reflection results to concrete actions in the school as a learning ecosystem, in key areas such as Teacher CPD, school management, school openness, technology integration, innovation uptake, community engagement, social responsibility and others. The R4C self-reflection tool will give schools an insight of their level of openness and ematurity. It can highlight what is working well, where improvement is needed and what the priorities should be.

Examples of analysis of the data regarding institutional e-maturity and openness (macro level).

In the framework of the Open Discovery Space (ODS) project, two e-maturity (self-reflection) questionnaires assessing change/impact were completed by 400 schools. An increase in the e-maturity scores of 355 schools was recorded, while in 45 lowered scores were observed. Results from all e-maturity questionnaires show an increase of 8.61 % in the digital maturity of schools after 1 year.

Figure 1 shows a comparison between the two measurement schedules. Increased response scores were recorded in the categories ‘‘leadership and vision’’ (14.9 %), ‘‘professional development’’ (10.5%) and the introduction of ‘‘ICT in the school curriculum’’ (7.15 %). The ODS whole-school approach seems to affect the culture of the participating schools regarding the ICT exploitation and the leadership/ vision of schools’ staff. Access to numerous resources offered the opportunity to find resources that meet teachers’ varying needs, while the interaction with peers and the access to unique educational content and activities presents great opportunities for the CPD of teachers. The significant increase in these categories was an indication that community building succeeded due to ODS participation.

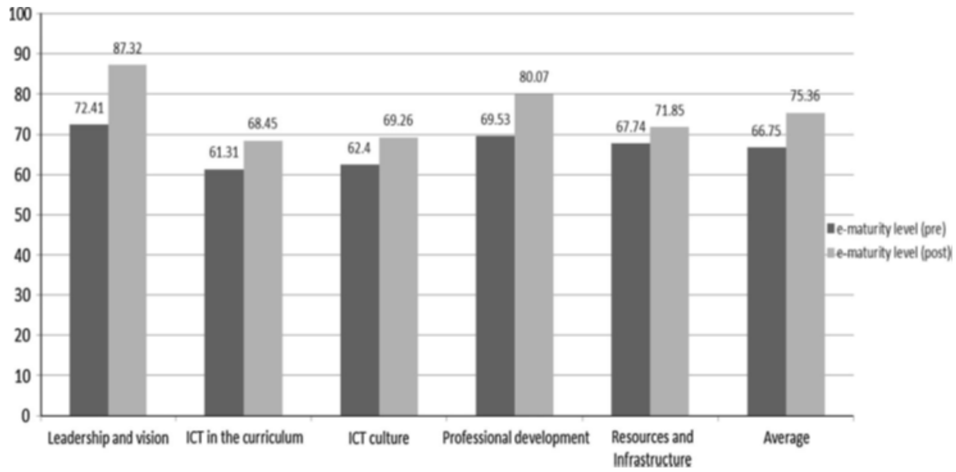


Figure 1. Pre- and post-e-maturity levels of the 400 European schools under study in the Open Discovery Space project

In the framework of the Open Schools for Open Societies project, a network of schools in 15 EU countries implemented innovative projects progressively adopting the open school culture. Figure 2 presents the results of an in-depth analysis of the performance of 500 Open Schools in openness (using the OSOS self-reflection tool) – following the clustering/mentoring approach introduced by the OSOS approach. The data demonstrate significant growth in openness (>15% on average) while the growth is much higher for less advanced schools (goes up to 45%) in a one-year intervention. Further analysis demonstrates that the school’s performance towards openness continues also after the second year of intervention at the same level OSOS has demonstrated at scale the process of transforming schools to innovative ecosystems, acting as shared sites of learning for which leaders, teachers, students, and the local community share responsibility, over which they share authority, and from which they all benefit through the increase of their communities’ science capital and the development of responsible citizenship.

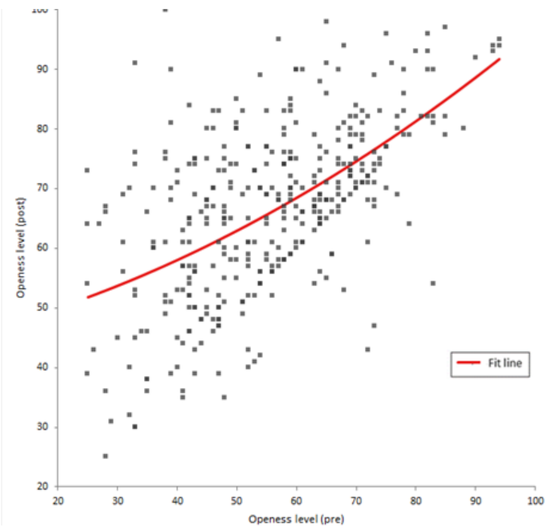


Figure 2 Open Schools' performance in openness – following the clustering/mentoring approach of the OSOS Coordination Action (data from 500 Schools). The data demonstrate significant growth in openness (>15% on average) while the growth is much higher for less advanced schools (goes up to 45%) in a one-year intervention.

3.2 Continuous teaching innovation (meso-level)

The focus of the data collection and analysis on this level refers to the monitoring and evaluation of the teaching staff skills and practices as well as the curriculum planning procedures of the school.

Implementing change requires a teacher to experiment with innovative (from the teachers' perspective) pedagogic approaches. From an organisational perspective, the school head will need to implement an environment that supports experimentation by celebrating success and regarding failures as unique chances to learn. In true learning organisations, teachers are supported to take necessary risks (all changes come with risk taking and perceived uncertainty) and feel appreciate when they share the successes and failures.

Open and e-mature schools must provide learning opportunities not just for students, but also for the teachers. Any significant modification to the way instruction is delivered requires watchful change management. Professional development should be a continuing, integrated part of teachers' instructional careers. Current practiced development requires careful planning, job-embedded and hands-on activities directly linked to the curriculum, plenty of follow-up, built-in evaluation using several assessment techniques, adequate time, sustained funding, and the willingness of educators to take on new and expanded roles. School heads and teachers have to invest time and resources to create a successful implementation and professional development.

There are a series of challenges that schools heads should consider when planning and implementing professional learning for their teachers:

- Selecting and introducing ideas in ways that foster trust and interest;
- Balancing administrator leadership and control versus teacher autonomy and independence;
- Planning, initiating, and monitoring implementation of training that inspires ambition as opposed to ambivalence;
- Ongoing support of industrious implementation, even in the face of challenges or setbacks; and
- Recognizing, celebrating, and rewarding accomplishments in ways that sustain positive change.

These actualities highlight the continuing need to change teaching practices in modern schools. This modification only could be created through professional learning opportunities that confirm currency with pedagogical methods, including developing technologies.

Furthermore, teacher competence frameworks can be of primary importance in describing the changing role of teachers in an open and e-mature school. It is useful to distinguish between teaching competences and teacher competences. Teaching competences are focused on the role of the teacher in the classroom, directly linked with the 'craft' of teaching -with professional knowledge and skills mobilised for action. Teacher competences imply a wider, systemic view of teacher professionalism, on multiple levels –the individual, the school, the local community, professional networks. The R4C School Analytics Framework is based on the belief that teachers need to use teaching methods which are appropriate for evolving knowledge societies. Students need to be enabled not only to acquire an in-depth knowledge of their school subjects but also to understand how they themselves can generate new knowledge, using ICT as a tool. For some teachers, perhaps for many teachers, these will be novel and challenging ideas, and it will take time for teachers to understand these new approaches to teaching. It will also require strong leadership from the government, from those responsible for the education and professional learning of teachers and from headteachers and school principals. This framework is divided in 6 categories:

Understanding ICT in education on policy level

- Identify key characteristics of classroom practices and specify how these characteristics serve to implement policies
- Explain and analyze the principles of using ICT in education. Describe how these principles can be put into practice in their own teaching. Analyze what issues arise in implementing these principles and how those issues can be addressed
- Design, implement, and modify school-level education reform programmes that implement key elements of national education reform policies

Curriculum and Assessment

- Match specific curriculum standards to particular software packages and computer applications and describe how these standards are supported by these applications
- Identify key concepts and processes in the subject area, describe the function and purpose of subject-specific tools and how they support students' understanding of these key concepts and processes and their application to the world outside the classroom
- Develop and apply knowledge- and performance-based rubrics that allow teachers to assess students' understanding of key subject matter concepts, skills, and processes
- Identify and discuss how students learn and demonstrate complex cognitive skills, such as information management, problem solving, collaboration and critical thinking
- Help students to use ICT to acquire the skills of searching for, managing, analyzing, evaluating and using information
- Design units of study and classroom activities that integrate a range of ICT tools and devices to help students acquire the skills of reasoning, planning, reflective learning, knowledge building and communication
- Help students to use ICT to develop communications and collaboration skills
- Help students develop both knowledge- and performance-based rubrics and apply them to assess their own understanding of key subject matter and ICT skills. Help students to use these rubrics to assess other students' work

Pedagogy

- Describe how didactic teaching and ICT can be used to support students' acquisition of school subject matter knowledge
- Incorporate appropriate ICT activities into lesson plans so as to support students' acquisition of school subject matter knowledge
- Use presentation software and digital resources to support
- Teaching is student-centered in this approach and the teacher's role is to provide direct instruction in consciously skilled ways and to structure problem tasks, guide student understanding, and support student collaborative projects.

- Describe how collaborative, project-based learning and ICT can support student thinking and social interaction, as students come to understand key concepts, processes, and skills in the subject matter and use them to solve real-world problems
- Identify or design complex, real-world problems and structure them in a way that incorporates key subject matter concepts and serves as the basis for student projects
- Design online materials that support students' deep understanding of key concepts and their application to real world problems
- Design unit plans and classroom activities so that students engage in reasoning with, talking about, and using key subject matter concepts while they collaborate to understand, represent, and solve complex real-world problems, as well as to reflect on and communicate solutions
- Structure unit plans and classroom activities so that open-ended tools and subject-specific applications will support students in their reasoning with, talking about, and use of key subject matter concepts and processes while they collaborate to solve complex problems
- Implement collaborative, project-based unit plans and classroom activities, while providing guidance to students towards the successful completion of their projects and attainment of deep understanding of key concepts
- The role of teachers in this approach is to explicitly model the learning processes and create situations in which students apply their developmental skills.
- Design online materials and activities that engage students in collaborative problem-solving, research or creating art
- Help students design project plans and activities that engage them in collaborative problem-solving, research, or artistic creation
- Help students incorporate multimedia production, web production and publishing technologies into their projects in ways that support their ongoing knowledge production and communication with other audiences
- Help students reflect on their own learning

ICT

- Describe and demonstrate the use of common hardware
- Describe and demonstrate the basic tasks and uses of word processors, such as text entry, editing text, formatting text and printing
- Describe and demonstrate the purpose and basic features of presentation software and other digital resources
- Describe the purpose and basic function of graphics software and use a graphics software package to create a simple graphic display
- Describe the Internet and the World Wide Web, elaborate on their uses, describe how a browser works and use a URL to access a website
- Use a search engine
- Create an email account and use it for a sustained series of email correspondence
- Describe the function and purpose of tutorial and drill and practice software and how it supports students' acquisition of knowledge of school subjects
- Locate off-the-shelf educational software packages and web resources, evaluate them for their accuracy and alignment with curriculum standards, and match them to the needs of specific students
- Use networked record keeping software to take attendance, submit grades, and maintain student records
- Use common communication and collaboration technologies, such as text messaging, video conferencing, and web-based collaboration and social environments
- Operate various open-ended software packages appropriate to my subject matter area, such as visualization, data analysis, role-play simulations, and online references
- Evaluate the accuracy and usefulness of web resources in support of project-based learning in a subject area
- Use an authoring environment or tools to design online materials

- Use a network and appropriate software to manage, monitor, and assess progress of various student projects
- Use ICT to communicate and collaborate with students, peers, parents and the larger community in order to nurture student learning
- Use the network to support student collaboration within and beyond the classroom
- Use search engines, online databases, and email to find people and resources for collaborative projects
- Describe the function and purpose of ICT production tools and resources (multimedia recording and production equipment, editing tools, publication software, web design tools) and use them to support students' innovation and knowledge creation

Organisation and Administration

- Integrate the use of a computer laboratory into ongoing teaching activities
- Manage the use of supplemental ICT resources with individuals and small groups of students in the regular classroom so as not to disrupt other instructional activities in the class
- Identify the appropriate and inappropriate social arrangements for using various technologies
- Place and organize computers and other digital resources within the classroom so as to support and reinforce learning activities and social interactions
- Manage student project-based learning activities in a technology-enhanced environment
- Describe the function and purpose of virtual environments and knowledge-building environments, and use them to increase knowledge and understanding of subjects in the curriculum and to develop online and face-to-face learning communities
- Describe the function and purpose of planning and thinking tools and use them to support students' creation and planning of my own learning activities and my continuous reflective thinking and learning

Teacher Professional Development

- Integrate the use of a computer laboratory into ongoing teaching activities
- Manage the use of supplemental ICT resources with individuals and small groups of students in the regular classroom so as not to disrupt other instructional activities in the class
- Identify the appropriate and inappropriate social arrangements for using various technologies
- Place and organize computers and other digital resources within the classroom so as to support and reinforce learning activities and social interactions
- Manage student project-based learning activities in a technology-enhanced environment
- Describe the function and purpose of virtual environments and knowledge-building environments, and use them to increase knowledge and understanding of subjects in the curriculum and to develop online and face-to-face learning communities
- Describe the function and purpose of planning and thinking tools and use them to support students' creation and planning of my own learning activities and my continuous reflective thinking and learning

An open and e-mature school promotes more flexible and creative ways of learning by improving the way educational content is produced, accessed and used, by fostering sharing and collaboration and by making the teacher a core node and change leader of a developing community of peers. The evolution of school and teacher communities, involving more and more members of the school community and being populated with more and more user-generated digital resources, is a very important indicator of a school's openness and e-maturity. These communities are the catalyst for introducing innovation in the school settings. Special attention should be given to the teacher's engagement in designing and developing innovative activities. Examples of data to be collected are: Number of communities that a teacher has created or is participating in, number of innovative school projects the teacher has designed and implemented and the participation in teacher professional development events (summer schools, seminars).

Data to be collected	
1	Number of communities that the teacher participates in
2	Number of communities that the teacher creates
3	Number of educational resources that the teacher creates
4	Number of school projects that the teacher creates
5	Number of webinars that the teacher participates in
6	Number of summer schools that the teacher participates in

Examples of analysis of the data regarding continuous teaching innovation (meso-level)

In the framework of the Open Discovery Space project, more than 400 school and thematic communities were established during the study period from the headmasters and the teachers of the participating schools. The community-building process was a crucial parameter in the ODS intervention: As communities were the main reference point for the school activities, the hub to the digital resources and materials (offered by the ODS) was generated by the involved teachers in the framework of the implementation phase. These communities were either public or private according to the school policy. The evolution of the communities, involving more and more members from the school staff and being populated with more and more user-generated digital resources, was another important indicator of the success of our intervention. These communities were the catalyst for introducing innovation in the school settings. Furthermore, the school communities were interconnected within the framework organized during the implementation phase. Figure 3 through Figure 5 show the evolution of such communities (represented by dots) and the establishment of connections (represented by lines) between them for a period of 12 months.

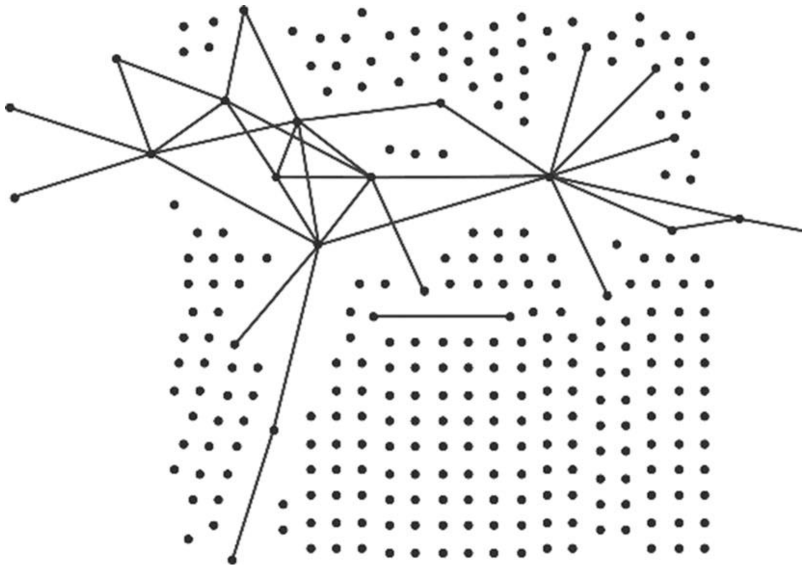


Figure 3. ODS communities' graph with single nodes being depicted (1st trimester). Each dot represents a single teacher community per school.

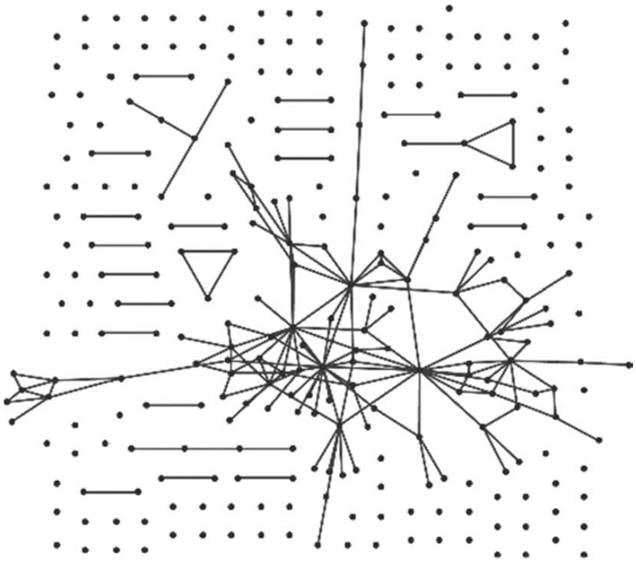


Figure 4. ODS communities Evolution (2nd trimester)

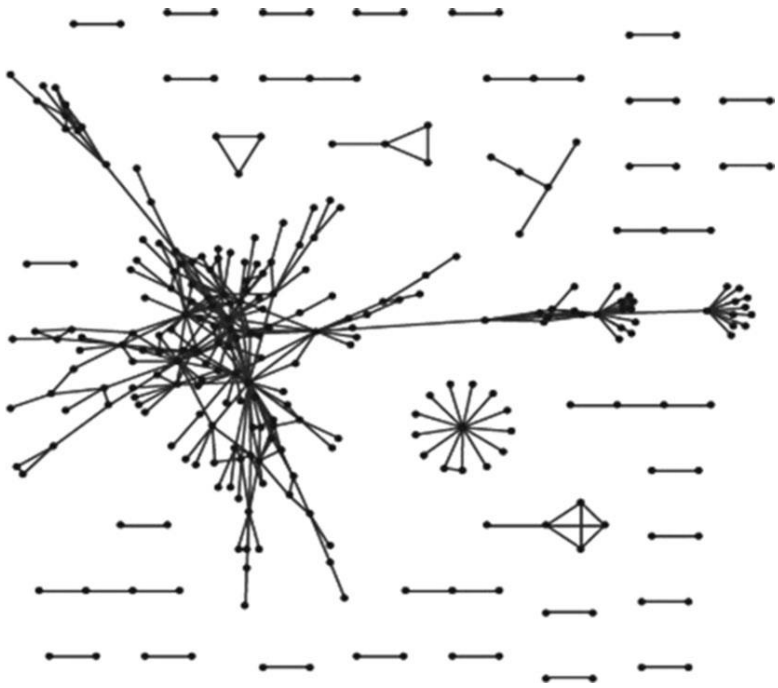


Figure 5. ODS Communities Evolution (4th trimester)

At the same time, one of the aims of the Open Discovery Space (ODS) model/approach was to provide the tools and mechanisms to support the members of the communities to become developers of educational content. Teacher communities (school based or thematic ones) are the spaces where educational content can be created. Figure 6 shows that one out of three registered users of the ODS portal (36 %) created and shared his/her educational resources with at least one community. Active contributors of the ODS portal far exceed previous findings for the conventional use of such an educational portal. This demonstrates that the provision of guidance and support and the implementation of an effective community strategy could have significant impact on the teachers' motivation to share their own resources and educational activities. The ODS community-building approach seems to support the development of trust between the members of the community and help teachers to become contributors and creators of educational content.

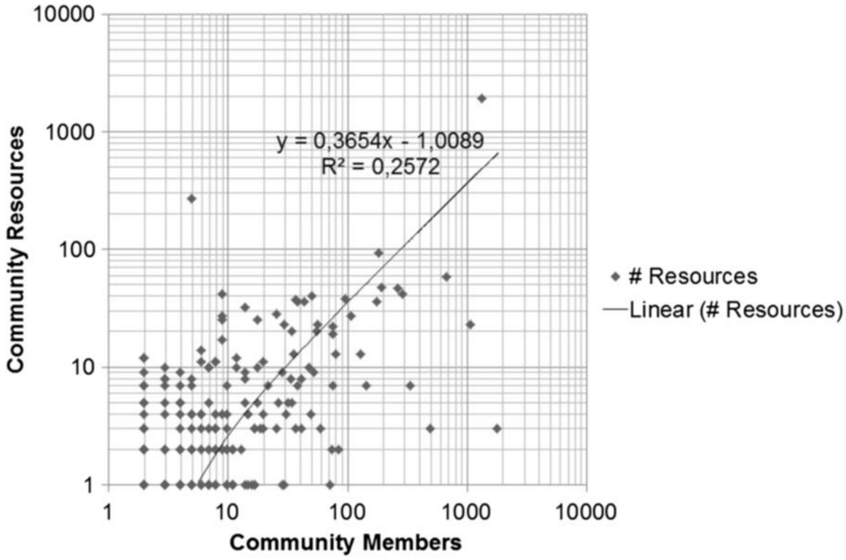


Figure 6. Creation of resources by school communities' members

3.3 Student performance (micro level)

The focus of the data collection and analysis on this level refers to the learning and assessment practices occurring either within or beyond the physical premises of the school. On this level, different pedagogical challenges should be taken into consideration: Learners as Creators of Educational Content, Collaborative Learning, Shift to Deeper Learning Approaches and Rethinking How Schools Work.

According to the NMC HORIZON Report 2015 K-12 "a shift is taking place in schools all over the world as learners are exploring subject matter through the act of creation rather than the consumption of content". Today a vast array of digital applications is available to support this transformation in K-12 education; indeed, the growing accessibility of mobile technologies is giving rise to a whole new level of comfort with producing media and prototypes. Many Educators believe that honing these skills in learners can lead to deeply engaging learning experiences in which learners become the authorities on subjects through investigation, storytelling, and production. The R4C Schools Analytics Framework takes into consideration the use of the collaborative tools for creating school projects and educational content.

Collaborative learning, which refers to learners or Educators working together in peer-to-peer or group activities, is based on the perspective that learning is a social construct. The R4C School Innovation Model (on which the R4C Schools Analytics Framework is based upon) involves activities that are focused around four principles: placing the learner at the center, emphasizing interaction and doing, working in groups, and developing solutions to real-world problems in the framework of the creation of the story. Collaborative learning models are proving successful in improving student engagement and achievement, especially for low performing learners.

At the same time, the Schools Analytics Framework should look into data concerning Deeper learning that combines the goals of standardized testing with soft skills such as mastering communication, collaboration, and self-directed learning. The ultimate goal is to assess a student's performance through more than just test scores. Project-based learning and inquiry-based learning have proven their efficiency in fostering more active learning experiences, both inside and outside the classroom. As technologies, such as tablets and smartphones are more readily accepted in schools, Educators are leveraging these tools to connect the curriculum with real life applications. These approaches are decidedly more student-centered, allowing learners to take control of how they engage with a subject. In advance examples of this trend, learners are able to brainstorm solutions to pressing local and global problems and begin to implement them in their communities.

PISA 2012 assessment framework has highlighted the importance of the problem-solving competence. Consequently, the School Analytics Framework will also collect data regarding this issue and the cognitive methods needed to solve real world problems. The acquisition of increased levels of problem-solving competence provides a basis for future learning, for effective participation in society and for conducting personal activities. Students need to be able to apply what they have learned to new situations. The study of individual students' problem-solving strengths provides a window on their capabilities to employ basic thinking and other general cognitive approaches to confronting challenges in life.

Furthermore, a highly important indicator of school openness and e-maturity on the micro level, is the positive impact on learning outcomes such as the increased student motivation and the increased interest in science and technology.

Some examples of ways to collect meaningful data regarding the students' engagement are:

3.3.1 SMQ Science Motivation Questionnaire

In general, motivation is the internal state that arouses, directs, and sustains goal-oriented behavior (Glynn, 2011). In particular, motivation to learn refers to the disposition of students to find academic activities relevant and worthwhile and to try to derive the intended benefits from them (Brophy, 2004). In studying the motivation to learn science, researchers examine why students strive to learn science, how intensively they strive, and what beliefs, feelings, and emotions characterize them in this process.

In the social-cognitive theory of human learning (Bandura, 2001, 2005, 2006), students' characteristics, behaviors, and learning environments are viewed interactively. Within this theoretical framework, learning is most effective when it is self-regulated, which occurs when students understand, monitor, and control their cognition, motivation, and behavior (Schunk, 2001; Schunk & Pajares, 2001). Motivated students achieve academically by strategically engaging in behaviors such as class attendance, class participation, question asking, advice seeking, studying, and participating in study groups (Pajares, 2001, 2002; Pajares & Schunk, 2001).

A construct, such as motivation to learn science, is not a directly observable variable. For this reason, a construct is often called a latent variable. Although a construct cannot be directly observed, it can be measured by means of items that serve as empirical indicators of how the construct is conceptualized by students. A construct could be conceptualized by students either as a unitary entity or as one with dimensions (sub-constructs). Students' conceptualizations of a construct may differ somewhat from how experts conceptualize it and describe it in the literature (Donald, 1993). Students' conceptualizations are important in their own right, however, particularly within a social-constructivist view of learning science, because students' conceptualizations influence their actions (McGinnis et al., 2002; Scott, Asoko, & Leach, 2007).

The Science Motivation Questionnaire II (Glynn) consisted of the following five subscales/factors, indicating that they were related to the six motivational components that influence self-regulated learning. Factor 1: intrinsic motivation; Factor 2: self-efficacy; Factor 3: self-determination; Factor 4: career motivation; Factor 5: grade motivation (each 5 items).

The students found science intrinsically motivating (interesting, enjoyable, etc.) when it was personally relevant (valuable, important, etc.) and vice versa. When the students' had high self-efficacy (I am confident, I believe I can, etc.), they were not anxious about assessment (I am nervous, I worry, etc.), and this was evident in their explanations of their motivation to learn science.

Glynn found **no significant differences in total scores** on the Science Motivation Questionnaire due to **gender**; however, there were small, meaningful score differences on the factor-based scales, which indicated that different profiles of motivation to learn science were associated with gender. The scores on the **self-efficacy and assessment anxiety scale** were **higher among the men then the women**, suggesting that the men had more confidence and less anxiety than the women did.

3.3.2 Intrinsic Motivation Inventory (IMI)

The Intrinsic Motivation Inventory (IMI) is a multidimensional measurement device intended to assess participants' subjective experience related to a target activity in laboratory experiments.

It has been used in several experiments related to intrinsic motivation and self-regulation (e.g., Ryan, 1982; Ryan, Mims & Koestner, 1983; Plant & Ryan, 1985; Ryan, Connell, & Plant, 1990; Ryan, Koestner & Deci, 1991; Deci, Eghrari, Patrick, & Leone, 1994). The instrument assesses participants' interest/enjoyment, perceived competence, effort, value/usefulness, felt pressure and tension, and perceived choice while performing a given activity, thus yielding six subscale scores.

The interest/enjoyment subscale is considered the self-report measure of intrinsic motivation; thus, although the overall questionnaire is called the Intrinsic Motivation Inventory, it is only the one subscale that assesses intrinsic motivation, per se. As a result, the interest/enjoyment subscale often has more items on it that do the other subscales. The perceived choice and perceived competence concepts are theorized to be positive predictors of both self-report and behavioral measures of intrinsic motivation, and pressure/tension is theorized to be a negative predictor of intrinsic motivation. Effort is a separate variable that is relevant to some motivation questions, so is used it its relevant. The value/usefulness subscale is used in internalization studies (e.g., Deci et al, 1994), the idea being that people internalize and become self-regulating with respect to activities that they experience as useful or valuable for themselves.

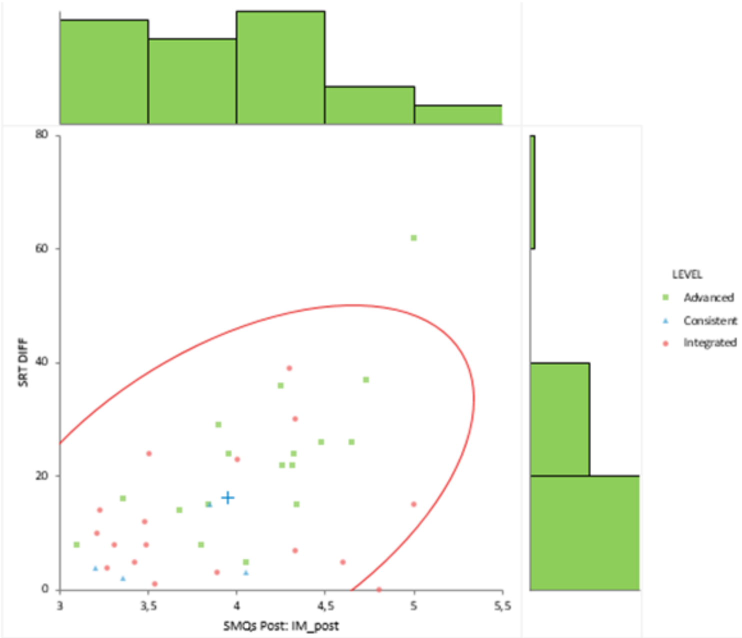
The IMI items have often been **modified slightly to fit specific activities**. Thus, for example, an item such as "I tried very hard to do well at this activity" can be changed to "I tried very hard to do well on these puzzles" or "...in learning this material" without effecting its reliability or validity. As one can readily tell, there is nothing subtle about these items; they are quite face-valid. However, in part, because of their straightforward nature, caution is needed in interpretation.

Another issue is that of redundancy. Items within the subscales overlap considerably, although randomizing their presentation makes this less salient to most participants. Nonetheless, shorter versions have been used and been found to be quite reliable. Still, it is very important to recognize that multiple item subscales consistently outperform single items for obvious reasons, and they have better external validity.

Furthermore, interesting information can be extracted from monitoring the students' involvement in innovative activities. Examples of data to be collected are: number of innovative school projects the student has participated, collaborated and presented.

Examples of analysis of the data regarding student performance (micro level)

The Open Schools for Open Societies project implemented large scale pilots including a variety of activities in more than 1200 schools in 15 countries. Thus, the challenge was to use a validation setting appropriate for a variety of projects applied in different settings with varying duration, themes, focus and additional research questions with a large number of participants. For this, the use of Interest and Motivation Questionnaires was promoted. A more in-depth analysis was conducted for the initial 100 OSOS Schools focusing on students' interest and motivation. The Interest and Motivation Questionnaires analysis was conducted with 1642 participants that completed the pre and post questionnaires to ensure comparableness of the different parts of the evaluation procedure. As an overall result there is an increase in interest and motivation of students after implementing activities following the proposed approach (see Figure 6). Furthermore, it was observed that the schools while they are increasing their openness level (so the organizational changes are realised) at the same time the students involved in activities increase their interest and motivation on science.



N	38

Correlation

Pearson's r	SMQs Post: IM_post	SRT DIFF
SMQs Post: IM_post	-	0,510
SRT DIFF	0,510	-

Figure 6: The graph demonstrates that the increased Self-Reflection Tool scores of the OSOS schools has significant impact on the increase of students' interest in science. This applies not only for the more "advanced" schools but also for the "consistent" and the "integrated" ones. The data were acquired from 1642 students who were involved in the OSOS project activities in the initial OSOS Schools.

4 Conclusion

If schools are to have the best possible chance of stimulating innovation, they must turn to data analytics. Much has been made of the benefits that data can bring to business and organisations alike in recent years. In truth, data is without any real value unless you can draw insights from it to make better decisions that drive success.

If schools are to make data valuable, they should build a culture around data. This means putting data right at the centre of all conversations – and it is a necessary step towards making informed decisions and uncovering insights into areas like operations, human resources or stakeholder engagement. After all, key decisions should be made based on facts or knowledge, rather than a knee-jerk or gut feeling reaction.

Schools must establish a strong culture of data use to ensure that data-based decisions are made frequently, consistently, and appropriately. This data culture should emphasize collaboration across and within grade levels and subject areas to diagnose problems and refine educational practices. Several factors (e.g., planning, leadership, implementation, and attitude) affect the success schools will have with developing and maintaining a data culture.

A clear plan for schoolwide data use is essential to developing such a culture. Schools should establish a representative data team to help ensure that data activities are not imposed on educators, but rather are shaped by them. This team should develop a written data-use plan that is consistent with broader school goals, supports a common language related to data use and teaching and learning concepts, and establishes data use as one of the key responsibilities of an education professional.

Schools can make concrete changes that encourage data use within schools. These changes need to ensure that teachers, principals, and staff have a thorough understanding of their roles in using data, and that they possess the knowledge and skills to use data appropriately. Schools should invest in leadership, professional development, and structured time for collaboration. They also may need to invest in additional resources, including relevant technologies and specialized staff.

R4C proposes the School Analytics Framework which is based on the R4C School Innovation Model, and defines a) the types of educational data to be collected at different layers (with a focus on analyzing the teaching practice and the professional development of teaching staff competences and/or identity) and b) the manner in which these data can used (individually or in combination) in order to populate the school innovation profile. These educational data can be collected from different school layers from a) the two self-reflection tools to be used in the framework of the project (SELFIE and OSOS-SRT) and b) from the data of these schools (teachers' communities, students projects, teachers' competencies, students learning outcomes) that are available through the Open Discovery Space Platform. Thanks to the services of the platform the consortium will be able to monitor teaching staff competences within communities of practice and/or professional training, the development of the student's projects.

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