Journal of Education and e-Learning Research
Vol. 10, No. 1, 36-42, 2023
ISSN(E) 2410-9991 / ISSN(P) 2518-0169
DOI: 10.20448/jeelr.v10i1.4337

Data-driven decision making as a model to improve in primary education

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Abstract

The digital evaluation field is a new area that arises in the core of education and studies highlight the importance of editing data as well as using ICT to drive internal school improvement. Data- Driven Decision Making (DDDM in advance) executes relatively simple models on carefully targeted data extracted through target questionnaires. This article contributes to the creation of a DDDM plan that considers the evaluation of a primary school in Greece. The research design is based on the DigCompOrg model and uses a quantitative technique through a questionnaire. The results presented include the analysis of the teaching team. Extracted data enabled the researchers to identify the requirements that the specific school must meet in order to proceed with self-evaluation in its digitalization process. The percentage results for teachers' self-perception of ICT use in lessons, teachers' digital competence, digital content use, pedagogical evaluation, digital communication with parents and digital support of school leadership indicated that significant changes in ICT integration continue to occur in the specific primary school, ICT culture and most of its components. For these reasons, this article presents a proposal for a DDDM theoretical model plan for primary school improvement presented at the end.

Keywords: Data driven decision making, DigCompOrg, ICT competence, Primary school, School improvement, Self-evaluation.

Citation | Maria, A., Maria Paz, P. E., & Isabel, G. P. (2023). Data-driven decision making as a model to improve in primary education. *Journal of Education and E-Learning Research*, *10*(1), 36–42. 10.20448/jeelr.v10i1.4337
History:
Received: 6 September 2022
Revised: 8 November 2022
Accepted: 24 November 2022
Published: 12 December 2022

Publisher: Asian Online Journal Publishing Group

Funding: This study received no specific financial support.
Authors' Contributions: All authors contributed equally to the conception and design of the study.
Competing Interests: The authors declare that they have no conflict of interest.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained.
Ethical: This study followed all ethical practices during writing.

Contents

Contribution of this paper to the literature

This paper's contribution to the literature review delves deeply into the main substance of digital evaluation fields. This article combines the various uses of the DigCompOrg framework and data-driven decision-making fields in order to create a plan for primary school improvement based on real data extracted from a primary school.

1. Introduction

The concept of digital competence is highlighted in different reports prepared by institutions and governments interested in the educational field (Redecker, 2017).The European Framework for Digitally Competent Educational Organizational or DigCompOrg is the model that best describes the process of digitalization at schools (Redep, Balaban, Zugec, Calopa, & Divjak, 2019) because it involves all the aspects of digital learning in different educational organizations and helps educational organizations with self-reflection and self-assessment (Kampylis, Punie, & Devine, 2015). The DigCompOrg concept is a digitally competent organization that achieves better results from different angles (Fernandez & Prendes, 2021).

In addition to this model, the literature review confirms the significant role of data in the digital educational era (Ng & Wakenshaw, 2017). By analysing digital data available on individual student actions and teachers, the research could have great outcomes for more specific evaluation (Gutiérrez Castillo, Cabero Almenara, & Estrada Vidal, 2017). "Data-driven decision making" is the field that best describes using data in education to make decisions and then making those decisions based on that data. New studies underlying the notion that assessment tools are oriented at processing data as well as using ICT to drive internal school improvement (OECD, 2015b). This suggests that educational quality is likely to be improved when decision makers develop policies and implement practices informed by relevant assessment data (Cox et al., 2017).

1.1. The Path to Educational Digitalization in Order to Improve Schools through DDDM

According to research by Pettersson (2018) and Vanderlinde and van Braak (2010), organizational, cultural and administrative change (Vanderlinde & van Braak, 2010) as well as competences acting within the school organization (Hauge, 2016) are all necessary for digital transformation at the organizational level. Digitalization should be considered an organizational task in order to have deep and sustainable change as well as school improvement. There is a great need to develop flexible tools for institutions (Bacigalupo, 2022; Hauge, 2016). Digitalization means data (Sestino, Prete, Piper, & Guido, 2020) and certainly data means data- driven decision making.

The European Commission released in 2015 the "European Framework for Digitally Competent Educational Organizations" known as DigCompOrg (Kampylis et al., 2015).The main objectives of the model are two: 1) promote self-reflection and self-assessment in their commitment to learning and digital pedagogies and 2) guide educational policies in the design and evaluation of integration programs of digital learning technologies (Fernandez & Prendes, 2021). DigCompOrg becomes a cross-sector conceptual model that promotes system change applicable in any context, looking for greater digital efficiency (Đurek, Ređep, & Divjak, 2017). Various studies have emerged that researchers could use this concept for their own purposes: for the construction of one's own (Redep et al., 2019) to reflect on pedagogies of Information and Communication Technology (ICT in advance) learning (Fedeli, 2017; Sebastian Lopez & De Miguel Gonzalez, 2017), for the preparation of ICT implementation plans (Brolpito, Lightfoot, Radišic, & Scepanovic, 2016; Giunti, Naldini, & Orlandini, 2018), for the identification of specific areas that needs improvement (Malach & Kostoloányová, 2017) or even for the construction of evaluation models (Campelj, Karnet, Brodnik, Jereb, & Rajkovič, 2019).

On the other hand, DDDM for smart policies and effective education is growing as a potential in education (Kurilovas, 2020). Over a decade of research has called for better use of data in education (Reeves, Pun, & Chung, 2017). Despite that, most schools and local education agencies still struggle to fully use their data to make better decisions (Grissom, Rodriguez, & Kern, 2017; Slavin, Cheung, Holmes, Madden, & Chamberlain, 2013). Organizational and political issues as well as a random approach to data storage have prevented the use of data to improve school performance and student and teacher experiences (Cech, Spaulding, & Cazier, 2018).

There are many types of DDDM models that can be used for creating a plan for an organization (Castellani & Carran, 2009). Each model can be adapted in order to enhance the needs of a school organization. In the sense of the above, this study proposes a DDDM plan for school improvement. All of the models are cyclical because of the changing nature of data (Castellani & Carran, 2009). This article highlights the importance of using the most useful sources to effectively extract the data needed to answer the questions developed in the previous step and that source is the teachers' questionnaire. The data are then analyzed and interpreted during the next step. From this step, a data-based plan must be developed and implemented (Castellani & Carran, 2009; Schildkamp, Poortman, Luyten, & Ebbeler, 2017).This article supports the below steps in order to have a DDDM plan for school improvement. These are: 1) Setting a vision 2) Choosing the appropriate data resource 3) Collecting the data 4) Analysing and evaluating the results.

In DDDM, research states that goal setting is placed at the top of the goals (Schildkamp, 2019). These goals need to be concrete and measurable (Mandinach & Honey, 2008; Schildkamp, 2019). The most important thing is that data collection be related to the targeted goals, next sense-making should be considered through these goals and actions should be directly focused on these goals. Finally and very important step, evaluation focuses on whether or not the goals were achieved (Schildkamp, 2019).

2. Research Method

By combining and mapping the identified institution-wide data types with the fundamental basics of self-evaluation and digital competences, this article presents and formulates the statements of its content. A DDDM self-evaluation plan focusing on digital competences is presented in particular based on the findings of DigCompOrg (Kampylis et al., 2015) and extracted data from school.

In the light of all of these statement, there is no statutory evaluation (OECD, 2017) of digital competences in Greece. This study tries to "extract" actual data from a Greek school based on DigCompOrg and apply it in a data-driven decision making model. The evaluation is obliged to rotate through new models of digital skills (Van Der Vlies, 2020) of all the factors that are involved in a school. For this reason, this inquiry presents below an analysis of data based on the six dimensions of DigCompOrg which are: 1) School Leadership 2) Infrastructure and Equipment 3) Teaching and Learning 4) Student Digital Competence 5) Continuing Professional Development and 6) Assessment Practices (Kampylis et al., 2015) as a high command of the digital area that we live. That is purely the reason why we need to monitor and evaluate the new data in a school (Sergis & Sampson, 2014).

Based on the above, the following research questions were raised: Can we design a model of evaluation based on DDDM and DigCompOrg at the same time? And also, is the combination of both a good way to evaluate the schools? As a general objective is defined the design of a decision making plan based on a DDDM model and the results obtained by this research. Adding to the above, the following are proposed as specific objectives:

1. To analyse how the variables in this model (DigCompOrg) affect each other from the teacher's perspective in order to have self-evaluation and school improvement.
2. To design a decision-making plan based on a theoretical DDDM model and the results obtained by this research.

This is descriptive research that is used to discover associations and a relationship between selected variables and to answer questions based on the on-going events of the present and uses a quantitative method.

2.1. Context

This study was carried out in a school in a Dodecanese residential area and in the centre of Rhodes Island in Greece. It is a big school with 2 groups of classes at each level from nursery school to secondary school. In general terms, the children who attended this school had a high socio-cultural level. It is considered to be a high standard school. The school has long experience with all kinds of projects mainly of an environmental and cultural nature (Malik, 2020). It has participated successfully in local, national and international contests and networks in recent years. Participation in such institutions includes activities such as teaching interventions relevant to the topics, outdoor visits and activities invitations to representatives of specialization to come to school and speak to parents, teachers and pupils. The relationship between teachers and other groups including parents and the school consultant is excellent. Moreover, the staff of the school is very experienced, fluent in English and also familiar with digital competence. Therefore, the school participates in many projects. When this research conducted, the school belonged to and participated in the European programs such as Erasmus and E-twinning as well as programs promoting sustainable development.

2.2. Instrument

Regarding the structure of the questionnaire, it is clear that it was designed to be relevant to the six areas proposed by DigCompOrg (Kampylis et al., 2015) and specifically to the Self-reflection on Effective Learning by Fostering the use of Innovative Educational technologies (SELFIE in advance) instrument which can be adapted to the needs of each school by adding or removing some questions (Broek & Buiskool, 2020). As indicated, the SELFIE questionnaire currently consists of the following six areas: A: Leadership, B: Infrastructure and Equipment, C: Continuing Professional Development, D: Teaching and Learning, E: Assessment Practices, F: Student Digital Competence (European Commission, 2018b; Fernandez & Prendes, 2021),as the formulated questionnaire of the current research. It is very important to notice that our questionnaire used the main areas of the DigCompOrg model and is based on the general idea of the SELFIE tool but the version administered by our research questionnaire different from the original version mostly in the types of questions. As a result, all questions posed to teachers were differentiated in order to capture the integration of digital competence in the Greek educational reality. The teachers' questionnaire consisted of 23 questions referring to the six areas of the DigCompOrg and the Likert style was used. Prior to the survey, the necessary steps had to be taken to ensure the validity of the questionnaires through which the research was conducted. In this context, prior to determining the structure of the final questionnaires, a pilot test with a questionnaire was conducted on a small sample of 15 teachers from a school. For the collection of research data, an electronic questionnaire was forwarded by email to the school, informing the principal of the school through a cover letter about the purpose and aims of this survey research, ensuring that the survey remained open from February until the end of June 2020 during period the schools close for summer vacation. Statistical Package for Social Sciences (SPSS) version 21 was used for data analysis in which data were entered for statistical control, processing and analysis.

2.2.1. Participants

Participants included thirty seven teachers from the school, representing a total of thirty seven teachers from the teaching staff population. All the teaching staff was willing to participate in the current research and all of them answered the questionnaires. The sampling in this research can be characterized as non – probability because samples were selected through non-random methods (Pandey & Pandey, 2021).

2.3. Ethical Issues

Participants were informed that they were involved in a process of research and its aims and that the personal data about them would be processed in a safe manner based on General Data Protection Regulation (GDPR) legislation, after the relevant approval by the Ministry of Education. The Privacy and confidentiality of their names were insured with official documents.

The research was carried out in the school during the class time. The researcher obtained official permission from the Greek Education Ministry to conduct the inquiry and was authorized by all the participants to publish the outcomes. Furthermore, the researcher made it clear to the participants that they could withdraw from the study any time and that doing so they would not affect the investigator's relationship with the institution, or any of the services that the institution concerns or provides.

3. Results

Teachers who have completed the questionnaire in all the areas of the DigCompOrg model, specifically referring to the areas of: "Continuing Professional Development", "Infrastructure and Equipment", "Student Digital Competence", "Teaching and Learning", "School Leadership" and "Assessment Practices".

According to teachers' perceptions the area of "School Leadership" of the DigCompOrg has obtained a high score with an average of 3.24. Teachers revealed that they were positive of the graded of support for the opinion that school leaders set new goals in implementing innovative programs that are related to the digital community in which we live in the specific area. The area of "Infrastructure and Equipment" was graded with a low score average of 2.29. 46 % of the teachers have a negative attitude in the use of digital educational programs. The average score in the area of "Continuous Professional Development" is 3.31. The findings indicate that the specific area in a school as an organization is inextricably linked with the concern of school leadership in academic development of teachers. Furthermore, the area of "Teaching and Learning" was valued with a low score of 2.28 from teachers. Despite that the research gave a very interesting result regarding the self -perception of teachers that refers to the capability of Greek schools to support educational programs through the use of ICT. The vast majority of teachers who answered the questionnaire, had a negative perception of the ability of the specific Greek school to support the integration of educational programs that concern the use of ICT . In the area with the highest score "Assessment Practices", valued at 3.41, the staff referred to how they often clearly presented their aims and goals of their educational routine, indicating that teachers had principles and almost always reported what they had done. Last, the area of "Students digital competence" average value of 3.20 revealed that the majority of the students' parents support and allow their children to make use of digital programs besides the school time, reinforcing that the students' parents and their children had a digital stimulus.

According to the results, the area valued with the highest score is "Assessment Practices". All the results from teacher's self-perceptions responding to the DigCompOrg areas are presented in Table 1, in order to answer the first objective of our research.

Table 1. Means and standard deviations on the dimensions based on DigCompOrg.

Dimension	Mean	St.D.
Continuing professional development	3.31	0.66
Infrastructure and equipment	2.29	0.84
Student digital competence	3.20	1.05
Teaching and learning	2.28	1.09
School leadership	3.24	0.84
Assessment practices	3.41	0.70

For answering the first objective, it is observed in Table 1 that Pearson's parameter criterion (Weaver & Wuensch, 2013) was used to explore relations between the "Assessment Practices" index and the other indexes of the model. "Assessment Practices" index is not related to the "Assessment Practices" $r(37)=0.279, p=0.095$. Only the "Teaching and Learning" index $r(37)=0.500, p=0.002$ is related to the " Assessment Practices ", but with a moderate correlation. Furthermore, the "Continuing Professional Development" index $r(37)=0.383, p=0.019$, the " Infrastructure and Equipment " index $r(37)=0.410, p=0.012$, and the " Student Digital Competence" index $r(37)=0.367, p=0.025$ have a low correlation with the " Assessment Practices " index.

In order to answer the second objective of our research and create the proposal for a DDDM plan that considers school improvement while taking in to account teachers' results and data, this article presents a cyclical figure of a DDDM plan proposal. Figure 1 presents the cyclical development of data- driven decision making process. The necessary steps are explained in Table 2.

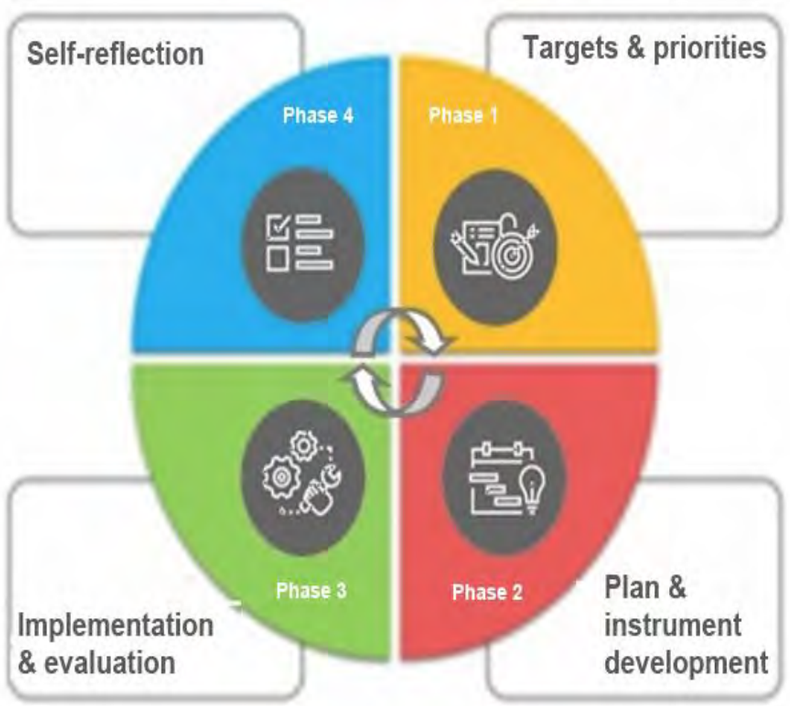

Figure 1. An action plan based on a DDDM model.

Figure 1 illustrates the cyclical development of the data- driven decision making process in order to achieve the target of school improvement. Phase 1 indicates the first and most important step, the definition of the target and all of the priorities of school organisation, the second phase includes the development of the instrument to collect data, the third phase includes the implementation of instrument and extraction of data in order to conclude in deficiencies and last phase, the clear view of the needs and implementation of an action plan.

Table 2. Analysis of the phases of the DDDM model.

Phases of the DDDM model	Improvement actions	Based on the score of the teachers' dimension
Phase 1	Creation of a common digital strategic plan based on school improvement. Proposal: teaching staff could suggest targets: a) Implementation in the curriculum activities as a lesson that concern augments reality. b) promoting the digital integration of special education programs by the Ministry of Education g) promoting digital programs concerning the learning of the Greek language by the refugees that Greece has absorbed d) Inclusion of digital programs in the daily life in all aspects contact with the local community and the communication with the external bodies. e) Internal training of school teachers in the integration of digital programs.	"Teaching and Learning" which has the lowest score 2.28 and "continuous professional development" with a great score of 3.31.
Phase 2	Plan: Integration of the above objectives in the defined internal planning of the school that always takes place at the end of the previous year and concerns the next academic year, with the help of equipment provided by the Ministry of Education to schools. Instrument development: construction of a digital questionnaire with the contribution of all teachers that will be related to the extraction of data for the above objectives set during the internal planning.	"Infrastructure and equipment" at score 2.29 and "student digital competence" at score 3.20
Phase 3	Implementation of the created instrument based on a flexible questionnaire and tailored to the needs of the specific school as well as data analysis .	"Assessment practices" with the highest score of 3.41.
Phase 4	Self reflection: The school manager as a leader with the cooperation of teachers should set up a discussion and externalization of the exported data to students and their parents in order to implement a new improvement plan for the next academic year. Adapting learning processes to the individual needs of students and having a discussion about the use of technology would be a creative way to externalize the needs of school improvement to those directly interested.	"Student digital competence" with the lowest score at 2.28 and "school leadership"at 3.24.

4. Discussion and Conclusions

This type of study was very useful for its implications on practice and its method of improving the educational reality because it provided us with valuable information on which to base our actions in order to improve the process of digitization that was taking place. These actions are based on the vision of the factors that are involved in school reality and directly in the organization and basically consist of participatory action research models in which researchers are part of the investigated reality and intervene directly (Colmenares, 2012). In the context of all these, a digitally competent organization will support the digital skills of educators and students involved in Fernandez and Prendes (2021), ensuring that school improvement in Greek reality can finally be supported by technology.

The DigCompOrg model promotes a systemic approach (Brolpito et al., 2016) that aims to encourage self - evaluation with the integration of ICT in educational organizations but also personal aspects of the factors involved in Fernandez and Prendes (2021). Bacigalupo (2022) supports the importance of unbundled competence frameworks that can manage the diverse needs of every organization and could adapt to each context (Bacigalupo, 2022). To better understand the meaning of the above, she draws in her research a great parallel between the ways that different cultures used Pollux in order to build constellations. This great overview highlights the importance of flexibility in competence frameworks. In the light of the aforementioned, we conclude that it is important for an organization to develop flexible models that are appropriate in schools.

On the other hand, as it concerns the field of DDDM, the data retrieved from a school could be used for many positive purposes. Veldkamp, Schildkamp, Keijsers, Visscher, and De Jong (2017) support that data has many advantages. They could be used to improve the performance of a school as an organization, predict the future problems of an organization or even stunt the problems that actually occur (Schildkamp, 2019). Despite all that, some questions that needed further investigation were: how to extract data in a reliable and valid manner and who gets access to school data from an ethical perspective? To answer the above question, this study used the DigCompOrg academic field model and was based on Greek school statutory laws. So, according to law 4189/B/09-10-21 of the Greek Ministry of Education which considers internal coordination procedures and self-evaluation of schools, the general responsibility of the procedures lies with the director or school leader of the school and all the teaching staff. Based on that, the data retrieved for the proposal of the plan were extracted through teachers'self-perception.

In conclusion, it is highlighted that internal planning with the integration of digital competence into the internal regulations of the school is as important as strategic action. Using a DDDM model and setting the goals that we ourselves want to externalize within as a school, we have a database that helps us better than the free and optional action. The integration of a data -based model should be a priority for the Ministry of Education and its implementation should be proposed in every school in the Greek reality.

The DigCompOrg is a precious model that aims to encourage self-reflection and self-assessment in educational organizations while also reinforcing their involvement in the development of the digital competence of the organization itself (Fernandez & Prendes, 2021).This engagement includes organizational aspects as well as

personal aspects of the factors involved. In this way, the results can open new lines of research that are oriented toward the development of constant evaluation for the own feasibility of the educational organism.

This article introduced a new model for providing recommendations to schools based on their ICT elicited from their relevance feedback data, and on teachers' self –perception.

The DDDM model could offer the fundamental framework for all the factors that are involved in a school to collect, process and visualize a more holistic set of educational data. This would be feasible if the model was applied to a larger survey sample, as it is extracted from the results. In this way, we propose that the school as an organization could more efficiently (a) design their unique and own strategic plan based on data-driven evidence oriented at information and communication technologies (b) Identify its unique six areas in need of evaluating, self – evaluating and school improvement and (c) Utilize all the resources/factors that exist in a school in order to achieve internal stability and school improvement.

Future research should focus on the annual application of the proposed action plan in order to draw intertemporal conclusions. Also, future research is necessary to investigate the approaches presented in this article and to be able to provide different views with practical examples.

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