UNIVERSIDAD DE MURCIA

ESCUELA INTERNACIONAL DE DOCTORADO

TESIS DOCTORAL

A Data Driven Decision Making plan based on DigCompOrg areas for improvement in a primary school in Greece

Un plan de toma de decisiones basado en datos en función de las áreas de DigCompOrg en una escuela primaria en Grecia

Maria Athanatou

2023

UNIVERSIDAD DE MURCIA

ESCUELA INTERNACIONAL DE DOCTORADO

TESIS DOCTORAL

A Data Driven Decision Making plan based on DigCompOrg areas for improvement in a primary school in Greece

Un plan de toma de decisiones basado en datos en función de las áreas de DigCompOrg en una escuela primaria en Grecia

---

Dª. Maria Athanatou

Phd Directors/Dirección de la tesis:

Dr. Mª Paz PRENDES ESPINOSA

Dr. Isabel GUTIÉRREZ PORLÁN

2023

UNIVERSIDAD DE MURCIA

DECLARACIÓN DE AUTORÍA Y ORIGINALIDAD
DE LA TESIS PRESENTADA PARA OBTENER EL TÍTULO DE DOCTOR
Aprobado por la Comisión General de Doctorado el 19-10-2022

D./Dña. Athanatou Maria

doctorando del Programa de Doctorado en

PROGRAMA DE DOCTORADO EN TECNOLOGÍA EDUCATIVA (PLAN 2014)

de la Escuela Internacional de Doctorado de la Universidad Murcia, como autor/a de la tesis presentada para la obtención del título de Doctor y titulada:

Un plan de toma de decisiones basado en datos en función de las áreas de DigCompOrg en una escuela primaria en Grecia

y dirigida por,

D./Dña. PRENDES ESPINOSA, MARIA PAZ
D./Dña. GUTIERREZ PORLAN, ISABEL DEL CARMELO
D./Dña.

DECLARO QUE:

La tesis es una obra original que no infringe los derechos de propiedad intelectual ni los derechos de propiedad industrial u otros, de acuerdo con el ordenamiento jurídico vigente, en particular, la Ley de Propiedad Intelectual (R.D. legislativo 1/1996, de 12 de abril, por el que se aprueba el texto refundido de la Ley de Propiedad Intelectual, modificado por la Ley 2/2019, de 1 de marzo, regularizando, aclarando y armonizando las disposiciones legales vigentes sobre la materia), en particular, las disposiciones referidasal derecho de cita, cuando se han utilizado sus resultados o publicaciones.

Si la tesis hubiera sido autorizada como tesis por compendio de publicaciones o incluyese 1 o 2 publicaciones (como prevé el artículo 29.8 del reglamento), declarar que cuenta con:

- *La aceptación por escrito de los coautores de las publicaciones de que el doctorando las presente como parte de la tesis.*
- *En su caso, la renuncia por escrito de los coautores no doctores de dichos trabajos a presentarlos como parte de otras tesis doctorales en la Universidad de Murcia o en cualquier otra universidad.*

Del mismo modo, asumo ante la Universidad cualquier responsabilidad que pudiera derivarse de la autoría o falta de originalidad del contenido de la tesis presentada, en caso de plagio, de conformidad con el ordenamiento jurídico vigente.

En Murcia, a 29 de Marzo de 2023

Fdo.:

Esta DECLARACIÓN DE AUTORÍA Y ORIGINALIDAD debe ser insertada en la primera página de la tesis presentada para la obtención del título de Doctor.

Información básica sobre protección de sus datos personales aportados	
Responsable:	Universidad de Murcia. Avenida teniente Flomesta, 5. Edificio de la Convalecencia. 30003; Murcia.Delegado de Protección de Datos: dpd@um.es
Legitimación:	La Universidad de Murcia se encuentra legitimada para el tratamiento de sus datos por ser necesario para el cumplimiento de una obligación legal aplicable al responsable del tratamiento. art. 6.1.c) del Reglamento General de Protección de Datos
Finalidad:	Gestionar su declaración de autoría y originalidad
Destinatarios:	No se prevén comunicaciones de datos
Derechos:	Los interesados pueden ejercer sus derechos de acceso, rectificación, cancelación, oposición, limitación del tratamiento, olvido y portabilidad a través del procedimiento establecido a tal efecto en el Registro Electrónico o mediante la presentación de la correspondiente solicitud en las Oficinas de Asistencia en Materia de Registro de la Universidad de Murcia

Acknowledgments

Ending this great experience which helped me discover aspects of myself that I didn't completely know, I would like to express my gratitude first of all to the person who inspired me and helped me complete this project, the exceptional professor and fully giving personality Dr. Maria Paz Prendes Espinosa for her tireless, thoughtfull, full of genuity collaboration and guidance during all these years. Furthermore, I feel the need to express my thankfulness to Dr. Isabel Gutiérrez Porlán as she also helped me with concern when needed. I am glad that I collaborated with these too professionals.

Also, I would like to thank my husband Emmanuil for his support and patience. He took care of our son when I had to study hard and never complained about anything.

In addition, a big thanks owns to my parents and sister as they always believe at me and give me strength. Also, I would like to thank all my colleges and students that took part in this research. It woudn't be possible to finish without their help.

The most important for the end, I would like to thank my son Nikolas and my daughter Paraskevi because they are the reason to be strong and move forward.

Index of Contents

Index of Tables

Index of Figures

Index of Acronyms

AA	Academic Analytics
BECTA	British Educational Communications and Technology Agency
CESI	Computer Education Society of Ireland
DDDM	Data Driven Decision Making
DESI	Digital Economy and Society Index
DigCompEdu	Digital Competence of Educators
DigCompOrg	Digitally Competent Educational Organizations
DSS	Decision Support Systems
DSS-PSP	Decision Support Software for Predicting Students' Performance
DWEC	Dublin West Education Centre
EFQM	European Foundation for Quality Management
EMM	E Learning Maturity Model
ICT	Information and Communication Technology
INTEF	Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado.
INTO	Irish National Teacher's Organization
IPPN	Irish Primary Principals' Network
IR	Investor Relations
ISTE	International Society for Technology in Education
LA	Learning Analytics
NCTE	National Centre for Technology in Education
NYCDOE	New York City Department of Education
OECD	Organization for Economic Cooperation and Development
R4C	Reflecting for Change

RRI	Responsible Research and Innovation
SPICE	Software Process Improvement and Capability determination

RESUMEN

Las tecnologías digitales son un elemento clave de gran importancia para las organizaciones educativas y pueden contribuir a marcar el camino hacia una educación de calidad. La integración de las tecnologías digitales exige un proceso de innovación educativa basado en tres pilares básicos: pedagógico, tecnológico y organizacional. En la propuesta de la Comisión Europea para promover la digitalización de la educación, se destaca que la competencia digital es una de las ocho claves que los gobiernos europeos deben trabajar en el ámbito de la formación competencias.

Otro elemento básico e importante de las competencias clave son los modelos de evaluación de las competencias digitales. Dando protagonismo a la evaluación, se señala que es una norma establecida para poder diseñar preguntas y encontrar los indicadores exactos que nos permitan medir con precisión el nivel de conocimiento y desarrollo de la competencia, en este caso la digital. La evaluación y la retroalimentación, que están vinculadas al uso de modelos digitales y estrategias más amplias, pueden conducir a nuevos y mejores métodos de evaluación.

El campo de la evaluación combinado con las nuevas tecnologías es un área nueva que surge en la educación. La investigación reciente afirma que las herramientas de evaluación digital están orientadas a la edición de datos, así como al uso de las TIC para impulsar la mejora interna de la escuela. Según esto, es probable que la calidad educativa mejore cuando los encargados de tomar las decisiones desarrollen políticas e implementen prácticas con información relevante de datos de evaluación utilizando tecnologías digitales.

Con referencia especial a los datos, hasta ahora la mayoría de ellos se usaban con fines de rendición de cuentas y cumplimiento, lo que significa informar sobre la enseñanza y el aprendizaje en las escuelaspero sin una orientación a la mejora. Recientemente, en la última década, hay un cambio de enfoque en la rendición de cuentas a una mejora continua. Es muy importante que el uso de datos comience con una determinada meta de mejora escolar y no un enfoque únicamente en la rendición de cuentas o en los datos disponibles. El uso de datos a menudo se enfoca en el rendimiento de los estudiantes, pero las escuelas también tienen otras metas de mejora escolar. Medir el progreso hacia estos objetivos requiere otros datos además de los puntajes de las pruebas tradicionales. Esta tesis extrae datos de estudiantes y docentes con el fin de obtener una mejora en el ámbito educativo. Los últimos estudios demandan un mejor uso de los datos en las organizaciones educativas. Los problemas organizativos, los asuntos políticos y un enfoque aleatorio para el almacenamiento de datos han impedido el uso de datos para mejorar la escuela y las experiencias de docentes y discentes.

Al combinar y mapear lo anterior,los principales pilares de esta tesis son la evaluación de competencias digitales basada en DigCompOrg y el conjunto de los datos obtenidos para ser utilizados en un modelo de toma de decisones basada en datos (Data DrivenDecisionMaking - DDDM) para la mejora escolar. El modelo DigCompOrg orienta los procesos de análisis y toma de decisiones sobre la digitalización organizacional y DDDM explota la importancia de los procesos de toma de decisiones apoyados en datos reales de

la organización, en este caso orientados a que la escuela pueda abordar procesos de mejora educativa. Los datos en el contexto de las escuelas se entienden como el conjunto de información que se recopila y organiza para representar algún aspecto de las escuelas que se está estudiando y como indica el marco teórico de nuestra investigación, la mejor manera de recuperar información sobre datos que conciernen a las competencias digitales es el modelo DigCompOrg.

DigCompOrg es el modelo que mejor describe el proceso de digitalización en las escuelas porque involucra todos los aspectos para el aprendizaje digital en las diferentes organizaciones educativas (primaria, secundaria, formación profesional y educación superior), ayudando a las organizaciones educativas con la autorreflexión y la autoevaluación. Además de eso, la revisión de la literatura confirma el enorme papel y la importancia de los datos en la era digital. Al analizar los datos digitales disponibles sobre las acciones individuales de los estudiantes y los docentes, se genera una mejora de resultados en la evaluación.

Partiendo de los pilares del modelo DigCompOrg, esta investigación recopiló datos como respuesta a la necesidad de evaluación de las competencias digitales de una escuela y luego utilizó este conocimiento para crear un modelo DDDM como un plan para lograr la mejora escolar. Además de eso, se realizó un análisis estadístico inductivo de los cuestionarios a través de la herramienta SPSS. Como se concluye del marco teórico, DDDM ejecuta modelos relativamente simples en datos cuidadosamente seleccionados y, tal y como hemos encontrado en esta tesis, estos datos están disponibles y extraídos a través de cuestionarios específicos. Con base en lo anterior, este estudio intenta abordar la necesidad de dar respuesta a las preguntas de investigación anteriores: ¿Es posible evaluar la escuela a través del conocimiento basado en competencias digitales de docentes y estudiantes que surge a partir de datos recuperados relacionados con las áreas de DigCompOrg? ¿Podemos adaptar los datos extraídos a un modelo DDDM que se referirá a la evaluación de las competencias digitales y el plan de acción de mejora basado en las áreas de DigCompOrg?

Por las razones anteriores, el objetivo principal de esta investigación es evaluar la competencia digital de una escuela primaria en Grecia en función de las áreas de DigCompOrg y proponer un plan de toma de decisiones basado en datos (DDDM) para la mejora escolar a partir del análisis de evidencias del estado real. Hemos estudiado, pues, el caso específico de un centro para su mejora, pero también hemos sido capaces de integrar dos modelos teóricos (DigCompOrg y DDDM) en una propuesta práctica. Los objetivos de investigación se concretan en:

a) Analizar el grado de desarrollo de la competencia digital de un colegio en Grecia según las áreas contempladas en el modelo DigCompOrg teniendo en cuenta la opinión de profesores y alumnos.

b) Analizar cómo se afectan entre sí las variables del modelo DigCompOrg a partir del cuestionario de docentes, con el fin de tener una autoevaluación y mejora escolar.

c) Diseñar un plan de toma de decisiones basado en un modelo DDDM y los resultados previos obtenidos sobre la competencia digital de la organización.

El informe de la tesis está organizado en dos partes, como es habitual: parte teórica y parte empírica. El marco teórico se completa con cuatro capítulos. El primer capítulo aborda una introducción en la que hacemos una presentación de la investigación y elaboramos una justificación de la misma. El segundo capítulo aborda el término evaluación, destacando la importancia y la falta de datos reales de evaluación en los centros educativos griegos, que es nuestro contexto para la investigación empírica. El tercer capítulo se centra en el concepto de competencia digital y los modelos de análisis de la competencia digital, mientras que el cuarto capítulo se dedica al análisis de los DDDM desde una perspectiva educativa.

En la parte empírica se explica que esta investigación utiliza el método cuantitativo, con un diseño de investigación de tipo descriptivo en el cual hemos aplicado dos cuestionarios (docentes y estudiantes). Los cuestionarios se distribuyeron a través de formularios de Google Form, pero aplicándolos en situaciones presenciales de aula para conseguir los datos de las muestras participantes. El proceso de cumplimentación del cuestionario de los estudiantes se vio interrumpido por la pandemia del COVID-19 y al fin 120 estudiantes pudieron completarlo. Por otro lado, todos los maestros de la escuela primaria estudiada lo cumplimentaron. Después de completar la recogida de datos, para el proceso de análisis se utilizó como herramienta estadística el Paquete Estadístico para las Ciencias Sociales (SPSS). Tras el análisis de los datos, los últimos capítulos son de conclusiones y discusión.

Entre los principales resultados encontramos que en el sistema educativo Griego hay deficiencias muy claras en los programas digitales, la capacidad digital del personal docente, falta de equipamiento digital en las escuelas y que falta formación por parte del Ministerio de Educación para emprender y llevar a cabo procesos deeducación a distancia de calidad.

Así pues, ya hemos indicado que esta tesis se sustenta en las interrelaciones planteadas entre las áreas del modelo DigCompOrg y la propuesta de mejora apoyada en un modelo DDDM, una interrelación que se ha diseñado a partir de los datos reales recogidos en el centro, tanto de estudiantes, como de profesorado, y haciendo hincapié en el área de evaluación que considera las “Prácticas de Evaluación”. Vale la pena mencionar que en nuestros resultados, el género no afecta el nivel de integración de las TIC y la competencia digital en la escuela.

Teniendo en cuenta que el sistema educativo griego evalúa cada colegio a través de criterios generales y alejados de la Competencia Digital, es muy importante señalar que aquí se ha intentado un equilibrio a través de la revisión de la literatura lo que ha supuesto una diferencia entre la aplicación de DDDM y la teoría.Resumimos a continuación los principales resultados.

En relación con los estudiantes, la mayoría destacó que el nivel de uso de las TIC depende de la "infraestructura y el equipo" disponible y que se fomenta la interacción entre los estudiantes y el docente a través de los artefactos digitales. Los estudiantes que tenían una fuerte motivación en el uso de las TIC tenían simultáneamente una muy positiva influencia

psicológica por el uso de las TIC. El alto nivel de motivación para el aprendizaje por el uso de las TIC fue positivo.

Además, el análisis de los resultados de la investigación destacó una correlación negativa moderada entre la influencia psicológica positiva por el uso de las TIC y la influencia negativa en la educación de los estudiantes por el uso de las TIC. Se ha comprobado una correlación positiva moderada entre la influencia psicológica positiva por el uso de las Las TIC y la cooperación con otros estudiantes mediante el uso de las TIC, lo que indica que el uso de las TIC mejoró el desarrollo psicológico de los estudiantes según su percepción y al mismo tiempo aumentó la cooperación entre ellos.

El análisis de los resultados de los docentes indicó que el grado de uso de las TIC en sus clases, según ellos, es alto. Además, desde la visión de los docentes se concluye que la mayoría de los padres de los estudiantes mantienen una comunicación digital con ellos y su reacción es inmediata, pero también se afirma que la escuela griega aún no se considera capaz de soportar todo el amplio espectro del uso de las TIC.

Asimismo, el objetivo de esta tesis que se refiere al análisis del área “prácticas de evaluación” desde la autopercepción de los docentes, los resultados muestran que los docentes deben tener un rol protagonista porque los estudiantes, sus antecedentes y circunstancias son complejos y se enfrentan a situaciones coyunturales, desafíos que requieren que los educadores aprovechen diversas fuentes de datos para obtener una comprensión integral. Por lo tanto, esto confirma que no es adecuado confiar solo en indicadores del rendimiento de los estudiantes y también que los educadores comprendan e interpreten mejor el significado de los datos. Más concretamente, la contribución en el campo mencionado está específicamente relacionada con el objetivo de esta tesis que considera la extracción de datos y una propuesta de un plan a través de un modelo DDDM que conciernen a las competencias digitales de todos los factores que intervienen en una escuela para tener una mejora escolar.

Esta tesis ha llegado a la propuesta de un plan de acción DDDM relacionado con las áreas DigCompOrg de la dimensión docente y extrajo datos para la mejora escolar, Además el trabajo concluye con propuestas de futuras investigaciones en torno al campo de la organización educativa digitalmente competente que contribuirá a promover una estrategia de digitalización teniendo en cuenta las necesidades y realidades del contexto, además de considerar como factor clave a los principales agentes educativos. Estas estrategias de mejora, al ser apoyadas desde la propia organización educativa, facilitan el cambio y los procesos de innovación apoyados en la tecnología.

ABSTRACT

Digital learning technologies can be a key issue for educational organizations and they can constitute a key pilar to build the journey to improve quality education. In the meaning of that sentence, integration of digital technologies demands digital innovation based on three basic brands: pedagogical, technological and organizational. In the statement of the European Commission's efforts, which until now intriguers' member states with guidelines and later carries out researches to insure the comparisons between individual European members and the developed world, it is highlighted that digital competence is one of the eight key that European governments are emerged to make a part of their lifelong learning strategies.

Another basic and important element of the key competences is the evaluation models for digital competences. Giving prominence to evaluation, it is appointed that is an established regulation in order to be able to design questions and find the exact indicators that allow us to accurately measure the level of knowledge and development. Evaluation and feedback which is linked to the use of digital models and wider strategies, can process existing assessment strategies and lead to new and better assessment methods.

The main pillars of this thesis is the evaluation of digital competences based on DigCompOrg and the milling of data retrieved in order to be used in a DDDM model for school improvement. DigCompOrg targets to organizational digitalization and DDDM exploitates the importance of decision making processes in order to have school improvement of data based organizational change. Data have been under discussion for school reform. Data in the context of schools is information that is collected and organized to represent some aspect of schools that are being studied and as theoretical framework indicates, the best way to retrieve information about data that concerns digital competences is the DigCompOrg model.

For the above reasons the main purpose of this research is to investigate the digital competence of a primary school in Greece related to the DigCompOrg areas and to propose a data driven decision making plan for school improvement based to the extracted data. We have therefore studied the specific case of a centre for improvement, but we have also been able to integrate two theoretical models (DigCompOrg and DDDM) into a practical proposal. Based on the above, the following are proposed as general objectives:

a) Analyse the degree of development of the digital competence of a school in Greece according to the areas contemplated in the DigCompOrg model taking into account the opinion of teachers and students.

b) To analyse how the variables of model DigCompOrg affect each other from teachers questionnaire, in order to have self-evaluation and school improvement.

c) Design a decision making plan based on a DDDM model and the results obtained by this research.

This final report of the research is organized in two parts: theoretical and empirical part. The first part, the theoretical, is composed by four chapters. The first chapter deals with the

general overview of the research and its justification. The second chapter addresses the term evaluation, highlighting the importance and the lack of in the Greek educational fields. The third chapter is mentioned to the concept of digital competence and the fourth is dedicated to the field of DDDM in educational meanings. In the empirical part, is stated that this research uses quantitative method with a use of two questionnaires (teachers and students) for a descriptive analysis. The questionnaires were distributed through Google forms and that was made with the physical contact between the researcher and the research sample. The fulfilling of the students' questionnaire was interrupted by the COVID-19 pandemic and 120 students were able to compete it. In the other hand, all the teachers of the primary school filled it out. After completing the data collection, for the analysis process was used the tool Statistical Package for the Social Sciences (SPSS).

This thesis is based on the interrelationships between the areas of the DigCompOrg model and a proposal plan of improvement supported by a DDDM model, which action has been designed from the real data collected in a primary school, both from students and teachers, emphasizing at the area of evaluation that considers "Assessment Practices".
As it considers also the results from students' dimension, it is worth mentioning that the gender does not affect the level of ICT integration and digital competence at school. The majority of student highlighted that the level of ICT use depends on the available "infrastructure and equipment", that there is a foster between students and teacher to interact through digital meanings, students who had strong motivation in using ICT they had simultaneously a very positive psychological influence by the use of ICT, the high level of motivation for learning by the use of ICT was weak positive correlated with the cooperation with other students by the use of ICT.

Moreover, the analysis of the research results highlighted a moderate negative correlation between the positive psychological influence by the use of ICT and the negative influence on students' education by the use of ICT, a moderate positive correlation between the positive psychological influence by the use of ICT and the cooperation with other students by the use of ICT indicating that the use of ICT enhanced the psychology of students and at the same time increased the cooperation between them.

Teachers' dimension analysis indicated that no matter how well adequate considered themselves in ICT use and digitally competent, the level of use ICT in their teaching lessons according to them is high. Also, from teachers' dimension is concluded that the majority of students' parents sustain a digital communication with them and their reaction is immediate but also stated that the Greek school is not considered capable of to support the full spectrum of ICT use yet. At last, this thesis came to the proposal of a DDDM action plan related to the DigCompOrg areas from teachers' dimension and extracted data for school improvement.

This thesis concludes with proposals for future research around the field of digitally competent organization that will contribute to the skills of the school factors which are involved, by being supported from an educational organization that leads innovation processes supported by technology.

CHAPTER 1

INTRODUCTION

In this chapter, a general overview of the study is first provided. Moreover, we have focused on the justification of this topic of research and its interest in the field of Educational Technology. The research problem that this study attempts to investigate is stated, its rationale is discussed and the research questions are then formulated. A brief outline of the thesis is finally presented to get a full picture of what the research process has involved and its results.

1.1. General overview of the research

The main research focus of the present dissertation is to highlight the ability to use the DigCompOrg model in order to extract data from teachers and students and thus use them in a proposal of a Data Driven Decision Making Model that promotes the improvement of a primary school in relation to the digital competence. This general research aim is based on double premise: 1) in the evaluation oriented at digital competence based on DigCompOrg European framework and 2) in data mining to specify whether they can be used on Data Driven Decision Making Models (DDDM in advance).

In an overall outline, this research is placed within the overarching research field of DigCompOrg and DDDM for schools within digital supported school environments. The main research problem relates to the possibility of use DigCompOrg to evaluate the digital competence in a Greek primary school and use the data to DDDM model to improve decision making in schools (Schilkamp, 2019), always in coherencence with the digital competence.

Assessment field combined with new technologies is a new area that arises in the main substance of education. New studies underlying that digital assessing tools are oriented at editing data as well as for using ICT to drive internal school improvement (OECD, 2015). According to this, educational quality is likely to be improved when decision makers develop policies and implement practices informed by relevant assessment data (Cox et al., 2017).

The concept of digital competence is highlighted in different reports prepared by institutions and official bodies interested in the educational field (European Commission, 2020; OECD, 2015; UNESCO, 2011) and it has two strands, referring to individual digital competence and organizational digital competence. The year 2008, UNESCO published a document with the policy of ICT competency standards for teachers with a special focus on teacher digital

literacy although without defining the meaning of the concept (UNESCO, 2008) but in the year 2017 DigCompEdu (Redecker, 2017) defined the requirements of competence frameworks for teachers education in order to serve multiple digital purposes in education systems (Caena & Redecker, 2019), with a broad sense to orient teachers' practice and continuous professional development, to embrace the support of digital integration of school institutions and at last, to promote the quality assurance for teachers career (Caena & Redecker, 2019). The concept of digitally competent organization is related to the concept of "learning organizations" and "competence-based organization" (Sergis, 2017; Stolly & Kools, 2017; Watson, 2014) or with the concept of "organizational learning" (Hong et al., 2017). In an organization, the high level of competence is considered major factor to their development (Harris, 2007; Lima Nogueira & Battaglia, 2012) and when this development considers a targeted and effective use of ICT (Durando, 2017) or an orgazizational preparation in order to embed the digital integration deep in the curriculum (Underwood et al., 2010), we can talk about the organizational e-maturity. Linking all the above concepts with teachers' and students' digital competence development organizational capacity building, European Commission launched DigComp projects.

In the year 2010, European Commission initiated the DigComp project, identifying a series of descriptors in order to contribute to a better understanding and development of digital competence among European citizens. Since then, and regardless of the different versions published, DigComp has been used for three main purposes (Lucas & Moreira, 2017): 1) policy formulation in the field of education, training and employment; 2) strategic design for education, training and employment initiatives; 3) evaluation and certification of competencies. Based on this common framework, different models have been developed like the «European Framework for Digitally Competent Educational Organizations» or DigCompOrg (Fernández & Prendes, 2021; Kampylis et al., 2015). According to Begicevic Redep et al. (2017, 2019), it is the model that best describes the process of digitalization at schools because it involves all the aspects for digital learning in different educational organizations (primary, secondary and vocational training or higher education), helping educational organizations with self-reflection and self-assessment (Kampylis et al., 2015).

The European Framework for Digitally Competent Educational Organizations (DigCompOrg) targets to support digitalization of educational organizations. DigCompOrg model is based on a digitally competent organization that achieves better results from different angles (Fernández & Prendes, 2021). DigCompOrg focuses on seven areas common to all educational institutions, including: 1) leadership and governance practices; 2) teaching and learning practices; 3) professional development; 4) evaluation practices; 5) curricula and content; 6) collaboration and communication practices; 7) infrastructure. In addition, it includes 15 specific sub-areas and connected as parts of the same whole - and 74 descriptors graphically interconnected in a wheel.

Further to this model that describes the digital competence of educational organizations, the literature review confirms the enormous role and significance of data in the digital era (Ng & Wakenshaw, 2017). It is a fact that the impact of data is increased and generated every day (Bharadwaj et al., 2013). By analysing digital data available on individual student actions and teachers', the research could have great outcomes to more specific evaluation

(Gutiérrez Castillo et al., 2017). The field that best describes data in education and making decisions based on that is Data Driven Decision Making.

Evaluation field combined with new technologies data driven is a new area that arises in the main substance of education. New studies underlying that assessing tools are oriented at processing data as well as for using ICT to drive internal school improvement (OECD, 2015). According to this, educational quality is likely to be improved when decision makers develop policies and implement practices informed by relevant assessment data using digital technologies (Cox et al., 2017).

This thesis presents a descriptive investigation on the degree of development of digital competence in a Greek school from the six dimensions collected by a questionnaire as a quantitative data collection technique. The results presented in this thesis take into account teachers' and students' opinions. Starting from the first stage of needs analysis, a DDDM model is then proposed that allow the school to advance in school improvement through decision making.

As it considers Greek schools, since the year of 2013 there have been many attempts for self-evaluation and improvement of school quality but none of them wasn't entire focused on digital competences. Despite of all these facts, none of them was also mandatory but it appeared imminent in the will of teacher staff and management of each school. Above the statement of all these, could there be an evaluation model oriented at digital competences based on the founds of self-evaluation? And could these data be used for creating tools such as Data Driven Decision Making to promote the digital improvement of this educational organization?

This thesis dissertation aims to highlight the areas in which an evaluation of the ICT competencies of the school arises as a need through the educational potential. Beginning with the pillars of the DigCompOrg model, this research retrieved digital data as an answer to the need of evaluation of the digital competences of a school and then used this knowledge to create a DDDM model as a plan to gain school improvement. In addition to that, an inductive statistical analysis of the questionnaires was made through SPSS tool. As it is concluded from the theoretical framework, DDDM executes relatively simple models on carefully targeted data (Duggan, 2014) and as this research has reported, these carefully target data are available and extracted through target questionnaires.

Based on the above, this study attempts to address the need for answer to the above research questions: Is it possible to evaluate the school through based knowledge on digital competences of teachers and students that arises from retrieved data related to the areas of DigCompOrg? Can we adapt the extracted data to a DDDM model that will concern the evaluation of digital competences and action improvement plan based on DigCompOrg areas?

Beginning with the DigCompOrg model this research specifies as a general objective of the study the evaluation of digital competence of a school through targeted data extracted, as a mean to have school improvement. Based on this general objective, the following are proposed as specific objectives:

Table 1
Research Questions and Objectives

Research Questions	Research Objectives
Are digital competences a key factor to improve the development of our educational organizations? Is it possible to improve schools through evaluation about digital competences?	Analyse the degree of development of the digital competence of a school in Greece according to the areas contemplated in the DigCompOrg model taking into account the opinion of teachers and students.
Is DigCompOrg useful to evaluate our Greek schools?	To analyse how the variables of model DigCompOrg affect each other from teachers questionnaire, in order to have self-evaluation and school improvement.
Can we design a model of evaluation based on DDDM and DigCompOrg at the same time? Is the combination of both a good way to evaluate the schools?	Design a decision making plan based on a DDDM model and the results obtained by this research.
Could the evaluation of digital competencies promote the motive in the use of them?	

This research uses a quantitative method to analyse the self-perception of teachers and students about the dimensions of DigCompOrg. The first phase is a descriptive research and the second phase proposes improvement actions according to a change-oriented research based on real data. The current research was completed after the opening of schools imposed by the first pandemic and quarantine, caused by virus SARS-Cov 2 and continued in the first half of the academic year 2020-2021, until the second quarantine in the end of October 2020. Data extraction has been quite difficult and with many losses due to the fact that this research had to be completed during the curriculum time, premises to accurately explain the procedures by the researcher herself to the children/students aged 6 to 12 years old.

A more general research at the analysis of the data, shall inform us that in the Greek educational system there are very clear deficiencies in digital programs, digital capacity of teaching staff (OECD, 17) and as by the time the research was completed, they had not been trained or defecated by the Ministry of Education to undertake and carry out Distance Education and in addition to that there are clear deficiencies in digital equipment in schools (Athanatou & Yfantopoulos, 2021). The Greek Ministry of Education until the year of 2020, relies on the will and knowledge possessed by teachers on their own and their initiative to manage digital programs (Athanatou & Yfantopoulos, 2021). The extraction of data enabled the researcher to define the problematic of this thesis dissertation and to its contribution.

The main contribution in the area of evaluation and digital competences is focused on the micro layer of the school organization (Sergis, 2017), towards examining the potential of DigCompOrg to evaluate digital competence of a Greek school through an expanded questionnaire and apply the results in a theoretical basis DDDM to provide decision support at school towards for effective evaluation design, as the main research problem of this study.

The focus in the process of data use is on teachers and students. Hamilton et al. (2009) noted that students as data-driven decision makers rose to the level of one of five recommendations in the Institute of Education Sciences' Practice Guide. Students need to

be actively involved in the data use process to enhance their commitment and motivation, which in turn can lead to enhanced learning (Fletcher & Shaw, 2012). However, a review study by Hoogland et al. (2016) into the use of data concludes that the role of the student in the data use process has not been studied much yet.

Also, as it considers the objective of this thesis which refers to the analysis of are "assessment practices" from teachers self perception, research agrees and recognizes that teachers should have a leading role because students, their backgrounds and circumstances are complex and face situational challenges that require educators to tap diverse data sources to gain a comprehensive (Datnow et al., 2017; Datnow & Park, 2018). So, this confirms that is not adequate to rely only on indicators of student performance (Mandinach & Schildkamp, 2021) and also educators have a better understanding and interpret of the meaning of data (Mandinach et al., 2019). Also, according to Mandinach and Schildkamp (2021) only teachers can make effective use of diverse sources of data to improve the quality of educational decision making but also they recognize during their research from teacher's view, there is a fear that data might be used for inappropriate decisions, including teacher evaluations.More specifically, the contribution in the aforementioned field is specifically related to the objective of this thesis which considers the extract of data and a proposal of a plan through a DDDM model that concern the digital competences of all the factors that are involved in a school in order to have school improvement.

Adding to the contributions and the help of understanding the trial of Greek education system to evaluate each school through general criteria but very far away from the Digital competence that Europe sets, it is very important to notice that here has been made an attempt for a balance view through literature review. This thesis refers to that especially because it is observed that there are nuances in theory, in practice and in research as it considers data (Mandinach & Schildkamp, 2021). So, there is a difference between the implication of DDDM and theory. Through literature review also has been observed that much of the studies have been placed in Europe and especially Belgium and Netherlands and of course United States, and to a lesser degree in New Zealand (Mandinach & Schildkamp, 2021). Now more and more countries are engaging and the research will show its results in the future.

1.2. Justification of the research

In order to have digital transformation at organizational level, studies have shown that change and support must happen in different layers of the school (Pettersson 2018b; Vanderlinde & Van Braak, 2010), including organizational, cultural and administrative change (Blau and Shamir-Inbal 2017; Vanderlinde and Van Braak 2010; Zhang 2010) and also, competences acting within the school organization (Hauge, 2016). As argued, digitalization should be considered an organizational task and in order to have deep and sustainable change as well as school improvement, it is a great need to develop tools for the institutions (Hauge, 2016). Digitalization means data (Sestino et al., 2020) and certainly data means Data Driven Decision Making.

Specially referring to data, until now most of them was used for purposes of accountability and compliance (Mandinach & Schildkamp, 2021), which means for informing teaching and learning in schools (Wayman et al., 2012) and not so much for school improvement (Hargreaves & Braun, 2013). Only in the last decade there is a change from focus on accountability to a continuous improvement (Mandinach, 2012). We agree with the study of Mandinach and Schildkamp (2021) that it is crucial for data use to start with a certain school improvement goal and not a focus solely on accountability or on the data available. Data use often focuses on student achievement, but schools have other school improvement goals as well. Measuring progress towards these goals requires other data than the traditional test scores (Schildkamp, 2019). This thesis extracts data from students and teachers in order to have school improvement in a holistic way.

DDDM for smart policies and effective education is growing as a potential of education (Kurilovas, 2020). The last decade of studies has called for better use of data in educational organizations (Honig & Venkateswaran, 2012; Reeves, 2017). Despite to that, most schools and local education policies still continue to fully use their data to make better decisions (Slavin et al., 2013; Grissom et al., 2017). Organizational issues, political matters and a random approach to data storage have prevented the use of data to school improvement and student and teacher experiences (Cech et al., 2018).

By combining and mapping the identified institution wide data types with the fundamental basics of self-evaluation and digital competences, this thesis presents and formulates the statements of its content. Especially, this research is going to present a DDDM self-evaluation plan oriented at digital competences, based on the founds of DigCompOrg and SELFIE instrument (Kampylis et al., 2015) and extracted data from school. European Commission released in 2015 the "European Framework for Digitally Competent Educational Organizations", known as DigCompOrg (INTEF, 2017; Kampylis et al., 2015).

The main objectives of the model are two: 1) promote self-reflection and self-assessment in their commitment with learning and digital pedagogies and 2) guide educational policies in the design and evaluation of integration programs of digital learning technologies (Fernández & Prendes, 2021), so information and communication technologies (ICT in advance).

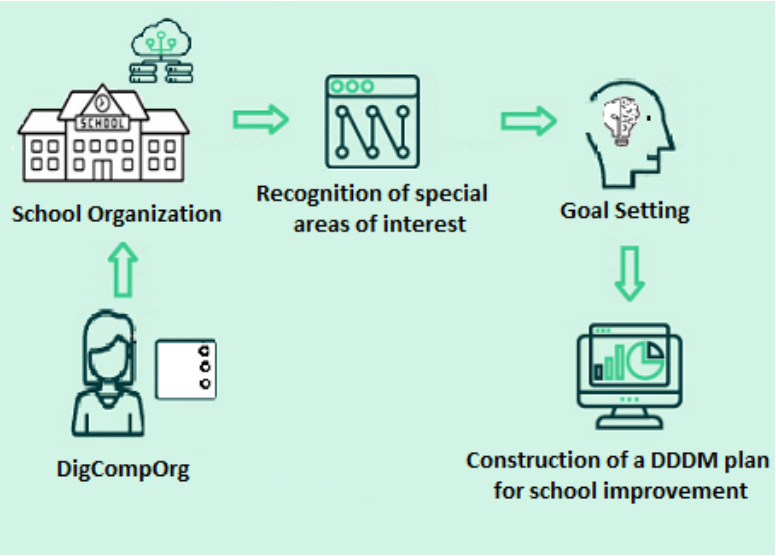
It is very important, before we come along with interrelation of the new proposal of a theoretical DDDM evaluative model of digital competences, DigCompOrg and self-evaluation of school, to report some basic elements that are substantial to our inquiry as a meaning to understand why is this topic so crucial and also the matter of great importance of using firstly the DigCompOrg model in order to extract data and then the proposal of a DDDM plan for school improvement internationally, but especially in Greece according to the OECD (2017; 2020) research. Therefore, the literature review presented below has highlighted the essential element that makes it a need for the educational fields.

Firstly, the matter of this research in focusing on DigCompOrg model in order to extract real data from a primary school was non-negotiable because DigCompOrg is a cross-sector conceptual model that promotes system change applicable in any context, looking for greater digital efficiency (Durek et al., 2017; Linko et al., 2016). 1700 Greek teachers have

obtained webinars about DigCompOrg and SELFIE tool [1] in Greece but there are no formal statistical facts about the number of primary schools that have used it. This happens due to the fact that there is no stationary digital police in Greece yet (OECD, 2020). At this point of view and highlighting the importance of this model, different studies have emerged that research could implement DigCompOrg for its own purposes meaning: for the construction of one's own (Balaban et al., 2018; Jugo et al., 2017; Redep et al., 2019); to reflect on pedagogies of ICT learning (Fedeli, 2017) for the preparation of ICT implementation plans (Brolpito et al., 2016; Giunti et al., 2018); for the identification of specific areas that needs improvement (Malach & Kostoloányová, 2017) or even for the construction of evaluation models (Campelj et al., 2019). For all of the above reasons, the DigCompOrg model was successfully selected in order to extract real data from a school organization. This part is analysed in section "Context" and referential to all these, there is an interrelation with the new proposed DDDM model and the pivot of self-evaluation oriented at digital competences.

Secondly, the selection of a DDDM plan in order to make a proposal for school improvement is originally based to the fact that we need educationally an effective use of data in order to make targeted decisions (Lai et al., 2014; McNaughton et al., 2012; Poortman & Schildkamp, 2016; Van Geel et al. 2016; Schildkamp et al., 2016). Taking into account data for developing, orienting and promoting educational-organizational change, has been the focus of studies on efforts to improve schools (Schifter et al., 2014). Thus, decision making with target the school improvement that is based on real data that are extracted through internationally admissible of their great importance and value frameworks like DigCompOrg, gives gravity to the quality of data that this research extracted. In the statement of the above, DDDM model plan for school improvement based on extracted data through DigCompOrg was a value way to insure the right use of data.

Figure 1
DigCompOrg as basis for constructing DDDM model.



[1] https://www.ekt.gr

In most OECD countries, school evaluations ensure compliance with rules and procedures, and focus increasingly on school quality and improvement. Another recent trend has been the development of school self-evaluation, which has become a central mechanism for encouraging school-led improvement and objective setting (Chapman, 2013). Strengthened systems for external and school-level monitoring and evaluation are seen as essential complements to the increasing decentralization of education systems internationally to ensure local and school accountability for education quality (OECD, 2020).

On a very different way until year 2021, Greek schools had no external evaluation, nor appraisal of teachers (OECD, 2017). A process of self-evaluation was briefly introduced in the 2013/14 school year (Circulars 30973/Γ1/05-03-2013, 190089/Γ1/10-12-2013, Ministerial Decision 30972/Γ1/05-03-2014), introducing a two year pilot project, alongside a new teacher evaluation system that combined appraisal with promotion and posts of responsibility, but due to the resistance from teachers' unions,the idea of both teacher appraisal and school self-evaluation were not performed (OECD, 2017). Some public services have evaluation but at present this function is relatively undeveloped in Greece (OECD, 2017) until the year of 2022. Also, there is restricted coherence between the different levels and consistency between the data gathered by the Ministry of Education, Research and Religious Affairs (MofERRA) and the statistical Authority (ELSTAT). No recent educational policy that concerns evaluation initiative or have been evaluated in Greek schools (OECD, 2017). School data need to be counted and according to the study of OECD for Greece (2017) data can boost accountability.

Thus, the current research also provides an analysis of the area of DigCompOrg "assessment practices" from teachers self perception by observing how this area affects the other areas of DigCompOrg. In our thesis, all the areas of DigCompOrg framework are combined in order to create a holistic DDDM plan with main target the school improvement. The goal setting is the most crucial part and all the other necessary steps in the school improvement process need to have as a guide these goals (Schildkamp, 2019). This was the highest valued area according to teachers and also, combined with the stationary law of Greece 4189/B/09-10-21 that considers internal coordination procedures and self-evaluation of schools, the general responsibility of the procedures has the director/school leader of the school and all the teaching staff. So, there is a cooperation between them in every year coordination and planning. Students are not involved at all. This was the main reason that this area was accentuated in favour of the self perception of teachers, as was the highest valued area.

So, according to the above and as it is observed in the results below, "assessment practices" according to teachers self perception, is a highly rated and a very important factor in order to process to school improvement. This thesis correlates the other areas of DigCompOrg framework with the specific area in order to have a holistic view of its importance and how this specific area affects the others.

In order to monitor effectively the school organizations it is required good basic data (OECD, 2017), so this thesis justifies the interest of the research in Greece and especially primary schools. Self-evaluation refers to the essential try of all the school community

members to delight the way for school improvement and function (MacBeath, 2000; Theofilidis, 2014), has an enormous value and is able to corroborate the advance by providing promptly a high quality feedback (OECD, 2001). That is the reason why there is a great need for research in the Greek educational fields.

Due to the fact that we live and grow in a digital area, in order to improve the provided quality that school serves, the educational system must constantly change (Burner, 2018). Digital technology is part of education in ways that would have been hard to imagine even a few years ago. A quick instance is like distance learning that stood as a pivot of education through the pandemic that SARS-Cov2 spread (Athanatou & Yfantopoulos, 2021; Darling-Hammond et al., 2020; Lennox et al., 2021; Ramploud et al., 2022; Zhu et al., 2022). After COVID-19 outbreak the digitalization has flourished the idea of digital school in a more formal way, and now schools' Digital technology is "woven so tightly into the fabric of everyday life" (Zammuto et al. 2007, p. 750) that there can be few areas of education that go untouched by 'the digital' in one form or another. Classrooms and other formal learning environments are awash with computer hardware and software, and a growing amount of educational work is conducted on a 'virtual' basis (Selwyn, 2016). In particular, the school management and universities are ruled by software systems that support and structure individual action in a variety of ways (Pont et al., 2008; Tan & Hunter, 2002; Williamson, 2018). Despite the diversity and complexity of technologies in use, 'the digital' is now an expected but largely unremarkable feature of the educational landscape (Cone et al., 2022; Selwyn & Facer, 2014).

In the statement of all these and based to the fact that there is not statutory evaluation in Greece (OECD, 2017, 2020) of digital competences this inquiry tries to "extract" actual data based on DigCompOrg from a school and apply them in a data driven decision making model. The evaluation is obliged to rotate at new models of digital skills (Van Laar et al., 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, 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).

Before we conclude to that, it needs to be clarified that there are some misconceptions about DDDM (Mandinach & Schildkamp, 2021). In order to achieve our target we have to find the right resource of data. Mandinach and Gummer (2015) make clear the importance of considering diverse data sources in the decision-making process because all too often, educators think only of student performance indices as educational data. With the novelty of this approach being related to the exploitation of data from teachers and students for evaluating school oriented at digital competences, this research answers to the current research problem.

The possibility to use DDDM in order to improve decision making in school is a new area in the substance of education. Carefully targeted data can lead us to carefully targeted decisions. This is confirmed also from the studies of Coburn et al. (2009), Coburn and Turner (2011), Mandinach and Jackson (2012) and Mandinach and Schildkamp (2021). To specify, data use is a complex and interpretive process, in which goals have to be set, data have to be identified, collected, analyzed, and interpreted, and used to improve teaching

and learning (Coburn et al., 2009; Coburn & Turner, 2011; Mandinach & Jackson, 2012; Mandinach & Schildkamp, 2021).

Most important to all is to consider the goal of the use of data extracted and why are these things being measured (Tulowitzki, 2016). It is important to prevent goal displacement (Lavertu, 2014). In addition, educators may develop new goals and may need to think about new data to collect to monitor progress towards these new goals (Schildkamp, 2019).

CHAPTER 2

EVALUATION OF SCHOOLS AS EDUCATIONAL ORGANIZATIONS

Evaluation of school as an organization is a very important strict of education. Evaluation issues are of great concern to public opinion, the educational community, researchers and decision-makers on the course of education. This issue has remained stagnant in Greece for a long time because of historical reasons (OECD, 2017). Today, however, it is necessary to give a great worth to the evaluation of education to be used as a mean of improving and developing educational units.

Assessment field combined with new technologies is a new area that arises in the main substance of education. New studies underlying that assessing tools are oriented at editing data as well as for using ICT to drive internal school improvement (OECD, 2015). According to this, educational quality is likely to be improved when decision makers develop policies and implement practices informed by relevant assessment data using Data Driven Decision Making (Cox et al., 2017).

As it considers Greek schools, since the year of 2002, there have been many attempts for self-evaluation and improvement of school quality but none of them wasn't entire focused on digital competences (OECD, 2017). Above the statement of all these, could there be an evaluation model oriented at digital competences based on the founds of self-evaluation? And could these data be used for creating tools such as Data Driven Decision Making?

Below are presented the topics that are studied on this research and interwoven with the fields of evaluation. This section develops the theoretical framework of evaluation and self-evaluation, alongside the basic analytical concepts related to the problematic scope of the evaluation set out oriented at Information and Communication Technologies.

2.1. Evaluation of educational organizations: definition and trends

Evaluation of education is an issue that always concerns society and educational policy makers. Evaluation is defined as the systematic and organized process in which systems, individuals, frameworks or results of an educational mechanism are evaluated on the basis of predetermined criteria and predetermined purposes (Scheerens et al., 2012). Pashiardis & Brauckmann (2009) considers the evaluation of the educational project as a process

through which the leadership of an education system or school unit collects information about the teacher and the learning environment of the school unit in order to improve them. The evaluation of the educational project is part of the administrative function of the audit within the educational organizations (Pashiardis & Brauckmann, 2009). Evaluation of a school should pursue equally testing questions and it should cast its net wider than easy-to-measure performance so it reflects on how the school learns and what it needs to do to improve (MacBeath & Mcglynn, 2002, p.8).

Evaluation indicates two measure points which is: a) the collection and analysis of information and b) use of such information for decision-making school-based. Each object of evaluation is to assess the quality that school offers, to identify problems by collecting and analyzing information and to develop proposals for change or innovation (De Grauwe & Naidoo, 2004).

Evaluation capacity refers to the organizational capacity to conduct and use evaluations (Cousins et al., 2014). The use of evaluating the educational project is very important as it is a level of development and expresses a general philosophy that governs a society as to the purpose of measuring and monitoring the results and functioning of the education system (Bamberger et al., 2010).At the same time, it reflects the state's priorities refers to its aspirations for the provision of education in the general effort to achieve the social and economic goals of the state (Paleokrassas et al., 1997). As described by Alkin and King (2016), over the years evaluators have cycled through various conceptualizations of “use,” including instrumental, conceptual, and symbolic use. Most prominently, instrumental use refers to the direct use of evaluation findings for decision making. Conceptual use or enlightenment implies that an evaluation is used “to change levels of knowledge, understanding, and attitude” (Peck & Gorzalski, 2009, p. 141). Symbolic use refers to an evaluation being used “to convince others of a political position” (Peck & Gorzalski, 2009, p. 141). Currently, a prominent concept of use is that of process use, which refers to the potential utility of stakeholders’ participation in the evaluation process (Lemire et al., 2020, p.54).

Mapping the evaluation, we identified recent trends. The identified trends are not equally relevant or applicable across the many sectors and areas within the broad scope of evaluation and this means that the diverse nature of evaluation is a field of practice (Lemire et al., 2020) and has much more yet to come. One big field that is emerged and is going to grow for years is Big Data Analytics (Bamberger, 2016). Big data refers to new data sources and analytical approaches combined with technological advances that allow an analyst to access, manage, and make use of data as a development of evaluation (Lemire et al., 2020). Data collection through evaluation can be used as a predictor to many situations (Bamberger, 2016).

Another recent trend that emerges is understanding how and why programs work based on a realistic evaluation (Lemire et al., 2020). According to these authors, this type of evaluation tries to understand how, why and under what circumstances programs and what works for whom, in a logical way. In the operation of this type of mechanism are included case studies that have great value for evaluators and stakeholders to learn and for making decisions about future.

Last, the recent trend of educational evaluation is Complexity Theory and Systems Thinking (Bedir et al., 2020), that refers to systems thinking (Dugan et al., 2021; Forss et al., 2011) which distinguish between "complex" and "complicated" (Lemire et al., 2020). Complexity Theory and Systems Thinking are theories of organizational change processes that are dealing with the matter of how organizations operate, interrelate and sustain themselves with their environments (Amagoh, 2016; 2018; Osifo & Omoregbe, 2011). General systems theory explores principles and laws that can be generalized across various systems like educational organizations. Complicated programs for evaluation have multiple levels and strands and also, are common in evaluation (Funnell & Rogers, 2011) instead of complex programs which are continuously floating and difficult to predict (Peck, 2015). Systems thinking in evaluation is useful for understanding how social programs and policies work. This trend is referring to evaluation that involves systems change (Lemire et al., 2020). Certainly, evaluation through systems thinking is connected with data (Benninghaus, 2019a; Dugan et al., 2021) and decision making is integrated as a connection to Systems Thinking (Hogan & Weathers, 2003; Trochim et al., 2006)

School evaluation is a widespread approach used to ensure quality across Europe (OECD, 2013; 2015; 2016). According to OECD (2015) school inspection is the most interrelated activity which is connected with the meaning of evaluation of a school as an organization (OECD, 2015). In 26 countries, both external and internal school evaluation is carried out (Eurydice, 2015; OECD, 2013). In case a country uses both external and internal evaluation, the relationships between then are examined (Eurydice, 2004). Only in 10 countries internal evaluation gives feedback to the external evaluation (Eurydice, 2004). The type of evaluation that is used depends on political priorities of each country. The outcome of school evaluation and its several possible methods that may happen is the quality assurance, often co-existing with other approaches, such as monitoring the entire education system or teacher evaluation (OECD, 2015). Globally there is a tendency in development of school evaluation. Countries in which school evaluation is underdeveloped, such as Greece (OECD, 2017), may be an important field of study for evaluating the education system as a whole, assessing educational benefits from local authorities, or evaluating teachers on an individual basis (Livingston & Flores, 2017).

2.2. Internal and External Evaluation of educational organizations

Considering the fact that governments and education policy makers have a major willing for improving educational performance and school quality, emphasized in the internal and external evaluation type of schools as organizations.

In the internal evaluation the process starts from the school itself and aims at evaluating the educational that is provided (MacBeath, 2005). In these systems, internal evaluation aims at applying innovations to education and the ongoing re-education of educational practices (MacBeath & Mortimore, 2001). The internal evaluation is also presented in forms such as hierarchical internal evaluation, where the upper class within the school unit considers those who are lower, collective internal evaluation or self-evaluation, which is usually presented in decentralized education systems and is based on a different view (McDonald, 2003). In

particular, self-evaluation follows processes that penetrate educational reality, senses it from inside, gives feedback and contributes to an improving quality of the educational system.

The main advantages of collective internal evaluation or self-evaluation are (MacBeath, 2005) that it activates all the factors in the educational community and strengthens the relationship of trust and reciprocity among them, gives teachers the opportunity to realize in a specific way the particular conditions of the school, creates conditions for initiatives and undertaking innovative actions, cultivating co-responsibility and self-commitment, highlighting and disseminating positive educational activities it identifies weaknesses and creates conditions for improvement, indicates in the educational hierarchy in a specific way the children of interventions, contributes to the improvement of educational practices and the change of school culture (MacBeath & Mortimore, 2001).

This form of self-evaluation presents two aspects. The first aspect describes a bureaucratic process in which the school's educational potential is involved by running a school routine, with the result that this attitude does not contribute to the ultimate goal (Saitis, 2000). The second aspect describes the activation of all the school's educational factors, which will contribute to the implementation of innovations in the school and will mobilize forces, so that there is cooperation between the school unit - community - society (Saitis, 2000).

The National Association for the Education of Young Children in the United States describes the key points of quality in the form of various self-evaluation factors, concerning various educational factors (NAEYC, 2009). These factors are: a) teachers inter-relationships and professional training, their lifelong development and commitment, their exertion of authority and management of leadership and their assessment of students' progress b) parents and students, along with the respective communities they form c) material elements: building infrastructure, school equipment, and d) general frame (NAEYC, 2009). All of these are considered vital for the quality of the operation of each preschool unit within the educational system.

Therefore, self-evaluation of a school institution is particularly important for the realization of its objectives. However, beneath the surface of all the above reasons, a number of other factors are involved, complicating the whole process. Such are: the non-transparent and contradictory objectives, whether the control is external or internal, down or bottom-up, or both, the way all these elements interact and the problems and the disputes, which arise through this process (Schratz, 1997). Furthermore, it is a difficultly measurable process, because, on the one hand, the educational project results are manifested in the long run, and on the other hand, these effects involve human temperament and other unpredictable factors (Naxakis, 2002).

In addition, the evaluation of the educational work in the school context of the unique centralization that characterizes the Greek educational system, constitutes an innovative project of supporting the change of structures, processes, relations and culture in the direction of gradual deconcentration, recognizing the relative autonomy of schools, and enhancing teachers' degrees of freedom in the implementation of their work. It has a systemic nature and is linked to many interdependent factors such as resources and resources (infrastructure, equipment, form and content of school knowledge, teaching tools)

(Zhao & Frank, 2003), organizational and administrative structures, educational processes (teaching methods, pedagogical practices) the supporting initiatives (training, compensatory and support interventions), etc. (Solomon, 1999).

As it considers external evaluation of schools, is an established approach to quality assurance in schools (Olafsdottir, et al., 2022). It is carried out by evaluators who are not members of the staff of the respective school and who are accountable to the authorities responsible for education (Eurydice, 2006). The external evaluation of schools concerns activities carried out within the school environment, but without seeking to assign responsibilities to individual staff members (MacBeath et al., 2005). This kind of evaluation aims at monitoring or improving the quality of the education provided or the performance of the pupils (MacBeath et al., 2005). However, the range of aspects under evaluation varies from country to country depending, for example, on the degree of autonomy of schools (Eurydice, 2004; OECD, 2018).

In most educational systems (27 out of 31 where external evaluation is foreseen), external evaluation of schools is the responsibility of a central and supreme body (Eurydice, 2006). On the one hand, it may be a part of the central or higher education authorities commonly called "inspection", or, more rarely, "evaluation section". On the other hand, it can be a separate service, entirely dedicated to the inspection of schools (Eurydice, 2019).

Typically, the frameworks for external evaluation established at a central level cover a wide range of aspects, such as the quality of teaching and learning, student learning outcomes, various areas of school management, and compliance with regulations (MacBeath et al., 2005).

According to Eurydice (2019), external evaluators who usually conduct it, follow specific guidelines or have lists of topics and indicators to take as granded when evaluating the quality of a school. These indicators might include criteria specifically relating to digital education, and therefore require evaluators to evaluate aspects that are related to this area. The majority of external evaluators are asked to evaluate the quality of teaching and learning in each curriculum subject, as well as to evaluate compliance regarding curriculum time or learning outcomes (MacBeath et al., 2005). Despite to that, this guideline looks beyond a simple type for a subject-based evaluation of ICT (Eurydice, 2019). Instead it focuses on whether there are wider evaluation criteria related to the digital integration across the whole school. The criteria involve the integration of digital technologies across the curriculum and in school management processes, as well the quality of digital infrastructure and the level of investment (Eurydice, 2019).

Among the countries that external school evaluation is carried out, only 14 out of 163 include criteria related to digital education in their external school evaluation frameworks (Eurydice, 2019). For example, in Ireland and in some regions in Spain, evaluators may consider in which grade schools are integrating digital technologies by assuring that the school has a digital learning plan settled, that the “Digital Learning Framework” is used and the school is compliant with the criteria of the “Digital Strategy ICT” funding programme (Eurydice, 2019). Different aspects of digital education are covered through evaluation frameworks but they usually include in which grade digital technologies are being integrated into the teaching and learning process.

The most important observation is that the most modern educational systems of school around the world now have highly developed evaluation processes (Godfrey, 2020). Guided by the external evaluation trends have followed the need for schools to develop their own capacities for self-review. An OECD report (2013) describes a number of ways in which developing school evaluation capacity should be a priority for school improvement. So, according to this thesis view, a combination between self-evaluation and digital competences that European Commission for quality insurance suggests would boost the desirable goal of school improvement.

2.3. Educational evaluation models: the pivots of educational evaluation.

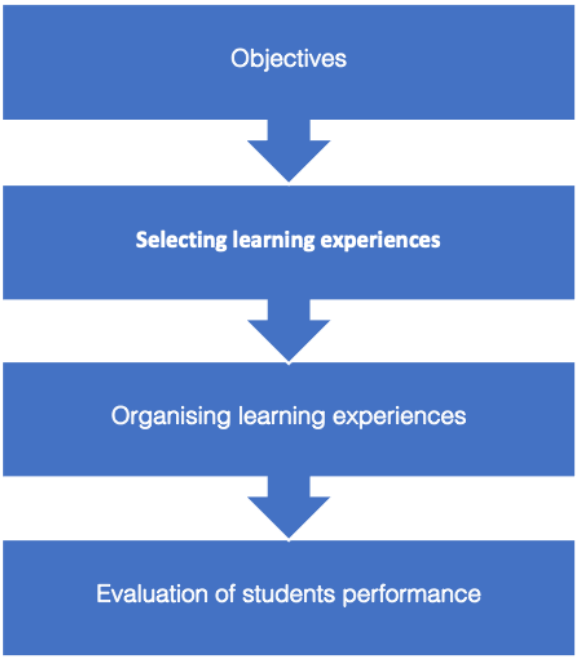
Purpose of this chapter is the mapping of the theoretical background on which the development and evolution of the scientific field of educational evaluation was established. Special emphasis is placed on the summary presentation of the most important models of educational evaluation and its particular characteristics. A large number of educational evaluation models are presented in the international bibliography, which have several similarities and variations and that happens mainly due to the different approach of each researcher (Anh, 2018; Bonniol & Vial, 2007; Petropoulou et al., 2015; Spector & Yuen, 2016; Stufflebeam, 2001). By the term "educational evaluation model" we mean the approach which contains both the theoretical framework of the evaluation and the purpose of its objective, the roles of the participating actors, the research methods and the research instruments used, the aim of its application and the use of its results (Nevo, 2013; Petropoulou et al., 2015; Shim et al., 2015; Vo, 2018).

2.3.1. Target-centred or target model

Target-centred or target models have as their primary concern the control over the achievement of the goals set. They aim to determine whether and to what extent the objectives of the curriculum have been achieved. Representatives of target-oriented models are Tyler, Metfessel & Michael, Provus and Hammond (Owston, 2008; Petropoulou et al., 2015; Stavropoulou & Stroubouki, 2014).

Tyler believed that the last step in the evaluation process was the most critical because if there was a difference between the goals and the results, careful study and detection of the possible causes that led to this deviation should be followed (Anh, 2018; Petropoulou et al., 2015), as it can be seen in Figure 1 below. Metfessel & Michael model was based on the Tyler model (Akinci & Erdogan, 2021) but has some innovative elements in its methodological implementation framework, such as the use of a variety of technical data collection and analysis tools, the determination of predefined criteria and levels of desired performance, as well as the involvement of the school community in the evaluation process (Stavropoulou & Stroubouki, 2014).

Figure 2
TheTyler's model



Source: Print, (1993, p. 65).

The Provus model approaches differently the evaluation (Saalman, 2020) which is a process that has three main pillars: a) to determine the desired levels of performance b) to establish the difference between the performance in some of the dimensions of the program and the predetermined desired performance level and c) gathering and exploiting information on the potential variations observed in the desired outcome to ensure ongoing monitoring and supervision of the training (Tudevdagva, 2020). Innovation is based on the use of problem-solving and decision-making processes and supports the cooperation between the program stakeholders (Petropoulou et al., 2015).

2.3.2. Decision-Management Models

The most important representatives of these theoretical models are Alkin and Stufflebeam and are designed to collect, process and analyze data that are needed for decision-making by the management of education (Lemire et al., 2020; Petropoulou et al., 2015).

The Alkin model is a classic example of a "decision-management" model and proposes five distinct types of evaluation: a) the evaluation of the system, which is the evaluation carried out to provide information on the education system, b) the design of the program, which evaluation is made in order to select the best educational program to meet the needs that have been recorded, c) the implementation of the program, to what extent the program has been properly implemented , d) improvement of the program, which is the evaluation aimed at collecting, processing and analyzing data related to the progress of the program implementation e) the certification of the program which is the evaluation that checks the quality of the program and the generalization of its use (Alkin & Christie, 2004; 2013; Lemire et al., 2020)

The Stufflebeam model (Stufflebeam, 2007) known as CIPP (acronym for the words Context, Input, Process, Product), was designed to help educators successfully cope with design, structure, implementation and reaction decisions, and proposes a different type of evaluation for each type of decision: framework evaluation, input evaluation, process evaluation and result evaluation (Stufflebeam & Zhang, 2017).

Stufflebeam's (2000) CIPP model (Sagern & Mavrot, 2021; Warju, 2016) which means Context, Input, Process, Product (CIPP), as shown in Figure 2, is one of the most tested model that has been developed (Stufflebeam, 2000). This model was used in order to improve accountability for the school programs of United States. The specific model then was used for social programs, health, business and military. The model defined as "a comprehensive framework for guiding evaluations of programs, projects, personnel, products and evaluation system" (Stufflebeam, 2003, p.31). The CIPP model has four different dimensions which are context evaluation, input evaluation, process evaluation and product evaluation (Vo, 2017a). According to this model an evaluator can use the whole CIPP model or just one dimension of it (Anh, 2018).

Figure 3
The Stufflebeam model

Note. Adapted from "*The CIPP Model for Evaluation*", by Stufflebeam, D. L., 2003, pp. 33, Boston, MA: Kluwer Academic Publishers.

2.3.3 Critically Centred Models

Models of scientific judgment or critically centred attach, particular emphasis to the evaluator scientific judgment and experience. These models advocate that the knowledge and judgment of the qualified evaluator largely ensure objectivity and credibility in the

evaluation process. The most representative models of this theoretical movement are Scriven, Eisner and Borich (Grammatikopoulos, 2006; Vianna, 2000)

The Scriven model is called "Goalless Free Evaluation". According to this, the evaluators should check the results of the evaluated program, its targets and draw conclusions about its overall value and not with the predetermined targets (Anh, 2018; Petropoulou et al., 2015). Scriven suggested that if the evaluator does not know the goals of the process he is asked to evaluate then he cannot influence his judgment and he will not be able to detect the unwanted results of the programs or the projects (Anh, 2018; Vianna, 2000).

The Eisner Model (Connoisseurship Evaluation) marks that the assessor should express the views freely on the basis of his experience and knowledge and places great emphasis on the critical competence of the educator. This model attaches great importance to the type of goals to be set during the evaluation (Petropoulou et al., 2015; Vars et al., 2002).

The Borich model proposes Structured Hierarchical Decomposition and in order to achieve the overall evaluation of a program, the components of the program must be analysed first and then a documented overall judgment - its appreciation. This model exploits the structured analysis, in which all participants act as a team and work together (Narine & Harder, 2021).

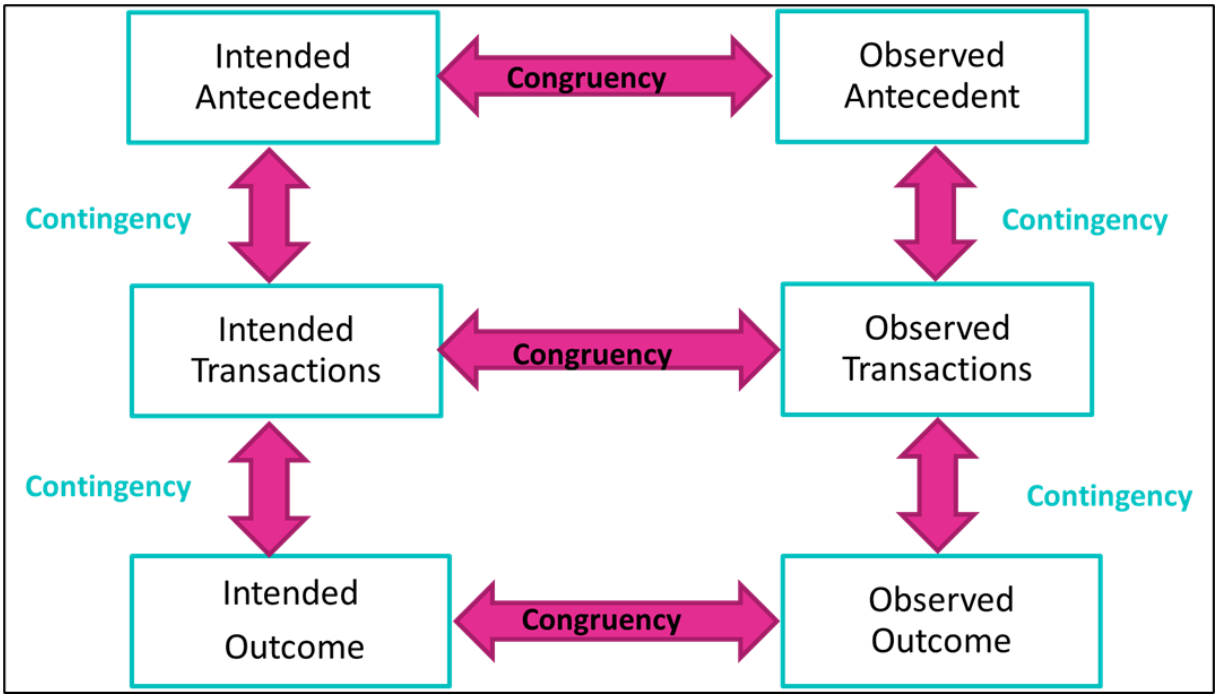
2.3.4. Participatory models

Participatory models are a new trend in the evaluation process and according to them the evaluation is an anthropocentric process focused on the interaction between participants (Petropoulou et al., 2015; Sager & Mavrot, 2021). Through the collaboration of the evaluator and the evaluated, the needs of the people are understood, the deficiencies and the weaknesses are taken into account and the conditions under which the educational intervention took place are considered. Representative models are Stake and Cuba (Petropoulou et al., 2015).

The Stake model or the "Response Evaluation" (see Figure 3) model gives a particular emphasis on the actions and activities of the program and less on the evaluator's positions (Nevo, 2013). It essentially argues that the evaluation should take into account the needs and characteristics of the evaluators and be based on them. Thus the evaluation process becomes participatory, flexible and based on the subjective judgment of the evaluator.

Figure 4

The Stake model or the "Response Evaluation" model.



Note. Reprinted from "Program Evaluation, Particularly Responsive Evaluation", by Stake, R.E. (2000). Retrieved from https://www.examrace.com/Study-Material/Education/Stakes-Responsive-Curriculum-Evaluation-Model-Education-YouTube-Lecture-Handouts.html

2.3.5. Educational effectiveness models

Education effectiveness models attempt to highlight which factors in the learning process, and curriculum at different school levels can directly or indirectly explain the differences found between student achievements taking into account the particular social and economic characteristics of the pupils. It is a basic model to depict the functioning of educational systems and schools as organizations is an analytical tool to define facets of school effectiveness (Scheerens & Blömeke, 2016). Representative model is the Kyriakides & Creemers (Petropoulou et al., 2015).

The model of Kyriakides & Creemers is the most modern Dynamic Model of Educational Efficiency, which identifies the dynamic relationships that develop between the multiple factors associated with effectiveness (Kyriakides & Creemers, 2008). The aim of this model was through its approach to contribute to the development of educational evaluation tools and consequently to the improvement of the quality of education (Creemers & Kyriakides, 2015). Based on the Dynamic Model of Educational Efficiency, it is effective to identify those weaknesses and develop appropriate strategies to improve schooling practices.

2.3.6 Self-evaluation models of the school

The self-evaluation models of school claims that school unit is a living learning organization, where members in a continuous way widespread their capacity to create the results that they really want, where collective ambitiousness is free and where people are continually

learning how to learn (Chapman & Sammons, 2013; Kyriakides & Campbell, 2004; Senge, 1990). Self-evaluation is considered to be the pillar on which systematic collection, analysis and evaluation of the necessary data for continuous improvement of the quality of the school happens (Schildkamp et al., 2009). MacBeath (2005) is considered to be one of the most prominent scientists of this trend and gives a particular pedagogical value to the concept of self-evaluation. Below, in Table 2 there is a list of the models that were presented in this section.

Table 2
Educational evaluation models

Evaluation Models	Representers	Characteristics
Target Models	Tyler(1942), Metfessel & Michael (1967), Provus (1971), Hammond (1973)	Oriented at the goal settled from the beginning.
Decision – Management Models	Alkin (1969), Stufflebeam (1971)	Oriented at affecting the management of the school positively in making decisions by retrieving data.
Critically Centred Models	Scriven (1967), Eisner (1979), Borich (1977)	Oriented at the value of evaluators scientific judgement.
Participatory models	Stake (1975), Guba (1978)	Oriented at the meaningful collaboration of evaluator and evaluated.
Self-evaluation models of school	MacBeath (2005)	Oriented at the flexibility of a school organization to make its own try for setting goals and evaluating the process by retrieving data.
Education effectiveness measurement models	Kyriakides & Creemers (2008)	Oriented at the learning process and the factors that could affect it

2.4. Self-evaluation at schools oriented at ICT in Europe

Self-evaluations help planners to analyze the school's current stage of development in ICT and Digital Technologies. Completion of all the self-evaluation processes provides the school with a snapshot of its strengths and challenges in relation to Technology Enhanced Learning and allows the school to identify priorities for progression to more advanced stages and becoming a Digital School of Europe (Eurydice, 2019).

Across Europe there are several frameworks in relevance to the digital maturity of educational institutions: Assessing the e-Maturity of your School (Ae-MoYS), Framework for Digitally competent Educational Organizations (DigCompOrg), Digital Competence of Educators (DigCompEdu), eLearning Roadmap, eLemer, The ePortfolios & Open Badges Maturity Matrix (ePOBMM), Future Classroom Maturity Model (FCMM), HEInnovate/Heinnovative, Jisc Strategic ICT Toolkit (JISC), Ledning, Infrastruktur, Kompetens, Användning (LIKA), Microsoft Innovation Framework & self-reflection tool, NACCE SRF, OPEKA, Up-scaling Creative Classrooms in Europe (SCALE CCR), School mentor, VENSTRESS, FDMS and the SELFIE tool (Redep, 2021). A detailed description of them is made in Table 3.

The results of a literature review and of qualitative analysis of the above frameworks (Redep et al., 2017) have shown that there is no generic framework and instrument that could be implemented in schools for identifying areas and elements that are very important for establishing a system of digital mature schools combined with evaluating the level of schools digital maturity and advising about how to upgrade the level of digital maturity (Redep, 2021). Despite to this information, the "European Framework for Digitally Competent Educational Organizations" (DigCompOrg) (INTEF, 2017; Kampylis et al., 2015) is the one that best describes the comprehensive field of the digital maturity of schools (Redep, 2021). Different studies have shown that the DigCompOrg can be implemented for various purposes: for the construction of one's own (Balaban et al., 2018; Jugo et al.,2017; Redep et al., 2019); to reflect on pedagogies of ICT learning (Fedeli, 2017; López & González, 2017); for the preparation of ICT implementation plans (Brolpito et al., 2016; Giunti et al., 2018); for the identification of specific areas of labor improvement (Malach and Kostoloányová, 2017) or even for the construction of digital evaluation models (Campelj, 2019).

DigCompOrg takes into account all aspects of digitalization for learning in educational organizations (Kampylis et al., 2015).The main objectives of the model are two: 1) promote self-reflection and self-assessment in their commitment with learning and digital pedagogies and 2) guide educational policies in the design and evaluation of integration programs of digital learning technologies (Fernández & Prendes, 2021). It presents seven key areas: 1) leadership and governance practices; 2) teaching and learning practices; 3) professional development; 4) evaluation practices; 5) resumes and contents; 6) collaboration and communication practices; 7) infrastructure (SELFIE, 2019). In turn, these areas are divided into 15 sub-areas with 74 interconnected descriptors to which other specific ones can be added, depending on the context (Kampylis et al., 2015).

The objectives of these interconnections are linked with "organizational" and "individual" responsibilities in a constant flow. It follows from the above that for an educational organization to be considered "digitally competent" is needed a balanced mix between strong leadership and governance and people on the other side (Fernández & Prendes, 2021). It is observed that this concept of digitally competent organization is related to that of "learning organizations" and "competence-based organization" (Antal et al., 2014; Stoll and Kools, 2017; Tejada and Ship, 2005; Watson, 2014), with the concept of "organizational learning" (Hong et al., 2017) or even with "professional learning communities" (Thompson et al., 2004). The main idea is creating a culture of collaborative work with a common purpose that transcends the individual and moves to the organizational sphere (Fernández & Prendes, 2021).

Although DigCompOrg was first designed to be used by educational organizations, now becomes a cross-sector conceptual model that promotes system change applicable in any context seeking greater digital efficiency (Durek et al., 2017; Linko et al., 2016). The policy creators and the decision-makers in the education system can exploit existing frameworks for the digital maturity of educational institutions in the development of policies and initiatives aimed at the successful integration of digital technologies into the educational system (Redep et al., 2017).

Underlying the idea of a school that may have a difference in some aspects from a typical representative of a particular level (Redep, 2021) that DigCompOrg promotes, this thesis uses self-evaluation of the digital competence based on the characteristics of the school on its own characteristics and regarding the maturity level it has been appraised (Redep, 2021). According to Redep (2021), the main goals of digital transformation through a theoretical review, based on frameworks for the digital maturity of educational institutions (Redep, 2021) are: 1) Contemporaneity of educational processes; 2) Collaboration between participants and stakeholders; 3) Student-centricity; 4) Content excellence; 5) Creativity and innovation culture; 6) Commitment to continuous change; 7) Cooperation with stakeholders; 8) Concern for equal opportunities and others. All the above make the part of evaluation a key sector of DigCompOrg framework and our research.

2.5. School self-evaluation in Greece

Self-evaluation of schools constitutes a central part of effort to improve themselves in many educational systems. Self-evaluation gives an opportunity to the school unit to become aware of itself, to realize school life areas where good work is done, to point out others which need improvement and to enhance the teachers' professional development (Theofilidis, 2014). Chapman claims that self-evaluation should be shaped by the schools themselves and incorporated into the usual management systems (Chapman, 2008). The development of self-evaluation strategies has led to effective, intelligent schools (MacGilchrist et al., 2004). The school as an organization has as a general purpose the cognitive, the social and the emotional development of students (MacGilchrist et al., 2004). If the school combines the human dynamic with the practical resources we have an intelligent school (MacGilchrist et al., 2004). Intelligent schools use all of their material resources in order to have the maximum efforts of improvement (MacGilchrist et al., 2004). Concluding from all the above, the use of ICT in the self–valuation procedures is a matter of great importance. The use of ICT in all aspects of a school characterises a school as smart (Omidinia et al., 2013).

The Greek Ministry of Education and the Institute of Educational Policy in the "Self-Evaluation at a Glance 2013- 2014", considers it a continuous dynamic process integrated into the functions of the school, followed a two year pilot project, alongside a new teacher evaluation system but due to the resistance from teachers' unions, both teacher evaluation and school self-evaluation were "frozen" (OECD, 2017). Below there is a report of every aspect of this failure.

For so many reasons that they are going to be mentioned and especially for the reason of non transparency in the self-evaluation procedures, the Greek teachers did not continue the processes of self-evaluation and evaluation in general (OECD, 2017). This process was not mandatory by the Ministry of Education. They protested against of any form of evaluations with unions as supporters. As a meaning of understanding the whole culture of Greek teachers above the term evaluation, this thesis must report some facts.

According to the OECD (2017) report, the trends on Greek educational system changed to more wider forms of educational evaluation and by that meaning that took a participative form, focusing on the evaluation of educational work and self-evaluation of school, rather than on individually teachers' evaluation (Verdis, 2002). But the target and the form of it remained one in which it was very hard to develop a culture of evaluation of teachers, as it was often seen as punitive and controlling means, compromising and leading to the reduce of teacher autonomy (IEP, 2016).

From the 2013/14 school year an annual school self-evaluation project became obligatory for all types of pre-primary, primary and secondary schools. The legislation (Circulars 30973/Γ1/05-03-2013, 190089/Γ1/10-12-2013, Ministerial Decision 30972/Γ1/05-03-2014) states that at the beginning of each school year, every school organization has to set its own educational achievement targets and plan the way that they want to reach them. The framework of school self-evaluation includes a review of teaching and learning based on defined indicators that were set by the Institute of Educational Policy (IEP). These were: action planning for the improvement of special areas of interest, implementation of improvement plans and controlling and evaluating the use of evidence and progress according to the intended outcomes (OECD, 2017). At the end of each school year, the staff should provide a school's report through a centrally provided reporting template and submitted to the relevant regional Directorate. The school leader supports the whole procedure by offering advice and training on specific evaluation according to necessities (OECD, 2017). It is worth noting is that the self-evaluation, by giving schools the ability to plan, organize and evaluate their own work, seeks to offer them more autonomy (OECD, 2017).The truth is that during that years, again with the directions and unions legally support, few schools implemented self-evaluation.

In conclusion, we would say that there is not mandatory self-evaluation or other form of evaluation in Greek Educational system until the year 2022. In order to apply the self-evaluation procedures in the Greek educational system this challenge requires of educational policymakers, to have a great design, so as to promote self-evaluation.

Policy makers and strategic planners should ensure that teachers are properly informed about the process and the methodology, cultivating a positive attitude towards it, improving their educational work and professional development, removing their fears, suspicions and insecurity (OECD, 2017). Furthermore, teachers should be trained on the methodology, the tools and the self-evaluation practices so that they can apply them adequately and consistently (Mazurkiewicz et al., 2014). The most important thing above all and according to this thesis opinion is involving teachers and education leaders in developing and owning the culture of evaluation. Every school according to its retrieved data should have its own form and type of evaluating itself. Evaluation processes will not work if they are seen as something as imposed and punitive, and of course the history in Greece means that is a risk (OECD, 2017).

2.6. Conclusion

Despite the fact that there has been made great effort from the educational European community to develop and implement digital evaluation tools, we see that each country implements its own Information and Communication Technology policy (OECD, 2017). According to this, we cannot extract universal results for the technological capacity of the schools of the European Educational Community. Therefore, additional research and proposal for future study would be a concrete tool to be used by all member states to assess the technological capacity of the members of the European Union.

Also, as we see from the evaluation models that are exposed, the existing research work focusing on providing targeted recommendations to sustainable school improvement, is low (Mandinach & Gummer, 2015). It is concluded that only in Targeted models and Self-evaluation models the interesting is around the target setted. As we deepen in the theme, it is observed that Self-evaluation model gives the necessary flexibility to a school as an organization to create the vision that needs in the path of goal achievement. Other models such as participatory, decision-management and critically centred models give value to the participants unlike education effectiveness measurement models that have a more linear form. All the models consider the change, but further to that the researchers need to highlight what could gain through its every model uniqueness. That is why this thesis supports the flexibility of evaluation models. The conclusion conducted is that in Self-evaluation models there is a special concern about the goal settled but further research is necessary so as to propose methods and systems to support school organizations in engaging in these processes and to extend them within the digital-supported context.

Furthermore, the framework and tool for the digital maturity of educational institutions can be used to evaluate a school's digital maturity level, but also to identify areas for improvement that could enable the growth of the scale of digital maturity, and improve the overall reputation of the educational institution. Through the implementation of the framework and tool for assessment, educational institutions can develop their own digital strategies to enhance teaching, learning, and business processes and undertake the digital transformation by using digital technologies (Redep, 2021).

At last, it would be a great matter of discussion the approaching of feedback in digital form that can support opportunities for learning (Lamb, 2018) and generally in digital integration within the digitally-mediated society. The need to consider when and how our approaches to feedback should pay greater attention towards opportunities for the multimodal representation of academic knowledge (Lamb, 2018) and school improvement as this thesis suggests is now more important than ever.

Concluding, as OECD (2013) reports building a school evaluation capacity is a priority for school improvement and thus to that, another important reason for using self-evaluation is the migration of decision making processes to the local school level (Ladden, 2015).This thesis supports the opinion of using as a strategy self-evaluation for improving schools (Chapman & Sammons, 2013; MacBeath & Mortimore, 2001; 2005; MacGilchrist, 2010). As MacBeath et al. (2000) highlight, self-evaluation is the meeting point of internal and external expectations of a school, of internal and external evaluation and of accountability and

development (MacBeath et al., 2000). The most important element that made self-evaluation best suited and valued for the current research, is that self-evaluation has to identify its own target and focus on the identity of the school that is referred (MacBeath et al., 2000). In the meaning of the above self- evaluation should always have its own eligible story to wright and is a flexible strategy in order to have school improvement.

CHAPTER 3

DIGITAL COMPETENCE

Educational Technology has a promising and prominent future, but those with responsibility in defining discipline and building their own space, assume that the simple use of technological means does not involve talking about Educational Technology only (King & South, 2017).It is a great matter to focus our attention on the theoretical models that support pedagogical action supported by technologies and the didactic action configured as a first stage process and that theoretical framework will enable us to rebuild knowledge and to advance and innovation in the real practices of the educational world (Prendes Espinosa, 2018). Schools are ecosystems with a wide range of interrelating component elements, the actions of which can affect the whole structure in unique ways (Zhao & Frank, 2003), should be taken a holistic view that effectively includes all of the potential actors and their level of contribution. This is one of the greatest reasons that the matter of identifying the level of school digital competence is complex and needs special attention in the way that is compromised because schools are ecosystems with a wide range of interrelating component elements (Zhao & Frank, 2003).

This chapter presents the concept of digital competence. According to OECD (2017) this challenge is at the core of virtually countries' education policies, and comprises two aspects. First, teachers need sufficient training to deploy and teach about digital technologies. Second, countries need a standard for digital skills and literacy for students (R van der Vlies, 2020). As it considers Greece, it is important to note that the pervious years there was no formal strategy for the digital transformation to a digital competent environment of the public sector at national level. Moreover, it is also observed that there no strategy for the development of innovation in public governance[2]. In addition, through this section is highlighted the need to digital capacity of the entire educational organization in order to have a holistic digital approach.

3.1. Digital competences of teachers: definition and models

An individual competence in general, is a fundamental idea in the areas of human resource management, lifelong learning and performance management (García-Barriocanal et al., 2012; Tripathi & Ranjan, 2013). They can be defined as: "a set of knowledge, skills and attitudes that an individual possess or needs to acquire, in order to perform an activity within a specific context. Performance may range from the basic level of proficiency to the highest levels of excellence" (Sampson & Fytros, 2008, p. 165). Digital competence is the key concept on the set of knowledge. The European Union defines this term as: "the safe, critical and responsible use of and interaction with digital technologies for learning, at work and for participation in society. It includes information and data literacy, communication and

[2] www.nationalcoalition.gov.gr

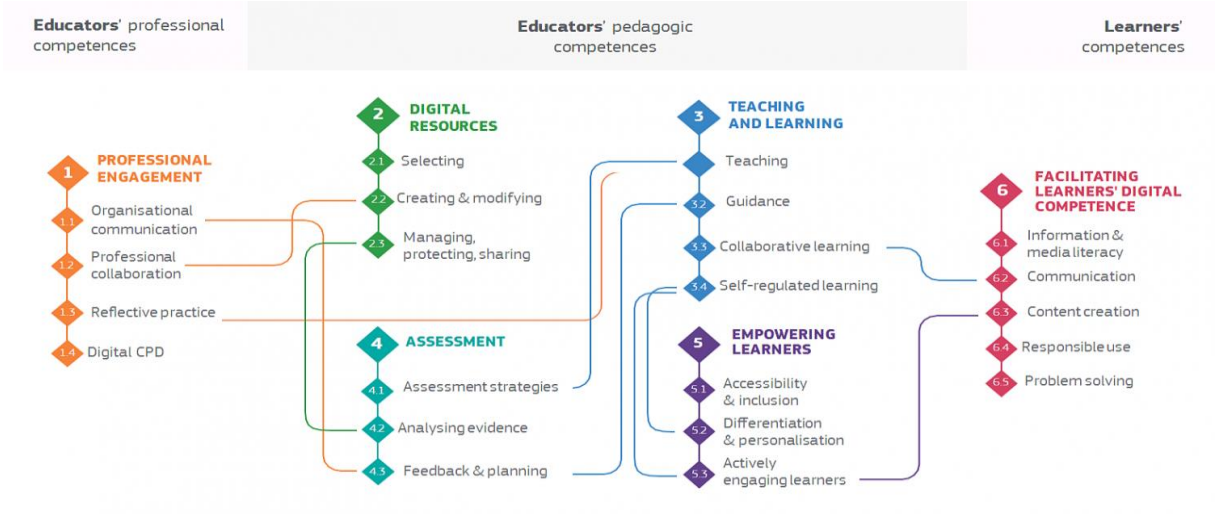
collaboration, media literacy, digital content creation (including programming), security (including digital well-being and cybersecurity-related skills), intellectual property issues, problem solving and critical thinking" (Council of European Union, 2018, p. 9)

Digital competence of teachers is the basis to make effective use of technologies and every teacher must be master in the current society (Basilotta-Gómez-Pablos, 2022; Cabero et al., 2020). Teachers must act in order to support their students as an active part of a digital word (Domingo et al., 2020). Adding to this definition, Durán et al. (2019) comment that adopting a set of pedagogical criteria and applying a set of skills in order to have effectively integrated new technologies into their pedagogical practice is a key to make an effective use of ICT. Ferrari (2012) defined the term of digital competence as: “the set of knowledge, skills, attitudes, abilities, strategies and awareness that are required when using ICT [information and communication technologies] and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning and socialising” (Ferrari, 2012, p. 30).

There are many types of models and frameworks that are highlighting aspects of teachers' digital competences. The most well-known is “European Framework for Digital Competence of Teachers: DigCompEdu” (Caena & Redecker, 2019) that is really helpful for teachers from all levels of education to assess their abilities in digital technologies, to identify where they can be trained and to assess the objectives of this training (Redecker, 2017).

The model DigCompEdu (Figure 5) is spread around six areas of competences (Caena & Redecker, 2019) in which teachers should be enbaptysed and trained. These are: 1) professional engagement (using digital technologies for communication, collaboration, and professional development), 2) digital resources 3) teaching and learning (organizing the use of digital technologies in teaching and learning), 4) assessment (commitment in assessment with digital technologies), 5) “charging” learners with abilities using digital technologies and 6) facilitating learners’ digital competence (enabling learners to creatively and responsibly use digital technologies for information, communication, content creation, wellbeing and problem-solving) (Redep,2021). The European Framework for the Digital Competence of Educators (DigCompEdu) is designed to align the digital competences that teachers must have in order to be adapted to new educational terms (Carretero et al., 2017).

Figure 5
The DIGCOMPEDU framework



Source: Redecker & Punie (2017, p.8)

International Society for Technology in Education (ISTE) proposes the "Information and Communication Technology Standards for Teachers" (NETS-T) and UNESCO the "ICT Competencies for Teachers" (ICT CFT) (UNESCO, 2019). ICT CFT has until now three versions and focuses on 18 competencies:

1. Articulate how their classroom practices correspond to and support institutional and national policy;
2. Analyse curriculum standards and identify how ICT can be used pedagogically to support attainment of the standards;
3. Make appropriate ICT choices to support specific teaching and learning methodologies;
4. Identify the functions of hardware components and common productivity software applications and be able to use them;
5. Organize the physical environment to ensure technology supports different learning methodologies in an inclusive manner;
6. Use ICT to support their own professional development ;
7. Design, modify and implement classroom practices that support institutional and/or national policies, international commitments and social priorities;
8. Integrate ICT across subject content, teaching and assessment processes, and grade levels, and create a conducive ICT-enhanced learning environment where students, supported by ICT, demonstrate mastery of curriculum standards;
9. Design ICT-supported project-based learning activities and use ICT to facilitate students to create, implement and monitor project plans and solve complex problems;
10. Blend varied digital tools and resources to create an integrated digital learning environment to support students' higher-order thinking and problem-solving skills;
11. Use digital tools flexibly to facilitate collaborative learning, manage students and other learning partners and administer the learning process;

12. Use technology to interact with professional networks to support their own professional development ;
13. Critique institutional and national education policies alike, suggest revisions, design improvements and speculate on the impact of these changes;
14. Determine how best to incorporate student-centred and collaborative learning to ensure mastery of multidisciplinary curriculum standards;
15. While determining learning parameters, encourage student self-management in student-centred and collaborative learning;
16. Design knowledge communities and use digital tools to support pervasive learning;
17. Play a leadership role in devising a technology strategy for their school to turn it into a learning organization;
18. Continually develop, experiment, coach, innovate, and share best practice to determine how the school can best be served by technology.

Unlike ICT CFT which obviously enties the matter of revision/evaluation, the NETS-S focuses on the tree levels of teachers' pedagogical use of ICT are (Yieng & Daud, 2018): 1, Knowledge acquisition; 2, Knowledge deepening and 3, Knowledge creation. ETS-T standards are:

1. Facilitate and inspire student learning and creativity;
2. Design and develop digital-age learning experiences and assessments;
3. Model digital-age work and learning;
4. Promote and model digital citizenship and responsibility
5. Engage in professional growth and leadership;
6. Social, ethical, legal and human issues which means that teachers' behaviour should align the legal and ethical practice related to digital use.

Also there is a trending interest in higher institutions in order to learn the state of digital competencies of university institutions and developing (Basilotta-Gómez-Pablos, 2022). More specifically, Helfenberger, Prendes & Gutiérrez (2019) in their study developed ideas and models to provide for attests and/or certificates from multiple perspectives the digital competence. Those are:

a) a model based related to management, teaching and research competences taking into account the relevance of digital competences, plus a certification model based on different levels and external evaluation;

b) a model for a competence framework-app as self-evaluation tool for university teachers departing from a database of empirically validated competencies, and

c) an open source educational repository to promote peer-valuing digital academic educational products.

Durán, Gutiérrez and Prendes (2016a) studied, analysed and discussed, at international and national level, a representative and systematically chosen, sample of theoretical models of teachers' digital competencies. Those theoretical models regarde mutual and differentiating elements. They all refer to digital competencies for citizens, teachers and university professors. In the 21st century, citizenship requires a digital alphabetise that is

relevant to everyday life and therefore can be initiatived from a primarily technological perspective. That contains the inclusion of fields of technology, communication and information, the capacity to exploit the educational potential of technology and the capacity to innovate educational processes incorporating technologies effectively. Teachers' digital competencies involve technologies for the use in teaching procedures.Adding to the above, in their research is highlighted that all models agree that university professors' digital profile is more complex and that the definition of their digital competencies needs to include three fields of action: teaching, research and administration (Durán et al., 2016a).

From this view, the authors (Durán et al., 2016a) developed a proposal for a comprehensive model of digital competencies for university professors that includes the fields of technology, communication, information, multimedia, security and problem solving as the least requirements for citizens, for teaching activities supported by technology such as management teaching, evaluation of students' outcomes, exploiting technology's didactic potential, technology training, facilitating learning and creativity by using technology and also dimensions related to university professors' profile such as research, pedagogic innovation, diffusion and publication of academic output in the web.

In 2016 the authors revised their own model and they defined 10 areas of digital competence for university teachers, and finally Prendes, Gutiérrez & Martínez (2018) exposed a second version of their digital teachers' competence model with five levels of domain relative to digital competence. This model has thefounds to be the base for different approaches to digital competence of teachers, not only in the higher education system because it could be used to different educational levels.

In a general way, apart from the identification of the three main constituents of competence (knowledge, skills and attitudes) and their span in a continuum of proficiency level, the latter definition highlights a key factor that greatly affects the other two, especially the context in which the competence is being performed and assessed. The definition of context "the particular situation in which a practitioner is required to operate" (Cheetham & Chivers, 2005) is considered vital, since the level of proficiency of a specific competence is highly dependent on the context in which it is used (Cheetham & Chivers, 2005; Wesselink & Wals, 2011). Moreover, competences themselves differ when performed in different contexts, since the required knowledge, skills or attitudes of the individual are shifted to meet the new requirements of the changing context (Le Deist & Winterton, 2005).

3.2. Organizational competence of schools

Apart from the individual meaning, competence has also been identified as a characteristic of organizations (Sergis, 2017), with the assumption that the school is a learning organization. According to OECD the school is a learning organization that "has the capacity to change and adapt routinely to new environments and circumstances as its members, individually and together, learn their way to realizing their vision" (Kools & Stoll, 2016, p. 6). The concept of a school as a learning organization is very popular (Kools & Stoll, 2016). The school is considered as an organization by many theories that deals with

external environment, facilitates and sustains organizational change and innovation and even improves students' outcomes (Fullan, 2018; Giles & Hargreaves, 2006; Senge et al., 2012; Silins & Mulford, 2004; Tichnor-Wagner et al., 2016). Also, adding to the previous Lines and Mustian (2004) refers that an organization is competency based and also competency-based models can be implemented for training and development. Competencies are strategic issues of the organization (Lines & Mustian, 2004). By this point of view, the school as an organization has competences.

This standpoint has been adopted in this research for the particular context of schools, viewing a more holistic approach of schools as organizations. The model for measuring school's digital competence in our research is based on DigCompOrg and it has been analysed in a previous section. That view is clearly differentiated from the approach that regards organizational competences as entirely the sum of the individual staff competences, since a variety of other actors interplay and produce unique results, even with almost the same incoming stimulations (Rakickaite et al., 2011). From this view, organizations are regarded as "individual" bodies that are competent enough to specific fields and in their operation (Sergis, 2017). Moreover, the high level of competence at organizational level is considered vital to their development (Harris, 2007; Lima Nogueira & Battaglia, 2012) and constant evaluation of the actual outcome must be performed for remedying purposes (Dhillon, 2008).

The definition of organizational competence encompasses the organizational resources, capacities and competence itself (Sergis, 2017). The functions of the organizational resources (Zangiski et al., 2013) and the combination of them, can offer the organizational capabilities (Martelo et al., 2013). In addition, organizational competences illustrate capabilities that have been practised and have presented quantifiable outcomes (Open Learn, 2006). Finally, the concept of dynamic capabilities describes the ability of an organization to continuously develop its competences by adapting to new circumstances (Sanchez, 2004; Teece, 2007) and to introduce themselves in organizational learning

Figure 6

Representation of Organizational competence according to Sergis (2017).

Source: Sergis, 2017, p. 43.

A proposal was made by Sergis and Sampson (2014) about school digital competence profiling framework and it was defined as a three-dimensional entity. The individual competences dimension which address the competences of the core human factors

affecting the design and implementation of the schools' strategic plan, namely the teaching staff and the principals, the tangible assets dimension which mainly refers to the infrastructure of the school and the organizational culture dimension which the literature argues towards the school culture's importance for effective ICT integration in schools (Somekh, 2008). Figure 6 by Sergis (2017, p. 43) is a representation of the different concepts that emerges from the definition of organizational competence

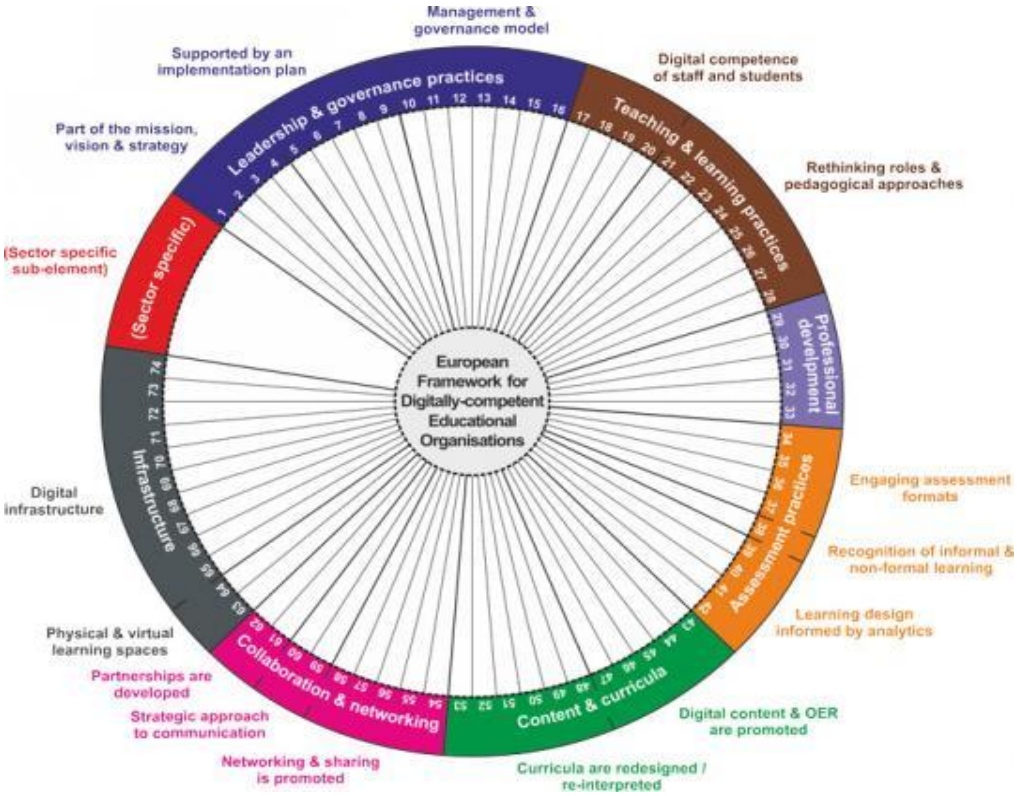
In order to measure the grade of digital integration of school as an organism, DigCompOrg framework is established by educational organizations as a model across Europe (Kampylis et al., 2015) (Figure 7).The digital competence has an effect in every school as an organization even in the curriculum (Javaid et al., 2020). DigCompOrg is positioned as one of the conceptual frameworks that best describes the comprehensive field of digital maturity in schools but it needs to be adapted to the local context (Fernandez & Prendes, 2022). Also, DigCompOrg has flexibility by allowing the creation of new thematic areas, depending on the educational sector in which it is applied but, on the other hand, no maturity levels are established (Serarols, 2019).

Adding to the previous, DigCompOrg aims at the analysis of real experiences concerning digital learning in educational contexts (Brolpito et al., 2016; Cabero-Almenara et al., 2020; Giunti et al., 2018; Linko et al., 2016); for the construction of their own digital maturity framework with practical implications (Balaban et al., 2018; Helenius et al., 2019; Jugo et al., 2017) or application of self-evaluation tools (Chopra, 2019; Trujillo et al., 2020). Based on the research of Fernandez and Prendes (2022), tools that include the six areas of the framework are used although some of them (Brolpito et al., 2016; Giunti et al., 2018; Linko et al., 2016) highlighting the areas of analysis of "leadership and governance practices", "teaching and learning practices", "assessment practices" as the most efficient in providing data for further reflection on ICT integration plans in the education system. Also, there has been made researches based on the application of the SELFIE tool (Bocconi et al., 2020; Castaño-Muñoz et al., 2018; Dvoretskaya, 2018; Dvoretskaya and Uvarov, 2020; Panesi et al., 2020).This researches have shown that he SELFIE is a valid tool and captures the digital competence of a school, indicating the same time various differences between the level of competence of private and public schools, concluding that there should be a different consultation of the groups that have used it. Thus to that, through these researches we can have a better view of the use and available resources of digital technologies in schools in Europe.

According to the findings of the research by Fernandez and Prendes (2022) the use of DigCompOrg model increases from the year of its appearance and this provokes the establishment of the self-evaluation as an outcome of the model application (Fernandez & Prendes, 2022).

Figure 7

European framework for digitally competent educational organization (European Commission, 2015).



Source: https://ec.europa.eu/jrc/en/digcomporg/framework, European Commission, 2015.

At last, the literature review presented in this section has emerged the essential elements of organizational competence. In the name of measuring ICT integration in schools or eMaturity, as the main substance of the organizational competence, the next section enlights the current literature review and its approaches.

3.3. Digital Maturity

The digital maturity of schools (eMaturity) is a concept that is becoming more and more significant within the modern educational system and organization in general due to the increasing importance of technology (BECTA, 2002; (Ochoa-Urrego & Peña-Reyes, 2021)). The use of ICT in schools is no longer a matter of individuality but it is planned and implemented at the level of the school as an organization, in accordance with local and state policies. The European Commission has recognized the importance of this concept (Redjep et al., 2021) and, through its policies and initiatives, systematically encourages the development of the digital maturity of schools.

Digitally mature schools are the ones at a high level of integration of ICT in their lives, operation, and the system which supports them. In digitally mature schools, the approach to ICT use in school management and teaching processes is systematized. Such schools operate in a supportive environment, with adequate resources that include not only financial funds, but also classrooms, laboratories, teachers and students adequately provided with ICT equipment.

According to British Educational Communications and Technology Agency, eMaturity is related to how effectively providers are using technology to deliver Harnessing Technology and meet other strategic priorities. It can be seen as: “The capacity of a college or learning institution to make strategic and effective use of technology to improve educational outcomes” (BECTA, 2008, p. 12).

Summarizing the literature review, there are many definitions for eMaturity. The first, provided by Durando et al. (2007, p. 8) defines eMaturity as the institution's "strategic and effective use of ICT to improve educational outcomes". The second states that eMaturity is the "organizational readiness to deal with e-learning and the degree to which this is embedded in the curriculum" (Underwood et al., 2010 p.5). These definitions share a common standpoint towards ICT integration, which views technology as being embedded in the educational institutions' processes (Micheuz, 2009). Fornell and Vivancos (2009) from the Ministry of Education of the Generalitat de Catalunya define technological maturity as the “degree of implementation of technologies in an organization attending to different dimensions. It occurs when the educational center makes strategic and effective use of technology to improve educational results” (p. 28). Also, the Ministry of Education of the Basque Government (2011) defines technological maturity as “the full use of digital media by the agents that participate in the education and training of citizens in their objective of training current and future citizens" (p.7).

Some definitions have a difference at the levels of ICT implementation but the idea of e Maturity is combined with the integration of ICT (Fornell & Vivancos, 2009; Golden et al., 2006; Underwood et al., 2010). Gilbert et al. (2016) states that the concept of eMaturity is referring both to educational systems and to schools so when we analyse the level of eMaturity of a school, the eMature student must have as a capacity digital competence in order to learn in the Information and Communication Society (Gisbert et al., 2016). Also, the eMature teacher is accompanied with the teacher's digital competence and thus to that there is the *“European Framework for Citizens' Digital Competence (DigComp)”* which states that citizens’ digital competence is the “critical and creative use of ICT to achieve objectives related to work, employability, learning, leisure, inclusion or participation in society” (Ferrari, 2012, p. 12).

The above stated imposes the key question whether our schools are digitally mature which means whether there is a systematic framework for a more successful ICT integration, and which evaluation model should be applied. A digitally mature school reports a high level of ICT integration of ICT in every aspect of its function (Ristic, 2017). According to this view, a digitally mature school has a systematized approach in to ICT integration which means in a supportive digital environment such as classrooms, laboratories, teachers and students equipped fully with digital resources (Ristic, 2017). In another point of view, a digitally competent organization is an organization that has implanted digital competences all over the wider school organization (From, 2017). Vanderlinde and van Braak (2010) highlight the great matter of importance of digital infrastructure, policy and leadership that could embrace teachers in transforming the guidelines into actual goals while teachers can put these goals into action in the everyday teaching practice. Also Wastiau et al. (2013) supports the comprehensive organization policy, leadership and digital infrastructure when

trying to achieve digital integration and improvement of the digital competences and at last Pettersson (2017) climaxes the complexity of digital competence when applied in educational contexts. Digital competence as a specific characteristic of a school organization (Vanderlinde & van Braak, 2010) indicates organizational competences or processes that schools need to implement to become digitally competent (Pettersson, 2017).

Concluding, this thesis notices that digital competence and the concept of eMaturity are highly related but a digital competent school as an organization does not mean that is eMature. Also, a school can be characterised as highly eMature if: ICT integration is in its strategic plan, fits implementation of ICT use in all activities, executes a strategic leadership which relies on the integration and obtaining the data from all school information systems, has a systematic approach in order to enhance digital competences of teachers and students, embraces professional training for the teachers, if ICT used integrated in advanced teaching methods and teachers and students regularly protect digital content by copyright. Also, the school needs to have adequate infrastructure and access to ICT resources and at last the school should be characterized by varied ICT project activities (Redep et al., 2020). Only then it can be characterized as a highly eMature school.

One of the first recommendations of UNESCO (2002) about the development of digital competences and integration of digital technologies in educational institutions (Durek et al., 2017) is the strategic digital planning (Ochoa-Urrego & Peña-Reyes, 2021) at the levels of educational institutions. In order to identify areas of digital maturity and elements that is in great need to raise their levels of digital maturity (Ochoa-Urrego & Peña-Reyes, 2021), researchers developed frameworks which include a set of methods, techniques and instruments that describe digitally mature organizations from the perspective of the concept and strategic documents (Durek et al., 2017).

3.3.1. Models evaluating Digital Maturity at schools

A review of literature revealed a set of existing frameworks for the measurement of the level of ICT integration in educational institutions. Twenty three frameworks for the measurement of the level of ICT integration has been identified in educational institutions. These are the ICT- Mark (BECTA, 2008), Belgian Model (Schreurs, 2007), NAACE ICT-Mark (NAACE, 2012), the P2P/P2V Inspectorates Framework (Sergis & Sampson, 2014), Eurydice (Eurydice, 2001), ICT-MM model from Chile (Solar et al., 2013), the Digital Schools Award (Digital Schools of Distinction, 2013), the ACODE Benchmarks (ACODE, 2014) and the E-Learning Maturity Model (eMM) (Marshall, 2007), Assessing the e-Maturity of your School (AeMoYS,2011)[3], DigCompOrg[4](2015), eLearning Roadmap[5] (2009), eLemer[6] (2010), The ePortfolios & Open Badges Maturity Matrix[7] (ePOBMM, 2013), Future Classroom Maturity

[3] http://emature.ea.gr
[4] https://ec.europa.eu/jrc/en/digcomporg/framework.com
[5] http://www.ncte.ie/elearningplan/roadmap
[6] http://ikt.ofi.hu/english
[7] http://www.eportfolio.eu/matrix

Model[8] (FCMM, 2010), HEInnovate[9] (HEInnovate, 2013). Jisc Strategic ICT Toolkit[10] (JISC, 2010), Ledning, Infrastruktur, Kompetens, Användning[11] (LIKA, 2013), Microsoft Innovation Framework & Self-reflection Tool[12](Microsoft IF & SRT, 2009), NACCE SRF[13] (NACCE SRF, 2005), OPEKA[14] (OPEKA, 2012, Upscaling Creative Classrooms in Europe[15] (SCALE CCR, 2012), School Mentor[16] (School Mentor, 2014) and Venstrers[17] (Venstrers, 2008). An overview of these frameworks is provided in Table 3.

Table 3
Models evaluating eMaturity at schools

Model	Categories of each model	Year
ICT- Mark (BECTA Model, UK)	- Leadership & Management / ICT vision and strategy - ICT in the curriculum - Learning and teaching with ICT - Assessment off and with ICT - Professional development - Extending opportunities for Learning - Recourses-Provision, access and management - Impact on pupil outcomes	1998
Eurydice	- Number of pupils per computer/per computer with an Internet connection - Responsibility - Budget - ICT in the curriculum - Percentage of teachers' ICT use - Hours per week - Approaches to ICT - Objectives of ICT - Reasons given for not using the Internet - Annual number of hours recommended for teaching ICT - Specialist ICT teachers - Initial training of teachers in ICT - Percentage share of compulsory teaching related to ICT, and the number of hours - Percentages of teachers received official training	2001
NACCE SRF	- Leadership and management - Teaching and learning with technology - Assessment of digital capability - Digital safeguarding - Professional development - Resources and technology	2005
Belgian Model	- Vision for ICT use in school - Secondary processes - Resources and partners	2007

[8] http://fcl.eun.org/hr/toolset2
[9] https://heinnovate.eu/
[10] https://www.jisc.ac.uk/guides/managingcourse-informationAe-MoYS
[11] http://www.iktpedagogerna.se/lika-it-tempen-paskolan
[12] http://www.is-toolkit.com/self_reflection.html
[13] https://www.naacesrf.com
[14] http://opeka.fi/Opeka-SystemDesign-1.0.pdf
[15] http://is.jrc.ec.europa.eu/pages/EAP/SCALECCR
[16] https://iktsenteret.no/sites/iktsenteret.no/files/ikt_ministerbrosjyre_eng.pdf

	- Primary processes - Desired results - Strategic goals	
e MM	- Learning - Development - Support - Evaluation - Organization	2007
Venstrers	- Transfer to further education - Exam results - Interactive exam results - Comparison of exam results - Fact sheet - Influx from primary education - Internal flow - Monitoring social security - Forestcamp number of students - Satisfaction of parents - Board report - Exam results - Interactive exam results - Finance - Use window and delivery - Influx from primary education - Internal flow - Market share - Compare school success rate - Students 'satisfaction	2008
eLearning Roadmap	- ICT infrastructure - ICT culture - Learning and teaching - Professional development - Leadership and planning	2009
HEInnovate/HEInnovative	- Leadership & governance - Organizational capacity - Learning and teaching - Preparing & supporting entrepreneurs - Digital transformation & capability - Knowledge exchange & collaboration - Internationalised institution - Measuring Impact	2009
P2V	- Leadership - Pupil Use - Impact on Learning and Standards - Infrastructure and access - The teaching process - Curriculum planning - Administrative Use - Quality Assurance	2009
Microsoft IF & SRT	- Infrastructure and equipment - Leadership and management - Teaching and learning with technology - Assessment of digital capability	2009
eLemer	- Learning and teaching - Technology transfer and service to society - Leadership, planning and management - ICT culture	2010

FCMM	- Identifying Stakeholders and Trends - Future Classroom modelling - Creating a Future Classroom Scenario - Learning Activities - Evaluation	2010
JISC	- ICT Proficiency (functional skills) - Information, data and media literacies (critical use) - Digital creation, problem solving and innovation (creative production) - Digital communication, collaboration and participation (participation) - Digital learning and development (development) - Digital identity and wellbeing (self-actualising)	2010
Ae-MoYS	- Leadership and Vision - ICT in the Curriculum - CT Culture - Professional Development Resources & Infrastructure	2011
OPEKA	- feedback for the teacher/student/administrators - analyzes and reports on how to develop the school - support for ICT planning - opportunity to track and evaluate the results of development	2012
SCALE CCR	- Infrastructure - Content & curricula - Assessment - Learning practices - Teaching practices - Organization - Leadership & values - Connectedness	2012
ePOBMM	- Institution policy and governance for technology supported learning and teaching - Planning for quality insurance - Information technology infrastructure to support learning and teaching - Pedagogical application of information and communication technology - Professional/staff development for the effective use of technologies for learning and teaching - Staff and students support for the use of technologies. - Student training for the effective use of technologies for learning.	2013
ICTE-MM	- Educational Management - Infrastructure - Administrators – Leadership and Vision - Teachers – Student Learning and Creativity - Students Creativity and Innovation	2013
LIKA	- Management and Leadership - Infrastructure and equipment - Digital competence - Advance & use	2013
ACODE	- Institution policy and governance for technology supported learning and teaching - Planning for, and quality improvement of, the integration of technologies for learning and teaching - Information technology infrastructure to support learning and teaching - Pedagogical application of information and communication technology - Professional/staff development for the effective use of technologies for learning and teaching - Staff support for the use of technologies for learning and teaching. - Student training for the effective use of technologies for learning. - Student support for the use of technologies for learning	2014
School Mentor	- Administration and framework conditions - School resources	2014

	- Mapping and planning - Digital competence - Pedagogical practice - Organization	
DigCompOrg	- Continuing Professional Development - Infrastructure and Equipment - Student Digital Competence - Assessment Practices - Teaching and Learning - School Leadership	2015

BECTA (British Educational Communications and Technology Agency-BECTA, 2008) has developed an e-maturity framework to help support further education factors in working towards e-maturity. This framework sets out eight areas of maturity and detailed indicators for five stages of maturity within each (BECTA, 2008). The five areas are: 1) leadership and vision; 2) contexts; 3) resources; 4) learning support; and 5) teaching and learning. Self-evaluation of digital maturity is done by the leader as he/she is the visioner of change and the teaching staff is to improve the teaching practice.

The Eurydice Network (Eurydice, 2001) provides information and analyses European education systems and policies. The model provided by Eurydice has 14 indicators: 1. Number of pupils per computer and number of pupils per computer with an Internet connection. ; 2. Responsibility for the purchase and maintenance of hardware; 3. Distribution of the specific budget between the purchase of equipment and expenditure on human resources; 4. Inclusion of ICT in the curriculum; 5. Percentage of teachers who use computers and/or the Internet in the classroom; 6. Average periods during which primary school teachers use computers (with or without Internet connections) in the classroom, in hours per week; 7. Approaches to ICT defined in the curriculum; 8. Objectives defined in the curriculum for the teaching or the use of ICT (primary and secondary education); 9. Reasons given for not using the Internet with pupils; 10. Annual number of hours recommended for teaching ICT as a subject in its own right (general lower secondary education); 11. Specialist ICT teachers; 12. Inclusion of ICT in the initial training of all teachers; 13. Percentage share of compulsory teaching related to ICT, and the number of hours devoted to such teaching, in the initial training of all teachers; 14. Percentages of primary school teachers and secondary school teachers who have received official training in the use of computers and/or the Internet in their teaching (Eurydice, 2001).

NACCE SRF (NACCE SRF, 2005) is a maturity model which helps schools to understand where they are in their technology strategy, plan the next stages of their technology strategy, record their progress. With a small cost offers the additional benefits linked to access for three staff members, capacity to store evidence and progress notes from each staff member, guidance throughout the process to help users, ability to apply for assessment .It is described by 6 areas, 11 elements and 220 indicators . It makes use of both qualitative and quantitative approaches with application areas at the nursery, elementary and high school levels in the United Kingdom[18].

[18] *NAACE SRF*. (n.d.). https://www.naacesrf.com.

The Belgium (Schreurs, 2007) assessment framework draws on the European Foundation for Quality Management (EFQM) excellence model which helps organizations, like schools, to determine at which point they find themselves on their way to excellence. According to Schreurs (2007) there are three stages in the evolution of ICT at schools. The first stands for basic principles in using computers by teachers, the second for applying the computer as a passive and active medium, such as the Internet and using it in various contexts and the third phase encompasses the seamless integration of ICT across the curriculum and Ristić: eMaturity in Schools 324 learning activities where the focus lies on the learner. The structure of the framework is divided into 6 sections: 1. The vision for ICT use in school (a strategy to achieve the ICT vision); 2. Secondary processes (school organization and management, teachers, ICT coordinators); 3. Resources and partners (ICT infrastructure, government regulations, funding programs); 4. Primary processes (curriculum development, integration of ICT in learning process, innovative learning model); 5. Desired results (results for the learner, teachers and ICT coordinators, parents, society and government); 6. Strategic goals (institution's global goals, specific learning goals). As Schreus (2007) mentioned, the biggest challenge for the schools is the integration of ICT in the learning process. It stands for the third phase of the evolution of ICT use in schools. In this case the strategic goals that have been identified are either institutional or specific learning ones. The main focus here is on the learner and how the learner can benefit from the use of ICT in the learning activities.

E Learning Maturity Model - Emm (Marshall, 2007) provides the base by which institutions can assess and compare their capability to develop, deploy and support e-learning. The eMM is based on the ideas of the Capability Maturity Model and SPICE (Software Process Improvement and Capability dEtermination) methodologies. The development of the eMM is focused on the ability of an institution to be effective in any particular area of functioning, in the capability to perform in high quality processes that are reproducible and able to be extended and sustained as demand grows. The underlying idea is that the ability of an institution to be effective in a particular area of work is dependent on their capability to engage in high quality processes that are reproducible and able to be sustained and improved. The characteristics of an institution that enable high quality processes are to some extent able to be separated from the details of the daily procedures that will vary depending on particular circumstances. This severance means that the analysis can be done disconnected of the technologies involved and pedagogies applied in order to allow a meaningful comparison across the sector. In the context of the above, capability of this model reflects to the ability of an organizational institution to valid that e-learning design, development and deployment is confronting the needs of the students, staff and institution. Capability also, includes the the e-learning support of teaching as demand grows and staff changes (Marshall, 2010).

European Schoolnet proposes an alternative method based on the results of the P2P research project, where inspectors from six countries developed a common EU level framework. This framework can be used to identify whether a school is e Mature. The framework consists of eight key areas, each comprising a subset of indicators. Five of these key areas focus on the school at organizational level: 1) Leadership: eMature schools should have a clear vision and strategy deployed in approaching ICT 2) Infrastructure and resources: eMature schools should have appropriate ICT-based resources and support

mechanisms to ensure their proper use 3) Curriculum planning: the eMature school meets (or even exceeds) national/international standards in curriculum planning using ICT, and has a coherent and innovative approach. 4) Quality assurance and improvement: the eMature school should demonstrate clear planning and review procedures, with a mechanism for ongoing improvement; 5) Administrative use: eMature schools use ICT to identify issues impacting learning and teaching (e.g. via tracking absenteeism, ICT-based assessment) and to support communication with school stakeholders (e.g. pupils, teachers, parents and the wider community)(Durando et al.,2007).

Venstrers (Scholen op de kaart - Vind en vergelijk scholen in de buurt, 2008) is an online tool described by 20 indicators. Its application areas are elementary and high schools in Holland. The information on the different pages of the schools comes from 2 different resources. The first resource is from the government (e.g. size of the school and the test results). The second resource is information from the schools themselves. They can provide a detailed description about e.g. the school's vision and mission and what sets them apart from other schools in the area. To provide these descriptions, schools log in "Vensters". This is their own online environment where they can enter information in these so-called "indicatoren" (indicators).

e-Learning Roadmap (Elearning Roadmap, 2009) is a framework described by 5 areas and 108 indicators. NCTE (National Centre for Technology in Education) website informs about case studies and videos in order to assist schools in developing their e-Learning Plan and indicating how teachers are integrating ICT in their classrooms. There are also templates available which are designed to be adapted and customized along the particular needs and priority areas of a school. It uses a qualitative development approach with application areas in elementary and high schools in Ireland[19].

HEInnovate (HEInnovate, 2009) is a framework and a self-reflection tool for Higher Education Institutions which aims at exploring their innovative potential. It is described in 7 areas and 44 descriptors and it is an initiative of the European Commission in partnership with the OECD. It uses a qualitative method[20].

Microsoft IF & SRT (Microsoft IF & SRT, 2009) is a framework which includes best practice processes and solutions that offer a strategic roadmap. The roadmap offers techniques that are proven through experience to improve innovation. For example, the framework shares lessons learned from Microsoft's own innovation strategies. It is an online self-evaluation tool described by 4 areas, 16 elements and 96 indicators. It uses both qualitative and quantitative method and finds application in elementary and high schools[21].

eLEMER (eLEMER, 2010) is a framework from Hungary and also a web-based online self-evaluation questionnaire which is spread in 4 areas, 40 elements and 10indicators.Qualitative and quantitative approaches are used in elementary and high schools. Also the Institute of Education, University of Szeged in Hungary proceeds in the

[19] http://www.ncte.ie/elearningplan/roadmap /
[20]. https://www.heinnovate.eu/en
[21] http://www.is-toolkit.com/self_reflection.html

eDia Online Diagnostic Assessment System for integrating technology-based assessments[22].

FCMM (FCMM, 2010) is a framework and online self-evaluation questionnaire in Brussels, challenging visitors to rethink the role of pedagogy, technology and design in their classrooms. The six learning zones of it have essential elements o 21st century skills: students' and teachers' skills and roles, learning styles, learning environment design, current and emerging technology and societal trends affecting education . The key points are: 1. Create; 2. Exchange; 3.Develope; 4.Interact; 5.Present; 6. Investigate. It is described by 25 indicators. According to FCMM framework education should result in a unique learning experience, engaging as many types of students as possible[23].

JISC (JISC, 2010) is a framework and online self-evaluation questionnaire described by 6 areas and 69 descriptors. This is an organizational perspective on the Jisc 'Six elements of digital capability. A separate profile for digital leaders covers the personal capabilities required to lead digital change. Other profiles based on the 'Six elements' are available for teachers in different areas of the organization to implement a digital strategy or plan. There is also an organizational audit tool and checklist and a series of organizational case studies in developing digital capabilities. So, the main users are the responsible for developing digital capability. It uses both qualitative and quantitative development approaches[24].

Ae-MoYS (Ae-MoYS, 2011) is a framework and online self-evaluation questionnaire described by 5 areas and 30 indicators. Qualitative and quantitative methods are used in order school staff from schools across Europe to illustrate their strengths and weaknesses in relation to ICT. This questionnaire is based on the Self-Evaluation Tool developed as part of the Digital Schools Award, which is an initiative of Ireland's NCTE in collaboration with the IPPN, INTO and CESI[25].

OPEKA (OPEKA, 2010) is an online tool for teachers and schools to measure and analyze their usage of information and communication technology in teaching. It provides teachers a comparison to other teachers, schools and national levels. It is described by 3 areas, 17 elements and145 indicators. It uses both qualitative and quantitative development approaches with application areas in elementary and high schools in Finland[26].

Scale CCR (Scale CCR, 2012) is a framework described by 8 areas: 1. Infrastructure; 2. Content & curricula; 3. Assessment ; 4. Learning practices; 5. Teaching practices; 6. Organization; 7. Leadership & values;8.Connectedness and 28 elements. It employs a qualitative development approach with application areas in elementary and high schools and best practice examples from throughout Europe[27].

ePOBMM (ePOBMM, 2013) or ePortfolios & Open Badges Maturity Matrix aims to provide a tool to facilitate for organizations in order to provoke a dialogue between practitioners, leaders in education and decision makers. Also can support effective ePortfolio and Open

[22] http://ikt.ofi.hu/english/
[23] http://fcl.eun.org/hr/toolset
[24] https://www.jisc.ac.uk
[25] http://e-mature.ea.gr/
[26] http://opeka.fi/Opeka-SystemDesign-1.0.pdf
[27] http://is.jrc.ec.europa.eu/pages/EAP/SCALECCR

Badge practice. This framework is described by 7 areas and 300 indicators and uses a qualitative method. Is applicated in the vast majority in universities across Europe[28].

ICTE-MM by Solar et al. (2013) is a model for supporting the ICT strategy in schools and provides a basis for self-evaluation and improvement. In a theoretical basis, it is not just a tool for diagnosis the needs of an educational organization but has also been created to guide the school leader in moving towards best practices in management and digital investment. It is based on 5 domains: 1. Educational Management – This domain is based on Technology Standards for School Administrations (School Management; Vision, Strategies and Policies; Organization and ICT Management). 2. Infrastructure – Software, Networks, Hardware, Maintenance Plan, Security. 3. Administrators – Leadership and Vision; Learning and Teaching; Productivity and Professional Practice; Support, Management and Operations; Assessment and Evaluation; Social, Legal and Ethical Issues. 4. Teachers – Student Learning and Creativity; Digital Age Learning Experiences and Assessments; Digital Age Work and Learning; Digital Citizenship and Responsibility; Professional Growth and Leadership. 5. Students – Creativity and Innovation; Communication and Collaboration; Research Thinking, Problem Solving and Decision Making; Digital Citizenship; Technology Operations and Concepts. Despite the above, the specific framework was built on the characteristics of a public school with low budget and no one esoterical expert for technical assistance. Consequently, the ICTE-MM model is functioning with a web tool for self-evaluation of critical variables that appreciates the capabilities of each school to carry out ICTE initiatives and guide principals in technical digital decisions.

LIKA (2013) is a framework and online self-evaluation questionnaire developed by Sweden to support digitalization in schools. LIKA aims at 4 areas in the business, management, infrastructure, competence and use and 78 indicators. It is the principal who makes a self-assessment which is then compiled in a summary and based on it a proposal for an action plan is presented. It adopts a qualitative development approach with application areas in elementary and high schools[29].

The ACODE benchmarks (2014) have been developed to assist institutions in their practice of delivering a quality technology enhanced learning experience for their students and staff (recognizing that some institutions refer to their practice with terms such as e-learning, online or flexible learning, blended, etc.). There are eight benchmarks, each of which can be used as a standalone indicator, or used collectively to provide a whole of institution perspective: 1. Organizational policy and management for digital supported learning and teaching; 2. Programming and improvement of the integration of technologies for learning and teaching; 3. Information technology infrastructure to support learning and teaching; 4. Information and communication technology applied in the appropriate pedagogical way; 5. Professional/staff development for the effective use of technologies for learning and teaching; 6. Support of the staff for applying digital technologies in learning and teaching; 7. Student training for the effective use of technologies for learning; 8. Support of the students for the use of digital technologies for learning. However, where these benchmarks become

[28] http://www.eportfolio.eu/matrix
[29] http://www.iktpedagogerna.se/lika-it-tempen-pa-skolan/

even more useful and strong is when they are used in a collaborative way with other institutions, as part of a benchmarking exercise.

School Mentor (2014) is a free resource from the Norwegian Centre for ICT in Education framework and online self- evaluation questionnaire described by 6 areas and 150 descriptors. It makes use of both qualitative and quantitative development approaches with application areas in elementary and high schools and best practice examples in Norway[30].

Digital Schools is a programme which encourages a whole school approach to digital technology in schools. Schools that successfully complete the 3 step programme receive a nationally recognized Digital Schools Award. Digital Schools also receive ongoing practical support and resources as part of the community of digital schools. Established in October 2013, the programme is supported by HP, Microsoft and Intel in partnership with the Department of Education, the Professional Development Service for Teachers, Technology in Education, the Computer Education Society of Ireland (CESI), the Irish National Teacher's Organization (INTO) the Irish Primary Principals' Network (IPPN) and Dublin West Education Centre (DWEC) (Digital Schools of Distinction, 2013).

DigCompOrg is a framework which is spread in 6 areas,15 elements and 74 indicators (Kampylis et al., 2015). It uses a qualitative development approach and is applicated by elementary schools, high schools and universities. The specific model is analysed on a previous section.

As it is concluded from the observation of Table 3, there are many similarities among the implemented frameworks but especially in specific areas such as “Leadership and Management”, “Infrastructure and Equipment”, “ICT integration in teaching and Learning practices” and “ICT culture, content and curricula”. Many frameworks are used in a national level and other find application across Europe. Also, it is noticed that a majority of them have a holistic implementation in all levels and grades of education but other frameworks are executed only at higher educational institutions. Furthermore, it is observed that if we make a comparison with the areas of DigCompOrg, many frameworks have a major lack at the area of “assessment practices” such as JISC, E-Lemer, OPEKA, School-mentor, LIKA and E-Learning Roadmap. As the systematic literature review of Ochoa-Urrego & Peña-Reyes (2021) observes, this may happen because some models cannot guarantee any transformation or development process by the use of solid technology (Ochoa-Urrego & Peña-Reyes, 2021). The same frameworks, with added the SRT framework of Microsoft, seem to have a lack at references in the area of educational content and curriculum. Adding to the former observations, HEInnovate does not have any special reference to the area of “Infrastructure and equipment.” Concluding, it is observed that DigCompOrg is the most completed framework for an educational organism because it helps the school itself to find its own way to transaction and its vision that is set to be achieved. DigCompOrg and through this, the meaning for collecting the data which is SELFIE, has so many potentials and flexibility that gives every school as an organization the chance to create its unique possibility into digital maturalisation.

[30] https://iktsenteret.no/sites/iktsenteret.no/files/ikt_ministerbrosjyre_eng.pdf

According to this thesis view, DigCompOrg on demand of its global concept characteristics, is best suited to serve as the basis for analysing the grade of digital competence in a school and digital maturity. Important researches of Durek et al. (2017), Redep (2021), Kampylis et al. (2019) or Fernandez and Prendes (2021) claim that due to its characteristics, DigCompOrg is the model that best describes the field of digital maturity of schools among the others and used the framework and SELFIE tool as the found of developing their research. DigCompOrg contains a general conceptual framework that reflects on all the areas of the process of a systematic integration into a school or in general educational institution. The framework is initiative designed to focus on learning and teaching activities for further ICT integration (Durek et al., 2017), but it is observed that its aspects embrace the most fancies of the school as an organization. DigCompOrg includes areas, elements and indicators that can be considered organizational or individual responsibility (Durek et al., 2017; Kampylis et al., 2019). It represents a very well structured framework that can be the basis for development of assessment tool of a school. The questionnaire that captures teachers and students self-perception is based on the DigCompOrg model and SELFIE tool, is flexible and it is used in order to promote self-evaluation (Costa et al., 2021). So, this thesis has used DigCompOrg as a base to develop the research.

3.4. Research on the use of eMaturity models at Greek schools

This chapter aims at highlighting the existing research of the use of eMaturity models at Greek schools. It is observed that there is a lack of digital capabilities in the entire Greek system and especially on the field of education (OECD, 2017). The efforts made for digital competence are only individual by the teaching staff and the school management, with the ultimate goal of school improvement. However, this fact does not come from the mandatory government line for digital capacity of the Greek school but from the personal will of the respective school leader. Also in this chapter we will highlight the effort that was to be made with the program “Reflecting for Change” (R4C), which was interrupted by the pandemic of Sars-Cov-2 and the Greek teachers managed due to the circumstances to acquire in fact this self- knowledge ability (Digital Skills For Digital Greece, 2019).

According to the DESI Report for 2018, Greece is ranked as 26th in the “Human Capital” dimension. It is referred that 46% of people have basic digital skills, much lower than the average rate of the EU (57%). Greece also, has a lowest number of ICT professionals in the EU, just 1.4 per 1000 employees and faces the problem of “brain leakage”, which means lack of capacity to digital transform the economy. The lack of ICT specialists though is of vital importance for the digital transformation of the economy. Also, according to the Women Digital Scoreboard for 2018, Greece is ranked in the 26th position with a score of 36.1 compared to 49.1, the average rate of the EU. It is important to note that women graduates are 13.7 per 1000 people aged 20-29, which is the 8th position in the EU level, but women ICT specialists are just 0.4% of the total of employment, which ranks Greece in the 28th position. From the above information it is clear that Greece in the present time haw a lack of existing number of ICT specialists (Digital Skills For Digital Greece, 2019). It is very low to

support the digital transformation of the country. Despite of the will for digital transformation in the public sector, research still have little knowledge about the integration of digital technologies and how is associated with the reform of public sector organizations (Xanthopoulou & Plimakis, 2021).

This weakness is also noticed in the digital public services, where Greek public governance is ranked 27th and the rate of users of digital public services is just 38% of the 4 Internet users in total, bringing the country to the 26th position. It is clear that the lack of digital skills is influencing to a great extent the capacity of the country to digitally transform and the capacity of the users to support the transformation. Additionally, the Digital Competence Framework is taken into account, according to which 17% of the EU citizens in 2017 did not possess digital skills and women in relation to men have a lower rate of basic digital skills (55% compared to 60%)(Digital Skills For Digital Greece, 2019).

In the statement of the above and in the attempt of the Greek government tries to build a digital profile at schools across the country, the Greek Ministry of Education announced the “Reflecting for Change” (R4C) program (Zygouritsas & Agogi, 2020). According to this, prioritizes the promotion of the use of "reflection tools" to support innovation and systemic change in schools. Proposes an innovation support framework (School Innovation Academy) and a roadmap in an attempt to introduce a culture of change that ensures the effective uptake of sustainable innovation, with an emphasis on achieving improved cognitive outcomes as set by the Europe strategy in 2020 (Zygouritsas & Agogi, 2020).

Three hundred schools were supposed to formulate a roadmap and their strategy for innovation, while making the best use of the potential of Erasmus+ and related policy initiatives (national and international), to be transformed into innovative ecosystems. The program brings together partners who can have a systemic impact with their actions and implement the results and findings of the program (Zygouritsas & Agogi, 2020).

Reflecting for Change (R4C) program objective was innovation to be perceived as the school's path to digital maturity (e-maturity) and integrated use of ICT, and especially as the school's path to “openness”. All that was supposed to be manifested in its relationship with external partners, in the commitment of parents, in the promotion of the well-being of the community as a whole, in the school's ability to combine curriculum implementation with a study of local challenges, in its willingness and ability to share its achievements with other schools and its commitment to the challenges of modern Responsible Research and Innovation (RRI) (Zygouritsas & Agogi, 2020).

The duration of the program was from November 2019 until October 2021. Unfortunately, the Greek Ministry of Education had no results on this because all this effort was interrupted by the pandemic that Sars-Cov-2 cost us.

It is important to note that at the moment, there is no formal strategy for the digital transformation of the public sectors at national level, especially in areas such the development of digital skills and the identification of digital profiles. Moreover, it is also observed that there no strategy for the development of innovation in public governance.

3.5. Conclusion

In the literature review carried out, it is drawled the conclusion that the digital competence and eMaturity models for education are developed by involving different types of entities, such as national and international education companies, research organizations as well as academic experts in this domain. These types of models can be applied in any level of education in order to have a strategically planning for ICT integration and digital maturation, based on the commitment between the educational organization strategy and the selected growth path, as well as associated investments and improvement activities (Carvalho et al., 2018). In fact, Bacigalupo (2022) in her study highlights the importance of unbundled competence frameworks that need to manage the diverse needs of every organization and be adapted to their specific context doing a great parallelism of the way that different cultures used Pollux in order to build constellations. This great overview highlights the importance of flexibility in competence frameworks.

The concept of digital competence is one of the most dealt in the latest literature reviews by many authors (Fernández & Prendes, 2021; Gisbert et al., 2016; Gutiérrez, 2011; Gutiérrez & Sánchez, 2016; Gutiérrez, Prendes & Castañeda, 2015; Prendes & Gutiérrez, 2013). It is also noticed that various national and international bodies and institution have addressed the issue carefully (Eurydice, 2019; OECD, 2017).

According to the latest Eurydice (2019) report "half of the European education systems are currently reforming the curriculum related to digital competence. The revisions aim either at introducing digital competence into the curriculum where it had not previously been addressed, or making the subject area more prominent. Some reforms are also about "changing the curriculum approach, updating content or strengthening particular areas such as coding, computational thinking or safety" (Eurydice 2019, p. 19).

It is also observed that there are little studies that examine the dynamics and innovation of digitalization in the public sector of Greece (Xanthopoulou & Kefis, 2019). The most important public sector which is education and thus school, is combined with relations that consider the local community, external stake holders, parents, flexibility of curriculum to change in new circumstances, openness to cooperation with the community and other schools and also, to cope with any kind of challenges that innovation brings (Athanatou, 2018). In the meaning of the above, the challenge is innovation as a commitment for e-maturity and integration the use of ICT.

Furthermore, considering the difficulty of schools in engaging in these complex endeavours (Sergis et al., 2014b), a significant need emerges for flexible models (Bacigalupo, 2022) that extract data in the terms of each school and its unique characteristics that will offer functionalities for facilitating schools in capturing and interpreting their digital data in order to lead to e Maturity of all the system. Moreover, the lack of relevant existing systems further strengthens the need to tackle this identified problem (Sergis et al., 2014b). The educational system is a key in facilitating the achievement of e Maturity at all levels of education (Sergis, 2017).

As it considers the need for digitally efficient teachers, the interesting in that increases day by day in order to improve students 'digital competences and to use digital technologies in

learning and teaching process properly and effectively (Redecker, 2017). In this perspective, digital training of teachers is extremely important to improve teachers' digital competences (OECD, 2017). In general, frameworks do not detail the special characteristics in order to acquire digital competence (Garcia-Martin & Garcia-Sanchez, 2017) but a wider explanation about digital competence.

From individual's digital competences "As educators face rapidly changing demands, they require an increasingly broader and more sophisticated set of competences than before" (Redecker, 2017, p. 4) and DigCompEdu (Redecker, 2017) to the path of a digitally competent organization, DigCompOrg and its various purposes of it (Balaban et al., 2018; Jugo et al., 2017; Redep et al., 2019) which also promotes in a digital way the school self-evaluation (Chapman & Sammons, 2013; Kampylis et al., 2016) is a completed framework. The specific framework can be used for the preparation of ICT implementation plans (Brolpito et al., 2016; Giunti et al., 2018), for the location of specific areas that can be improved (Malach & Kostoloányová, 2017 and also, for the construction of digital evaluation models (Čampelj, 2019). DigCompOrg framework, as it is the main model suitable for this research, is a model designed to be used by different educational organizations which considers doing a diagnosis about the ICT integration. Underlying all these ideas, DigCompOrg framework is capable to achieve deeper results from different angles.

It can be concluded that digital competence might not benefit from being regarded as an individual phenomenon on the meaning of single factors. Furthermore, it can be used as an organizational task, influenced and driven by data decision making integrated within and through a school organization.

CHAPTER 4

DATA DRIVEN DECISION MAKING IN EDUCATION

Evaluation field combined with new technologies data driven is a new area that arises in the main substance of education. New studies underlying that assessing tools are oriented at editing data as well as for using ICT to drive internal school improvement (OECD, 2015). According to this, educational quality is likely to be improved when decision makers develop policies and implement practices informed by relevant assessment data (Data Driven Decision Making or DDDM in advance) (Cox et al., 2017).

This chapter provides the essential background on the concept of Data Driven Decision Making in education, which will assist in identifying the core factors that affect school ICT integration processes and led us to the statement of the problem of this research combing Data Driven Decision Models with school evaluation and improvement. According to many executive educators we are fully data driven (Morgan, 2015). Also, the fields of AA and LA are explained because of their relation with the collection, process and handling of educational data.

After explaining the concept, in the last part it is presented how an evaluation model oriented at ICT can lead us to a Data Driven Decision Making model. In addition, through this section is highlighted the need to a DDDM strategy of the entire educational organization in order to have a holistic digital approach.

4.1. Academic Analytics and Learning Analytics: understanding efforts for entrance of Data Driven Decision Making in education

As a general framework to understand DDDM that is recorded as the efforts in Europe for data driven improvement in education, the following subsection describes two educational analytics strands, namely Academic Analytics (AA in advance) and Learning Analytics (LA in advance). The fields of AA and LA have a dividend in the field of decision making and data because of their relation with the collection, process and handling of educational data. As one of the main strands of this thesis is the collection and process of data, it is crucial for the current research to make a reference in this path of collection, processing and interpretation of educational data as a field. This subsection provides an overview of the subject interpretation of data and it highlights research trends that could be the focus of future research.

The expanding demand for data and analysis to inform institutional decisions means includes: (a) integrating and disparate data sources in an institution, (b) organizing and managing data for efficient and consistent reporting, (c) continual learning to understand

and leverage current technologies, (d) owning skills in data storytelling, (e) creating visuals to help communicate institutional priorities and strategies and last and (f) educating campus colleagues about the value of institutional data. The combination of institutional memory and domain expertise within IR offices guides them to the creation of knowledge, policy and strategy advance and leading to innovation through data (Gagliardi et al., 2018).

AA refers to data-driven decision making practices for informing operational purposes at the Higher Education level (Baepler & Murdoch, 2010). AA or Institutional Analytics (IA) (refer to the same object) focuses on the collection, analysis and visualization of academic program activities such as courses, degree programs, research, revenue of students' fees, course evaluation, resource allocation, and management to generate institutional insight (Campbell et al., 2007; Siemens & Long, 2011). So, the main interest is a political and economical (Romero & Ventura, 2020). This requires Institutional Research Offices focusing on required state and federal reporting, compiling data for accreditation purposes, and completing the occasional institutional ranking survey (Hawkins & Bailey, 2020). In another meaning and linking this field with the organizational processes and data interpretation, AA focus on organizational processes which include student admission and management, finances, leadership and infrastructure (Chatti et al., 2012; Daniel, 2015; Long et al., 2011).

Nearly in the same way, the attempts to apply data analytics in education have emerged as a new discipline called LA (Baker & Inventanto, 2014). LA have three important elements in their definition and these are: data, analysis and action (Siemens, 2013).They can be defined as the measurement, collection, analysis, and reporting of data about learners and their contexts, for the comprehension and developing of learning and the environments that happens (Long et al., 2011). LA is focused on data-driven decision-making and integrating the technical and pedagogical aspects of learning by using familiar predictive models (Romero & Ventura, 2020). LA are interdisciplinary areas including but not limited to information retrieval, recommender systems, visual data analytics, domain-driven data mining, social network analysis, psychopedagogy, cognitive psychology, psychometrics, and so on (Romero &Ventura, 2020).

A considerable amount of literature researches have been published on the use of LA Information Systems and AA Systems (Baker et al., 2011; Costa et al., 2015; Paz & Cazella, 2019, 2017; Rigo et al., 2014) with target to explore data that are collected from educational organizations. The growing interest on data analytics and the real need for eliciting useful knowledge from data with the aim of being beneficial for the data owner (Berry & Linoff, 2011) is giving rise to the design of more and more data mining proposals. This interest on data mining models is especially appealing to the research community and dozens of open source data mining tools have recently been designed by many researchers in the field (Baker et al., 2011; Chen et al., 2007 ; Costa et al., 2015; Paz & Cazella, 2019, 2017; Rigo et al., 2014;). All of this has given rise to a great opportunity to tune and improve existing algorithms as well as a way of distributing new models (Atalhi et al., 2017).

As it considers Greece and the field of Learning Analytics, the study of Tsoni et al. (2019) “From Analytics to Cognition: Expanding the Reach of Data in Learning” which considers an application called Prime-Edu. It considers the Prime –Edu application which is designed to receive data from “MySchool”, “Moodle”, the “DIARROI” (which means students drop out)

application and the “Classter” of Vertitech. “My School” is the web based application of the Ministry of Education, that all schools of Secondary Education in Greece use compulsory[31] . It is used as the only legal and compulsory source to receive data. Moodle is one of the most established asynchronous e-learning systems that offers many opportunities for analysing training data. It was also used by HOU. Finally, the DIARROI application is a training software that was developed to offer telematics services to reduce early school dropout (ESL) and educational leakage (Samaras et al., 2018).

Each of these tools whether it is Learning Analytics, Educational Data Mining or Academic Analytics is creating the opportunity for an institution to be able to make a decision through collected data. The use of data to make a decision is what is defined as data-driven decision making (Picciano, 2012, p. 11).The next chapter offers a literature review about the potential role of them in the fields of education.

4.2. Data Driven Decision Making: conceptualization

Data Driven Decision Making (DDDM in advance) is gaining an increasing attention in education globally (Lai & Schildkamp, 2013) because it considers to be a driver of internal school improvement processes (Dunn et al., 2013 Mandinach, 2012; Means et al. 2010; Mourshed et al. 2010). Specifically, DDDM is the systematic collection, analysis, examination and interpretation of data to inform practice and policy in educational settings (Mandinach, 2012) or according to Schildkamp and Kuiper is “the process of ‘systematically analyzing existing data sources within the school, applying the outcomes of analyses in order to innovate teaching, curricula, and school performance, and, implementing (e.g. genuine improvement actions) and evaluating these innovations” (Schildkamp & Kuiper, 2010, p. 482).

DDDM refers to the collection, analysis and interpretation of educational data in order to support leaders to orchestrate their schools’ planning towards meeting external accountability mandates as well as driving internal self-evaluation and improvement (Dunn et al., 2013; Mandinach, 2012; Mourshed et al. 2010) and also can contribute to increase the learning achievement of students (Poortman & Schildkamp, 2016; Van Geel et al. 2016).

DDDM has a wide use from the state to the individual, meaning the student to the teacher and also school leader (Kaufman et al., 2014; Thorn, 2001) and a prominent use is to make programmatic decisions as it is included in Marsh and Farrell (2014) definition for DDDM. In substance, DDDM is a mean of collecting data by all actors of school and thus to that we have reliable information to take a decision that considers each part of a school unit (Dunn et al., 2013).

Despite the huge attention of DDDM in public education, opportunities for genuine DDDM have been limited (Sergis, 2017). This happens due to the limited frequency and awkward timing of mandated assessments that form the basis for such decision making (Kaufman et al., 2014). Collaboration is the most important thing among the factors that affects the

[31] https://www.gov.gr/upourgeia/upourgeio-paideiaskaithreskeumaton/paideias-kai-threskeumaton/epharmoges-uposterixes-skholikon-monadon-myschool

implementation of DDDM (Means et al., 2010; Schildkamp, 2019). So, it is very important for an effective DDDM model the combination of many factors in a school unit. In order to support such practice, effective DDDM models utilize both diverse data teams and whole-school involvement and decision making to drive data analysis (Kaufman et al., 2014).

In DDDM, research states that goal setting is placed at the top of the goals (Schildkamp, 2019). This means that data use needs to start with certain goals, often connected to improving the quality of teaching and learning. These goals need to be concrete and measurable (Schildkamp, 2019). 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 et al., 2008; Schildkamp, 2019). According to Schildkamp (2019) (see Figure 8), the most important step is data collection to be related to the targeted goals, next sense-making should be considered through these goals and actions should be directly focused to these goals. At last and very important step, evaluation focuses on whether or not the goals were achieved. Previous research concerning specific goals in schools has shown that they can be divided into three blocks of goals: accountability goals, school development goals and instructional goals (Schildkamp & Kuiper, 2010; Schildkamp et al., 2013, 2014, 2017).

Figure 8
Data Driven process for improvement

Source: Schidlkamp, 2019

The current research proposes as an achievement goal school improvement through self-evaluation and use of data as a mean for decision making. In this point it should be mentioned that there always has to be as crucial point the existence of a target. The target is school improvement. In DDDM models is highlighted the importance of goal setting (Mandinach & Honey, 2008; Marsh, 2012; Schildkamp, 2019). At national level, for example, the goals may be educational standards that reflect the particular educational policies of a government at a given time. Moreover, data collection needs to be focused on the goals and actions should be directed towards these goals (Schildkamp, 2019). Actors that are very important in the setting of the goals are school leaders (Schildkamp, 2019). School leaders need to balance the various goals of different stakeholders with the culture, the

vision, mission and values of the school (Schildkamp, 2019). This means that DDDM models should and must have flexibility in their mission.

In order to achieve goals the school can collect them by many ways. This includes assessment results, surveys and systematic classroom observations (Schildkamp, 2019) in a formal and systematic manner (Mandinach & Honey, 2008; Marsh 2012; Marsh et al., 2006; Schildkamp & Poortman, 2015). Despite to that data can also be collected in a less formal manner. An example for this is through informal classroom observations and discussions (sometimes called informal data) (Schildkamp, 2019) and may be collected through formative assessment (Heitink et al., 2016). A third way of collecting data is educational research evidence (Brown, 2015). Moreover, a recent development in the field of 'big data' states that this could be a source that can be used to help inform decision-making in education (Veldkamp et al., 2017).

After this important process, the collected data are analysed and then goal setting is done in relation to the data (Schildkamp, 2019). This process is made by models that are going to be analysed in the next chapter. In such models, this process of sense-making involves improvement actions that depend on the collected data in order to determine if the aimed target is achieved (Schildkamp, 2019). The actors that are involved must engaged on the sense-making process because the implications regarding solutions to the problems and consequent actions based on the analysis of the data are often not self-evident (Mandinach & Honey, 2008; Marsh, 2012; Vanlommel et al., 2017; Schildkamp, 2019).

Previous research (Gelderblom et al., 2016; Childkamp et al., 2016) has suggested the ways in which teachers and school leaders may experience some difficulties with some aspects of this process. For example, this may include difficulties with analysis of data into an action plan (Brown et al., 2017; Shildkamp & Poortman, 2015; Schildkamp & Kuiper, 2010; Schildkamp et al., 2016).

Sense-making is not a straightforward or exclusively rational process (Bertrand & Marsh, 2015; Kanheman & Frederick, 2005). Furthermore, different types of data lead to different types of sense-making processes (Schildkamp, 2019). Analyzing and interpreting formal data is an entirely different process from analyzing and interpreting informal data. The latter tend to be acquired at a much faster pace, and therefore also require a much faster sense-making and decision making process: this may present challenges for teachers (Kippers et. al, 2016), who may not have been supported with professional development in this area (Schildkamp, 2019). This concludes to the need of training of teachers in order to be supported in the use of different types of data that includes the development, implementation and evaluation of them (Schildkamp, 2019).

At last, the data process can lead to action and evaluation. Poortman and Schildkamp (2016) referred that using data to improve the quality of education in most cases includes the use of data for three important pillars of school improvement:

1. curriculum (e.g. improving curriculum coherence),
2. assessment (e.g. developing and implementing (formative) assessments across the years to identify at risk students) and
3. instruction.

Implementing an action plan based on data is not an easy task for teachers and school leaders (Schildkamp & Visscher, 2009; Van Petegem & Vanhoof, 2004). Research studies like the current, could also contribute the maximum in evaluation phase and in the co-production and synthesis of evidence. Research results could be as an indicative management guide that teachers can use in the school improvement process, and researchers can assist teachers in the evaluation of their school improvement processes (Schildkamp, 2019). In addition, researchers could provide help at schools in collecting evidence (Brown & Greany, 2018; Campbell et al., 2017; Schildkamp, 2019).

Table 4
Defining Data Driven Decision Making

Study	Definition
Dahlkemper (2002)	DDDM is the process of collecting, analyzing, reporting, and using data for school improvement.
Doyle (2003)	DDDM is the process of collecting student data –academic performance, attendance, demographics, etc- in such a way that administrators, teachers and parents, can accurately assess student learning.
Crawford et al. (2008)	DDDM relates to policies and practices involving the use of student achievement and other data (such as attendance, course taking patterns and grades, and demographic data) to drive school improvement at the school, district, and state levels.
Schildkamp & Kuiper (2010)	DDDM refers to systematically analysing existing data sources within the school, applying outcomes of analyses to innovate teaching, curricula, and school performance, and implementing and evaluating these innovations.
Mandinach (2012)	DDDM is the systematic collection, analysis, examination, and interpretation of data to inform practice and policy in educational settings.
Dunn et al. (2013)	DDDM refers to the systematic collection of many forms of data from a multitude of sources in order to enhance student performance.
Marsh & Farrell (2014)	DDDM refers to teachers, principals, and administrators systematically collecting and analyzing various types of data to guide a range of decisions to help improve the success of students and schools.

Digital innovation is Data-Driven (OECD, 2020). Even though data has always been around in education, it is an area that right now gains the most interest and could be used in areas that we haven't think of yet (Schildkamp, 2019). Technologies increase the effectiveness and the value of data and data can lead to new possible applications, purposes and goals of data use (Schildkamp, 2019). Digitalization will further increase the collection of data, which will become more frequent and easier. Data can help at least teachers, administrators and policy makers to bring the coveted school improvement. In Table 4 are gathered the definitions that are found in the international bibliography.

4.3. Data Driven Decision Support Systems in Education

Apart from the above frameworks and decision support systems the literature review shows plenty of them to support schools in a more targeted way such as is the evaluation of students or even bigger like institutional assessment in higher education. As it follows, this chapter presents some of them.

Literature shows a growing development of frameworks and models that have two ways of bifurcation: the macro level for understanding school organizations and classes and the micro level for examing individuals' profiles and behaviours (Piety et al., 2014). If a school organization engages in an effective decision making and strategic adaptation to data analysis which is intended not only for circumstantial sense-making, but also for systematic and personalized prediction of instructional learning contexts the effort will outcome to discovery of behaviour-learning relationships and production of data-driven knowledge (Klasnja-Milicevi et al., 2017).

Table 5

Portrayals of Decision Support Systems

DSS	Characteristics
Communication Driven DSS	- Framework/ exchanges progressions to support collaboration and correspondence.
Data Driven DSS	- Report/file systems with inquiry. - Retrieval tools. - Data ware houses. - On-line Analytical Processing (OLAP)/ data mining instruments.
Document Driven DSS	- Complete report recuperation.
Group DSS	- PC based structure.
Knowledge Driven DSS	- Space/zone data. - Fitness in handling them.
Model Driven DSS	- Authentic. - Cash related. - Improvement/ amusement.
Web-Based DSS	- Electronic structure/web program.

The quality characteristics of DSS (Power, 2003) have the basic form of advancement that chooses the characteristics of the decision making. Some DSS are hybrid structures driven by more than one critical fragment (Castillo et al., 2007) talk about moreover the Group DSS and Web based and Inter-organizational DSS. They can be depicted as the following list (presented on Table 5):

- Data Driven DSS: Emphasize into access and control of inward association data and sometimes outside data, and may be based first on fundamental report/file systems with inquiry and retrieval tools, then data ware houses, finally with On-line Analytical Processing (OLAP) or data mining instruments.
- Communication Driven DSS: Involve framework and exchanges progressions to support collaboration and correspondence.
- Group DSS: It is an insightful, PC based structure that calculates and supports the course of action based on a plan that have structured as a team.
- Document Driven DSS: limits are settled and the team is taking care of progressions for a complete report recuperation and examination; records may contain numbers, text, and media.

- Model Driven DSS: Accentuate access to and control of a model, e.g., authentic, cash related, improvement, and/or amusement; use data and parameters, yet are not when in doubt data concentrated.
- Knowledge Driven DSS: are smart structures with specific issue, including data about a particular zone, perception of issues inside that zone and capability at handling some of these issues.
- Web-Based DSS: is an web structure that passes on decision support related information and/or instruments to an expert in order to make use of Web program (Explorer) like TCP/IP protocol.

The application of data mining on educational data for the development of accurate and efficient decision support systems (DSS) in order to monitor students' performance is becoming a new trend (Linán & Pérez, 2015; Livieris et al., 2016). Precisely, an academic DSS is a knowledge-based information system that captures, process and analyzes information which affects decision making performed by people who are professionals in the field and entitled by one person (Bresfelean & Ghisoiu, 2010). Through the use of a predictive DSS, it is possible to forecast students' success in a course and identify those at risk. Therefore, the development of an academic DSS is significant to students, educators and educational organizations and it will be more valuable if knowledge is issued from the students' performance that is available for educational managers in their decision-making process (Livieris et al., 2018). Below there are some examples of studies where specific educational systems were developed. A brief summary on Table 6 of additional literature resources on this topic is also provided.

In 2001, the New York City Department of Education (NYCDOE) introduced a system-wide data-support tool for its schools with the help of the Grow Network Company. The goal of Grow Network's NYCDOE Data Reports was to use paper and online reports to present relevant standardized test results to teachers, principals, and parents with specific recommendations for responsive action.

Feghali et al. (2011) developed a web-based decision support tool to assist with academic advising. The system enables users to make use of an already existing university information system and contributes to the relationship between an advisor and a student. Feghali et al. (2011) reported that a survey amongst students using this system showed a very high level of satisfaction between users. There exist also decision support systems that are not directly linked to the efficiency and effectiveness of an educational institution but they may have a significant impact on the institution and its performance. One such example is the web-based decision support system developed by Giannoulis and Ishizaka (2010) to rank British universities. Rankings of universities may have a sizable impact as it provides an indication of prestige which may directly influence the number and quality of students. These types of rankings can be done in various ways using different techniques of which DEA models are considered as one such technique. Giannoulis and Ishizaka (2010) refer to DEA as a possible option but implemented other multi-criteria decision methods in their decision support system.

To achieve an acceptable level of administrative and operational efficiency, Miranda et al. (2012) proposed a web-based decision support system for course and classroom scheduling. The system implements an integer programming model that is capable of generating optimal schedules. Other functionalities include a direct interaction facility for instructors to gather and obtain specific data.

Susnea (2013) argues that universities have become dependent on the collection, storage and processing of educational data. In order to make sense of the data and to improve decision making (which will maximize the performance of universities) an intelligent decision support system is proposed. The study describes a 3-component system; a data management system, a model management system (containing the analytic tools and models) and a user interface.

Dias and Diniz (2013) developed a fuzzy logic-based system that quantitatively estimates users' quality of interaction with a learning management system under blended learning. Users in this case refer to teachers/professors and learners. The quality of learning (effectiveness) is related to the quality of interaction which is enhanced through the fuzzy-logic model as it facilitates a better understanding of the relevant underlying aspects linked to a user's quality of interaction.

Klasnja-Milicevi et al. (2017) present a four stages general process (data, information, knowledge and practical value) that require to collect, classify, summarize, synthesize, evaluate and decide about educational data. That model agrees with Song, Ren and Zhang (2017) and implies a data mining system supporting multi-structured data sets through independent platforms, easy-to-use interface, analytic modules, and embedded statistical functions.

Livieris et al. (2018) presented a DSS-PSP (Decision Support Software for Predicting Students' Performance) for evaluating students' performance in the final examinations which consists of an integrated software application and provides decision support for students' potential. The specific DSS-PSP identifies the students that are probably going to fail in the final examinations and classifies the students based on their predicted passing grades.

Deniz and Ersan (2002) indicated the usefulness of an academic decision support system in evaluating enormous amounts of data that are referred to students' courses. Moreover, they presented the basic concepts used in the analysis and design of a new DSS software package, called ''Academic Decision Support System'' and presented various ways in which student performance data can be analyzed and illustrated for academic decision making.

Kotsiantis (2012) made a comparison to some algorithms in order to find out which algorithm is more appropriate for the accurate prediction of student's performance and also to be used as an educational supporting tool for tutors. In addition to that, he presented an original idea of a decision support system for predicting students' academic progress in distance learning, using some demographic characteristics, attendance and their grades in written assignments.

In their study, Chau and Phung (2012) illustrated the importance of educational decision-making support to students, educators and school organizations by pointing out that this

support would have more value if lots of relevant data and knowledge might come from data that are available for educational managers in their decision-making process. Additionally, they proposed a knowledge-driven DSS for education with a semester credit system by taking advantage of educational data mining. Their proposed educational DSS is helpful for educational managers to make more appropriate and reasonable decisions about students' study and further give support to students for their graduation.

Romero et al. (2013) studied how web usage mining can be applied in e-learning systems in order to predict the grades of university students in the final examination of a class. The researchers proposed a classification via clustering to improve the prediction of first-year students' performance. Adding to the above, they developed a specific mining tool which takes into account the student's active involvement and daily usage in a Moodle forum.

Paz et al. (2014) developed a DSS based on a clustering algorithm for college completion model. Their proposed system utilized data from students' registration and grades databases while the client front-end ensures adequate presentation so as to reveal significant details and dependencies. The system can be used to not only for supplying information to the user but also to aid the decision-making process aiming to decrease the high rate of academic failure among students.

Livieris et al. (2012) introduced a software tool for predicting the students' performance in the course of ''Mathematics'' of the first year of Lyceum. They conducted an experimental analysis making use of a variety algorithms which revealed that the neural network classifier achieved the best accuracy and exhibited more consistent behaviour. Also, in the year of 2016 the authors presented a user-friendly decision support software for predicting students' performance, together with a case study concerning the final examinations in Mathematics. Their proposed tool is based on a hybrid prediction system which combines four learning algorithms. Their experimental results application of data mining can offer significant insights in student progress and performance.

The literature review of the above studies reveals the creation and integration of decision support systems in different educational levels but mainly, the goal, or in another way the decision making of these frameworks, is different and accompanied with the expectations of the researchers and the targets that every educational organization wants to achieve. Generalizing the above facts, we could highlight that this is the greatest meaning of decision making: to set a goal and work for it by using all the available data that the educational organization has to offer.

Considering the goals of our study, we focus on the design of a framework applicable for data driven decision making in character of education and especially self-evaluation oriented at ICT, which requires a synthesis of previous scientific research and case studies and also the founds of DigCompOrg. That is one of the main goals of a systematic literature review (Booth et al., 2012; Cronin et al., 2008) to focus a broad research topic for designing, refining, and applying theoretical models and strategies that will facilitate further investigations and implementations. Below, on Table 6, there is a brief review of studies on DSS.

Table 6
Brief review of studies on DSS

Authors	Study
Deniz & Ersan (2002)	An academic decision-support system based on academic performance evaluation for student and program assessment.
Zilli & Trunk-Sirca (2009)	DSS for academic workload management.
Feghali et al. (2011)	A web-based decision support tool for academic advising.
Chau & Phung (2012)	A knowledge-driven educational decision support system.
Miranda et al. (2012)	Web architecture based decision support system for course and classroom scheduling.
Kotsiantis (2012)	Use of machine learning techniques for educational proposes: a decision support system for forecasting students' grades.
Susnea (2013)	Improving decision making process in universities: A conceptual model of intelligent decision support system.
Dias & Diniz (2013)	FuzzyQoI model: A fuzzy logic-based modelling of users' quality of interaction with a learning management system under blended learning.
Romero et al. (2013)	Web usage mining for predicting final marks of students that use Moodle courses.
Paz et al. (2014)	Academic decision support system for college completion model. In: International conference on advances in computer and electronics technology.
Livieris et al. (2016)	A decision support system for predicting students' performance.
Klasnja-Milicevic et al. (2017)	Data science in education: Big data and learning analytics.
Livieris et al. (2019).	Improving the evaluation process of students' performance utilizing decision support software.

4.4. Conclusion

The main conclusion of this chapter related to our thesis proposal is that DDDM, LA and AA have the same target which refers to the improvement of education or in another way, the school as an organization, by analyzing data in order to extract useful information for those who are interested. Businesses, industries and systems of healthcare have already been using data techniques to achieve better results through decisions making, so it is time for school organizations in all levels to start the annual use of it in a more statutionary way. Decision making based on data is a key factor at all stages of data collection to develop schools' digitalization strategies and their implementation (Hargreaves et al. 2015; OECD, 2015; Sergis & Sampson, 2016; Wastiau et al., 2013) and thus lead to school improvement.

In this chapter it was examined previous research from a variety of aspects, including the field of data, the algorithms used, the type of conclusions drawn, the educational level of application and the actual exploitation of the results in the educational setting. Previous findings indicate that higher education dominates the Data Driven Decision Making domain, while less focus has been given to secondary education and primary education. The future research should focus on primary schools and their improvement because the field of data seems to be promising.

This is also confirmed by the quantitatively review of Papadogiannis, Poulopoulos and Wallace (2020) and may be due to better access to data through the development of

Learning Management Systems in higher education institutions, as well as the fact that scientific experimentation can be performed more easily in higher education. So the interesting field as a rising area is the primary schools that seem to promising regarding the use of data. As it considers primary schools, according to Schildkamp (2019) DDDM has a focused on assessment data in order to have improvements in student achievement. The matter is that there are many other sources of data available in a school organization that there is the opportunity for all the actors of school or the researchers interested in these matters to use these data for school improvement (Schildkamp, 2019).

Considering the above, this study stresses the opportunity and use of DDDM models at primary education. In primary schools, according to studies the use of DDDM as a new field is either for supporting student learning and wellbeing (Bryceson & Sheridan, 2022; Williams, 2014) or as a drive to professional development of teachers (Staman, et al., 2014), or as instructional help for teachers (Gelderblom et al., 2016), also as the prevention of covid-19 or as the control of phycological and financial support and as a restart of the school processes (Yu et al., 2021). Furthermore there are studies about DDDM in primary schools that focus on the progress of use by teachers or the anxiety that DDDM costs to the teaching staff (Hamilton & Reeves, 2022; Marsh et al., 2010; Reeves & Chiang, 2018; Van Der Kleij et al., 2017). In addition to that there are studies that focus on DDDM and leadership and how this field is supportive for school for them (Park & Datnow, 2009; Plaatjies, 2019; Sergis & Sampson, 2016; Young et al., 2018) but none of the focus on the evaluation of digital competences and the construction of a school plan in order to have school improvement.

However, in order to fully understand the potential of data in education, more research is needed in terms of data use to improve the quality of schools. This thesis findings and suggestion, is that by focusing on earlier education level we can have a more profound impact on education in a holistic way. That is the reason why our research focuses in a Primary school. As in addition to that, this thesis proposed small teams meeting regularly and using an explicit, data-driven structure to disaggregated data, analyze student performance, set incremental student learning goals, engage in dialogue around explicit and deliberate classroom instruction, and create a plan to monitor instruction and student learning in order to have school improvement.

Finally, focusing on the earlier education levels and especially primary school case studies, that have a digital capacity of numerous pupils, in more diverse classes and having a more important impact in their lives and in society as a holistic option, is the most prominent future direction for data field. It is a path that can provide new research opportunities but more importantly a direction that can produce results that affect education and society in a more profound way. However, in order to realize the full potential of data in education, more insight is needed urgently in terms of the best ways to use data to improve the quality of schools. In the study of Khan (2019) that considers also a university in Finland, the main target is to use the data in order is to increase the digitalization of course contents. The data were available through “Systematic Creativity and TRIZ basics” framework. So concluding, it is highlighted in the international literature review that none of the studies has used DigCompOrg in order to extract data and use them through DDDM plan in order to have

school improvement. Also, it is observed that models of digital competence and DDDM can be used as a co-creation (Torfing et al., 2019) of a plan, which refers to the attempt of two actors to try to construct a solution for a common problem, as this thesis proposes. Co-creation has been proposed by academic fields (Jukic et al., 2019; Voorberg et al., 2015) and both the Organization for Economic Co-operation and Development and the European Union – as the most successful strategy for managing the problems of the public sector of the 2008 economic crisis (European Commission, 2012, European Commission, 2013; OECD, 2011, OECD, 2019). Until recently, the academic and political interest in this concept has initiated a theoretical discussion of the conceptual properties of co-creation, as an empirical research of co-creation sites (Jukic et al., 2019; Voorberg et al., 2015).

The need now is school improvement and this research uses the contribution of DigCompOrg and DDDM as fields in order to achieve that goal.

CHAPTER 5

RESEARCH METHOD

In this chapter we describe the main metholodological aspects of the present research. First, the research problem, questions and objectives to present what outputs and outcomes we will arrive to. Next, the method and the research context: the participants, instruments for collecting data with its validation and the research phases are going to be presented.

This chapter is the core of the empirical design research and it is the base of the next chapters about results and conclusions as it is usual in a PhD report.

5.1. Research problem

Different studies have emerged that DigCompOrg has various uses: for the construction of one's own (Balaban et al., 2018; Jugo et al.,2017; Redep et al., 2019); to reflect on pedagogies of ICT learning (Fedeli, 2017; López & González, 2017); for the preparation of ICT implementation plans (Brolpito et al., 2016; Giunti et al., 2018) for the identification of specific areas that need improvement (Malach & Kostoloányová, 2017, for the construction of digital evaluation models (**C**ampelj et al., 2019) or even for inclusion in schools (Panesi et al., 2020).

On the other hand, data used in DDDM can be extracted from various contexts such as standardized assessments (Schelling & Rubenstein, 2021). Despite to that and due to the complex nature of DDDM, this study focused on a DDDM model that can lead school to improvement (Campbell & Levin, 2009; Levin & Datnow, 2012; Mandinach, 2012; Mandinach & Honey, 2013; Schildkamp, 2019).

Based to the fact that there is not statutory evaluation of Digital competences (Sergis, 2017) this inquiry tried to extract actual data from a school and apply them in a data driven decision making model. The evaluation is obliged to rotate at new models of ICT's skills of all the factors that belong to a school. For this reason, this inquiry presents below data based on the principles of DigCompOrg as a high command of the digital area that we live and entries them in DDDM model in order to have school improvement (Campbell & Levin, 2009; Levin & Datnow, 2012; Mandinach, 2012; Mandinach & Honey, 2013; Schildkamp, 2019).

This issue is deemed as crucial since these actors obviously play a vital part in the overall planning and delivery of the school's ICT vision and strategy (Sergis, 2017). Therefore, their

specific Digital competences of teachers and students should be explicitly taken into account when measuring the Digital competence level of schools (Sergis, 2017).

This inquiry tried to feature the real enquiring thoughts and issues about DigCompOrg and DDDM that give the ability to new technologies and data to bring a new internal change for "healthiness" at schools. In the statement of the previous literature review, the next section formulates the research questions.

So our research problem is:

Is it possible to improve decision making processes in schools relative to digitalization of the organization?

5.2. Research questions

Digitalization is an issue of growing importance at elementary education institutions (Pettersson, 2021). In this regard, the instrument based on DigCompOrg (SELFIE questionnaires) that the present research presents will support elementary education institutions in developing their individual approaches to engage in digitalization, methodological, conceptual approach and school improvement through evaluation. According to Bacigupo (2022, p. 1) the digital "competency frameworks are not binding, and users are not expected to comply with them, but rather to use them flexibly, to disaggregate and regroup them to achieve their own goals".

Many studies refer that digitalization do not always concern sustainability in schools (Aesaert et al., 2015; Hakansson Lindqvist, 2015; Hauge, 2014) and that the digital technologies which are implemented obviously support and reproduce previous practices rather than creating new ones (Glover et al., 2016). So, considering that, this thesis expands the previous research by proposing a flexible DDDM model regarding all the data that are gathered through the DigCompOrg.

Despite the huge attention of DDDM in public education, opportunities for genuine DDDM have been limited (Datnow et al., 2013; Dawson, 2021; Hubbard et al., 2014; Kauffman et al., 2014; Sergis, 2017). This happens due to the limited frequency and mandated evaluations that form the basis for such decision making (Kaufman et al., 2014). Another important thing for the implementation and use of DDDM models and a central factor for this is collaboration (Means et al., 2010). As noted, it is very important for an effective DDDM model the combination of many factors in a school unit. To support such practice, effective DDDM models utilize both diverse data teams and whole-school involvement and decision making to drive data analysis (Kaufman et al., 2014).

The following research questions are raised:

- Are digital competences a key factor to improve the development of our educational organizations?
- Is it possible to improve schools through evaluation about digital competences?
- Is DigCompOrg useful to evaluate our Greek schools?

- Can we design a model of evaluation based on DDDM and DigCompOrg at the same time?
- Is the combination of both a good way to evaluate the schools?
- Can we design and adapt instruments to involve teachers and students?
- Is it possible through the evaluation of digital competences to have a motive in the use of them by students?

The following section presents the objectives of the research to answer all these research questions.

5.3. Research objectives

DigCompOrg model aims to reflect the problematic around self-evaluation of school organisms that strengthens the integration and growth of digital competences in a school organism, involving organizational and personal aspects of the factors of a school (Fernández & Prendes, 2021). SELFIE instrument relies on the self-perception of the respondents (García-Valcárcel et al., 2020) which are major factors in the educational process (Dvoretskaya, 2018) and can be formulated according to the correspondence and the potential of the each educational organization (Broek & Buiskool, 2020). Adding to the previous, iterative models of data use which are consisted of defining goals, collecting different types of data sense-making, taking improvement actions and evaluation (Campbell & Levin, 2009; Levin & Datnow, 2012; Mandinach, 2012; Mandinach & Honey, 2013; Schilkamp, 2019) is a new area in the substance of education and also these models can be formulated according to the potential of every school organism (Bacigalupo, 2022; Sergis, 2017). Based on the above the general objectives of our research are formulated according to the previous views:

1. To analyse the degree of development of the digital competence of a school in Greece according to the areas contemplated in the DigCompOrg model considering the opinion of teachers and students.
2. To analyse how the variables of this model DigCompOrg affect each other from teachers questionnaire, in order to have self-evaluation and school improvement.
3. To design a decision making plan based on a theoretical DDDM model and the results obtained by this research.

On Table 7 below there is a detailed presentation of the general and specific objectives.

The next sub-chapter explains the methodology of this research. Therefore, as it is defined and clarified the purpose and objectives of this study, it is considered necessary to highlight the further utility of the main problematic.

Table 7
General objectives and specific objectives

General objectives	Specific objectives
1. To analyse the degree of development of the digital competence of a school in Greece according to the areas contemplated in the DigCompOrg model considering the opinion of teachers and students.	• To observe the level of ICT integration in a Greek school regarding students. • To analyse teachers' self perception about the digitalization of the school. • To evaluate the use of available digital infrastructure in the school. • To evaluate the impact of ICT use in the psychological influence of students.
2. To analyse how the variables of this model DigCompOrg affect each other from teachers questionnaire, in order to have self-evaluation and school improvement.	• To explain the areas those affect the highest rated area in order to have evaluation. • To find out how the available equipment affects their teaching with the use of technology. • To learn their perception of digital competence affects the use of ICT in their teaching.
3. To design a decision making plan based on a DDDM model and the results obtained by this research.	• To analyse the scores from teachers' dimension based on DigCompOrg areas in relation to a DDDM model. • To create a DDDM plan -based on data from previous analysis- as a process in order to have school improvement.

5.4. Methodology

This research has been designed with a quantitative research method to analyse the self-perception about the dimensions of DigCompOrg in teachers and students. These data have been used to design a DDDM plan for the improvement of the primary school.

Thus, the first phase is a descriptive research and by that terms we mean the research that "is used for the techniques of investigation by a direct observation of a phenomenon or a systematic gathering of data from population by applying personal contact and interviews when adequate information about certain problem is not available in records, files and other sources" (Pandey & Pandey, 2021, p. 84), which identifies data and a non-experimental design (Arnal et al., 2003). This type of research tries to understand the reality of education without intervention. Quantitative method aims to find relationships between various factors and refers to the systematic investigation of phenomena with statistical methods, mathematical models and numerical data (Pandey & Pandey, 2021; Salkind, 2010). The descriptive method is used to discover associations and relationships between selected variables and to answer questions based on the ongoing events of the present (Dulock, 1993).

In the second phase, our intention was to propose improvement actions in which the results are particularized offering a heuristic analysis that brings us closer to real setting (Vázquez & Angulo, 2003) using the change-oriented research (Kirby et al., 2006). Change-

oriented research is guided by a problem and aims at the processes of social change and advance (Alasuutari et al., 2008; Kirby et al., 2006). This concept promotes the idea of a flexible method (Joosse et al., 2020). The specific approach was best suited for the second part of our research in the meaning of attempting to the change through the target of school improvement.

5.4.1. Research context

This research conducted in a school located in a residential area and in the centre of Rhodes Island, in Greece. It is a big school with 2 groups of classes in each level, from nursery school to secondary school, and includes 185 students in the academic year 2019-2020 which corresponds to the year when data were collected. 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 ages of the primary students are between 6 to 12 years, which is the normal age for Primary School pupils in Greece. As an experimental school, its functions are supervised directly from the Education Department of the University of the Aegean which is also located in Rhodes Island. The teaching personnel is composed of 37 teachers which includes 20 primary general teachers, 2 teachers of English language, 2 teachers of gymnastics, 1 teachers of computers, an art teacher, a German's language teacher, a Drama teacher, a Music teacher and a French language teacher, 3 special education teachers and an "all day school" teacher.

The school has long experience with all kinds of projects mainly of environmental and cultural nature. It has participated in contests and networks of local, national and international level successfully over the last years. Participation in such institutions include 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, pupils. The relationship between teachers and other groups including parents and the consultant of school is excellent. Moreover the staff of the school is very experienced and fluent in English and also familiar with digital competence. Therefore the school participates in many projects.

When this research took place, the particular school belonged and was engaged to European programs like Erasmus and E-twinning and generally in programs about sustainable development.

5.4.2. Participants

It is chosen a specific school of Greece which includes a total population of 185 students and 37 teachers. About the teaching staff of the school, participants were 37 teachers of the school and that makes it a total amount out of the population of teaching staff. All the teaching staff was willing to participate in the current research and all of them answered the questionnaires, 37 out of 37 teachers answered the questionnaire. During that time of the academic year 2019-2020, the researcher was a colleague of them, so the teachers were disposed to answer it.

As it considers the students, that project follows a participant sample which was 120 students of the specific school, between the ages of six to twelve, out of the total population of 185 students of the school. Table 8 presents the total number of population and participating sample in the academic year 2019-2020. The sampling of this research can be characterized as non probability according to Pandey & Pandey (2021), in fact we have not selected the students. 120 students finally answered the questionnaire out of 185 students. Unfortunately, the academic year of 2019-2020 was hit by the pandemic that was caused by the SARS-Cov-2 and after the decision of Greek government to re-open the schools at 1st of June 2020. As it is observed, there was a leak of 65 students after the re-open of schools. The parents of the specific students did not give their consent to return to school, as it was not obligatory for this period of re-opening. So, these students could not answer the questionnaire of the research.

Table 8
Total number of population and participating group in the academic year 2019-2020

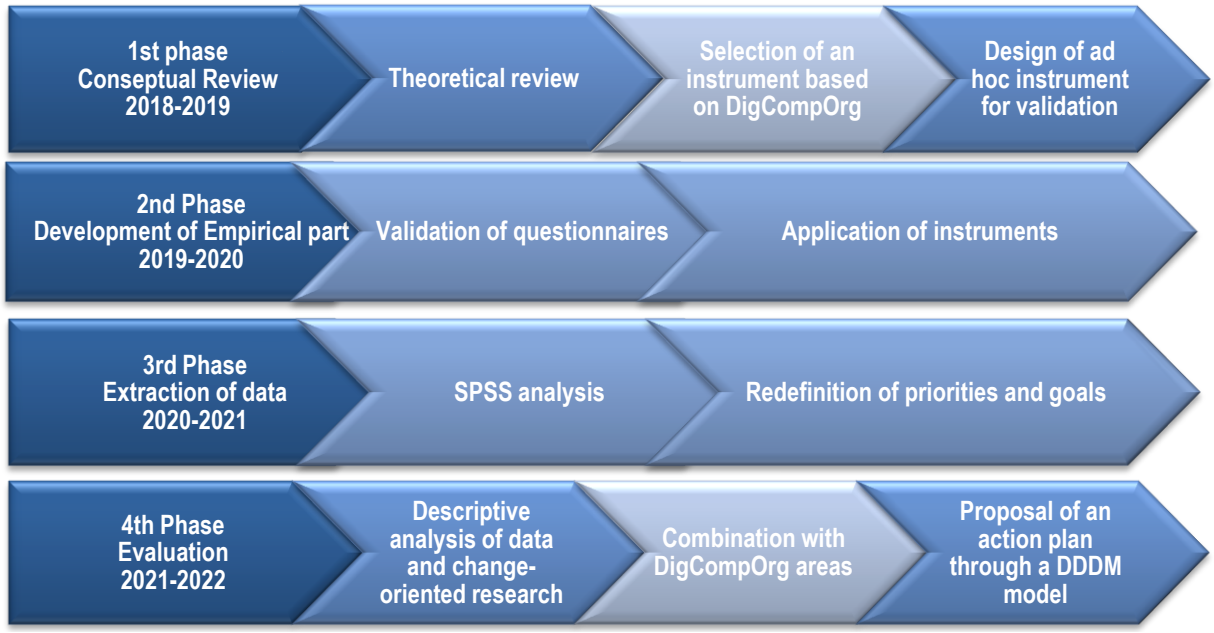
	Population	Participating group
Teachers	37	37
Students	185	120

5.4.3. Phases of the research

The research has been constructed in four phases. The first phase, which means the academic year of 2018-2019 included the theoretical review and the selection of a framework that contemplates the different areas competencies indicated in the DigCompOrg model and the design of the ad hoc instruments which includes the first draft of the adaptive questionnaires for validation. Also, in this phase the researcher waited for the approval of the Greek Ministry of Education to start the research. In the second phase (2019-2020) the first semester started with the validation of questionnaires through a pilot study. Also there has been made a deeper investigation of the areas of DigCompOrg and an evaluation of the applied instruments and second academic semester the modified instrument (see Table 10) has been applied to the sample. In the third phase (2020-2021), extracted data were analysed through SPSS model and a determination of priorities and goals was set. Finally, in the last and fourth phase (2021-2022) evaluation and action plan was set in order to combine the data with DigCompOrg areas and propose a self-evaluation action plan of the school through a DDDM model. The final report has started to take part from January 2022 until September 2022.

The empirical part of research started at December of 2019 and after that, the schools closed at March of 2020 due to the covid-19 pandemic. The Greek government decided to open the schools on June of 2020. So, the empirical part started at December 2019 but was finalized and completed with the re-opening of the schools on June 2020. Figure 9 presents the phases of the research by academic year.

Figure 9
Phases of the research



5.4.4. Instruments to collect data

The research is characterized as quantitative and in fact two questionnaires were shared, one for teachers and one for students. So data collection was done with structured protocols, such as questionnaires with closed questions (Salkind, 2010).

Regarding the structure of questionnaires it is clear that were based on the relevance of the six areas that DigCompOrg proposes (Kampylis et al., 2015) and specifically to the SELFIE instrument which can be adapted to the needs of each school and may choose to add or remove some questions (Broek & Buiskool, 2020; Costa et al., 2021). It was chosen to remove some questions that had no meaning for the Greek educational reality for instance, in the original version of SELFIE tool it is asked to teachers if *"sstudents bring and use their own portable devices during lessons"*. That question does not reflect to the Greek educational reality because according to a statutionary Greek law of Ministry of Education (law, 2472/1997) that considers "The protection of the individual from the processing of personal data" number of protocol 14/21-04-2016, it is forbidden for students to bring digital devices at school[32]. So, some questions do not have a point for the Greek digital educational reality. We chose to remove questions in both instruments and add other as items in order to receive data about students' parents and communication with teachers, sustainable development and local community and last, influence of ICT in students' education i.e. psychology, critical thinking and cooperation with others and also special education, always with respect to the six areas that DigCompOrg framework suggests. Below there is a detailed prescription of the two questionnaires with the added items.

[32] https://edu.klimaka.gr/sxoleia/genika/1783-apagorevsh-kinhtwn-thlefwn-hlektronikvn-syskevwn

Before we step to that, it is important to clarify that in the step approach of SELFIE tool, step 3 declares that you can select or add items that match the needs and context of your school (European Commission, 2018b). So in the current research, there were made adjustments of the questions of the initial SELFIE tool that are described and explained in Table 9 and 10 below. The quantitative instrument based on DigCompOrg model (Kampylis et al., 2015) has more questions than ours. According to the study of Broek & Buiskool (2020, p. 36) "SELFIE does not need a fundamental change but needs adjustment that they would be good to stick to the existing setup". In this point it has to be noted that in general, questionnaires are designed to measure a series of parameters that in many occasions are theoretical or abstract concepts (García et al., 2009). As indicated, the SELFIE questionnaire currently consists of the following six areas (Broek & Buiskool, 2020; European Commission, 2018b; Fernández & Prendes, 2021):

A: Leadership
B: Infrastructure and Equipment
C: Continuing Professional Development
D: Teaching and Learning
E: Assessment Practices
F: Student Digital Competence

It is very important to notice that our questionnaire used the main areas of DigCompOrg model and is based to the general idea of SELFIE tool, but the two administered by our research questionnaires differenced from the original versions, mostly in the content and type of questions.The added question are highlighted with blue colour in Table 10 that considers the contiguity between DigCompOrg areas and teachers/students questions (see above). In the meaning of that, all questions addressed to teachers and students differentiated in order to capture the integration of digital competence in the Greek educational reality.

So, as a general conclusion we would point out that the researcher through the specific questionnaires wanted to cover in essence the views of students and teachers on the integration of digital competence of the school according to the needs of main substance in Greek reality in the specific primary school.

5.4.4.1. Teachers' questionnaire

The questionnaire that this research used to extract data from teachers, added to SELFIE questionnaire the next ones adding questions to the already existing areas of DigCompOrg that consider the matters of: 1) digital communication with the parents according to teachers self perception which belong to the item of "Communicating with the school community" of the original version of SELFIE ; and 2) digital activities of the school that involve local community and sustainable development according to teachers self perception which belong to the items "Student collaboration" and "Cross-curricular projects" of the original version of SELFIE. School related communication already existed as a question in the original version/questionnaire of SELFIE tool but the researcher made it more specific referring to the parents of students. So, the questions about school related

communication have differed from SELFIE tool. The same has been done exactly with the questions that refer to the digital activities of the school that involve local community and sustainable development. Also, these questions refer to the same area of DigCompOrg but they are more targeted in the sustainable development and local community. In the end, teachers' questionnaire consists of 23 questions referring to the six areas of DigCompOrg.

As it considers parents digital communication, the international study of the contribution of parental involvement in children's school education, argues in favour of its positive effect on students, parents and teachers, but also on the quality of the education provided as a whole (Epstein & Sheldon 2002; Bruzos, 2009). An effective school is the one that promotes cooperation with parents, building bridges of support and trust (Strier & Katz, 2016) in order to create networks of social support for students. The active participation of parents can bring many advantages for all the school community so it is very enlighten to study the specific part through digital area. Also, research has shown the explicit role of the school in the sustainable development involving the local community (Athanatou, 2018) and this need is also emerged through the 17 global targets of "Sustainable Development Goals" [33].

5.4.4.2 Students' questionnaire

The questionnaires that this research used to extract data from students added to SELFIE items the next ones adding more questions to the already existing areas of DigCompOrg: 1) the digital communication with the parents according to students' self perception which belong to the item of "Communicating with the school community" of the original version of SELFIE ; and 2) digital activities of the school that involve local community and sustainable development according to students self perception which belong to the items "Student collaboration" and "Cross-curricular projects" of the original version of SELFIE; and 3) students opinion about the influence of ICT in their education i.e. psychology, critical thinking and cooperation with others and also special education which belong to the item of "Student collaboration" but none of the questions of the original version of SELFIE does not focus phycology and critical thinking in the ICT use.

The last is a very interesting area that rises in the main substance of digital integration. In the past studies result shows that are neglected the possible interfering between students' ICT psychological factors and school (Huang et al., 2017; Lei et al., 2021; Thomée et al., 2010; Xiao & Hew, 2022).

In the end students' questionnaire consists of 36 questions referring to the six areas of DigCompOrg. In order to have a comprehensible and fully understood questionnaire for students the researcher had to add some close ended question that can be answered either in one of the two ways, "yes" or "no" (Fowler & Cosenza, 2009) except from the Likert style ones. Also, in the beginning there was some student's demographic information as it is obvious in Table 10 below, and students were also asked to define what teaching infrastructures have their teachers in the classroom (Figure 6). In Table 9 there is a clear prescription of the total number of questions and areas in two instruments.

[33] https://inactionforabetterworld.com/17-pagkosmioi-stoxoi/

Table 9

Total number of items and areas of teachers' and students' questionnaire.

	Teachers	Students
Areas	6	6
Total number of items	23	36

Bellow there is a detailed parallelism of the questionnaires' between SELFIE (European Commission, 2018b) items and also there is a classification of the added questions to these dimensions. The contiguity between areas of DigCompOrg model and teachers/students questions is shown on Table 10.

A specific taxonomy has been followed concerning the formulation of the six areas and the grouping of the content. The target was to categorize the fields that are needed to be evaluated are gathering over six areas and are combined with the indicators of DigCompOrg (Kampylis et al., 2015). Next step of pilot study them, to avoid threats of validity, the researcher built the quantitative part of the study which was the questionnaires.

Table 10

Contiguity between DigCompOrg areas and teachers/students questions.

	DigCompOrg (Kampylis et al., 2015)	Questions for teachers:	Questions for students:
Area A	**A: Leadership** 1. Capacity of digital learning technologies. 2. Benefits of digital learning technologies are presented. 3. Strategy of learning in the digital age. 4. Emphasis on the open education. 5. Planning and identification of the obstacles. 6. The degree of autonomy of the involved members is determined. 7. Presentation of the motivations, opportunities and reward of the involved members. 8. Priorities are defined. 9. The goals for the existing educational method are defined. 10. Commitment to the action plan. 11. Division of Responsibilities. 12. Matching of resources, budget and human resources. 13. Evaluation of the quality of the action plan. 14. Specific points or initiatives are evaluated. 15. Comparison of the action plan after evaluation. 16. Check of policies and directions.	A: 1. Do you use digital systems from the Ministry of Education whose aim is the administrative and management support of the schools of the Greek territory? 2. Does school leadership set new goals in implementing innovative programs that are associated with the digital area that we live? 3. Is school leadership concerned about the academic development of the teachers and pushes for that? 4. Does school leadership appraise often the problems that concerns digital education that school staff experiences and try to solve them? 5. Is school leadership supportive enough with parent's concerns and does it communicate then to the teachers through often meetings?	A: No questions
Area B	**B: Infrastructure and Equipment.** 17. Physical learning environments take advantage of the benefits that a digital learning environment brings. 18. Improving of digital learning environments. 19. Establish an acceptable usage policy. 20. Investments by teachers and technicians in digital technologies. 21. Various digital technologies promote learning to any time and place. 22. Participants are encouraged to use atomic digital appliances. 23. Evaluation of the factors that exclude or promote inequality in use of digital technologies. 24. Technical support provided. 25. Supportive digitalis to people with disabilities is provided. 26. Safety measurement assessment of privacy and trust. 27. Evaluation of resource planning.	B: 1. How often do you use the interactive whiteboard as an education tool? 2. Do you use educational programs proposed by the ministry of Education through digital technologies?	B: 1. What digital teaching equipment do you have in your classroom? 2. How often does your teacher use digital teaching equipment aids in your classroom?

	28. A plan is implemented for Information Digital services.		
Area C	C: Continuing Professional Development. 29. Commitment to continuous professional development is explored. 30. Continuous professional development is provided to teachers. 31. Correspondence between continuous professional development and individual/school needs. 32. The ways of achieving continuous professional development are explored. 33. Promotion of the recognized or certified ways to continuous professional development.	C: 1. Do you think you have adequate knowledge of ICT? 2. Is school leadership concerned about the academic development of the teachers and pushes for that?	C: No questions
Area D	D:Teaching and Learning. 34. Teachers and students development of digital skills. 35. Priority is given to safety, risks and safe use. 36. Evaluation of the digital skills. 37. Digital skills are obtained in the professional evaluation of the educators. 38. Cooperation of teachers for achievement plan. 39. Teachers are invited to take on new roles. 40. Students are invited to take new roles. 41. Expansion of Pedagogical approaches. 42. Development of individual learning. 43. Creativity is promoted. 44. Cooperation and teamwork is promoted 45. Development of social and emotional skills.	D: 1. How often do you use ICT at your lesson? 2. Do you think that the Greek school is capable enough to support the use of educational programs with the use of new technologies? 3. Do you cooperate with other schools in your country or abroad with the use of new technologies and the Internet? 4. Do your students interact and solve problems in a web designed environment in the time of class lessons? 5. Do you often communicate with your students' parents through internet? 6. Is there communication with students' parents through Social Network? 7. How easy do students' parents react to a virtual stimulus? 8. Does the school unit where you work organize digital actions regarding traditions/folkways and customs of the local community? 9. Does the school unit you work at organize actions that have as a goal the sustainable development of the local community?	D: 1. Do you contact your teacher via email? 2. How often do you contact your teacher via email? 3. How often do you contact your teacher via interactive platforms?
Area E	E: Assessment practices. 46. Purpose of evaluation is expanded. 47. Holistic evaluation is differentiated. 48. Self - evaluation is promoted and peer review. 49. Feedback is promoted. 50. The previous empirical knowledge is also evaluated. 51. Basic learning of statistical analysis methods. 52. Establishment of a code related to data analysis. 53. The learning process is enhanced from learning data analysis 54. Management and design of a program are evaluated with data analysis.	E: 1. Do you apply innovative programs through new technologies with a goal to improve the educational process? 2. Do you make sure that the aims and goals of the educative routine are clearly presented? 3. Do you revise your instructional work with the aim of achievement educational targets? 4. Do you evaluate the educational results using digital programs?	E: 1. Does your school organize any activities through digital software that are used to assess tasks? 2. How easy is it to you use the digital software?

Area F	F: Student Digital Competence. 55. Teachers and students create digital content. 56. Widely and Efficient use of repositioned content. 57. Protection of copyrights. 58. Copyright and licensing in the use of digital tools and content. 59. Promoted of the wide open educational resources. 60. Creation of more integrated pedagogical approaches. 61. Redefinition of time and learning space. 62. Online learning and teaching achievements. 63.Promotion of learning in a real environment. 64. Digital learning is promoted in every Lesson. 65. Development of students' digital skills. 66. Teachers collaboration in order to gain experience and content sharing. 67. Recognition of efforts for knowledge exchange. 68. Student's participation in effective networking. 69. Promote participation in knowledge exchange activities. 70. Internal cooperation and knowledge exchange. 71. Presentation of a clear communication strategy. 72. Achieving dynamic net action. 73. Commitment to knowledge exchange through partnerships. 74. Provide motives to teachers and students in order to take an active part in collaborations.	F: 1. Do the students of the school have the opportunity to participate on European exchange programs in order to become accustomed to the basic values of the European Community? 2. In which grade/ extent do you think that parents allow their children to make use of digital programs besides the school curriculum time?	F: 1. Is there communication with other schools that are abroad through internet applications? (i.e. application o programs like Erasmus) 2. Is augmented reality used in school lessons? 3. If you answered yes, how often you use educational software in augmented reality? 4. Does the use of digital learning to motivate your learning? 5. Do you think the use of digital learning limits critical thinking? 6. Do you think that the use of digital learning has a positive effect on your psychology? 7. Do you think that the use of digital learning has a negative effect on your education? 8. Do you think the use of digital learning increases your collaboration with others? 9. Do you have children with physical disabilities in your class? 10. Do you have children with learning difficulties in your class? 11. Do you have children with behavioural problems in your class? 12. Do you use educational software for children with special needs, such as the above? 13. If yes, do you believe that the self-confidence of the specific students increases with the use of digital technologies? 14. Is the concentration of specific students improved? 33. Is their hyperactivity limited? 16. Is their will for participation in the course strengthened? 17. Do you believe that the social skills of these students are increased through the use of digital technologies in lessons? 18. How supportive is the teaching through digital technologies for you and your classmates?

5.4.5. Validity and reliability

Prior to the survey, the necessary steps had to be taken to ensure the validity of the questionnaires through which the research was conducted. The researcher tried to build a valid questionnaire with the characteristics of a multi-stage process with a lot of possibilities which is described as Prendes et al., (2016): tool design based on content analysis, cognitive interviews, experts' judge and pilot study. This research uses the pilot study in order to have validity.

As it considers the reliability in the study design (Pandey & Pandey, 2021) and on the data collected and analysed, for the analysis of the questionnaires, it is very important to evaluate the reliability of the tests. Internal consistency is the key in order to evaluate the reliability. Cronbach's alpha index (Cronbach, 1951) was used to measure the reliability of those questionnaires. The coefficient was measured for the questions where the Likert scale was used. The questions have an internal consequence and the questionnaire is characterized by reliability (Creswell, 2016).

In this context, before the structure of the final questionnaires, the researcher pilot tested teachers with a questionnaire which was checked on a limited sample (15 primary teachers) and selected by the available sample method. Questions had to be adequately piloted to measure the method accuracy. If changes are required, they are going to be made in order to have a validated form (Jain, 2016). This was a very delighting step because helped the researcher to detect everything incomprehensible, difficult to answer and needed change.

So, after this procedure the researcher came to the conclusion that the following research areas combined with digital competences need to be added to the questionnaire: digital competences that involve the actor of parents in school and sustainable development of the school. So, in the end 5 Likert-type new questions were added in the first draft of questionnaire. The reliability analysis conducted in teacher's questionnaire concludes by questions 5-point Likert-type scale, determined the scale's reliability value as 0,850 according to Cronbach's Alpha value (Taber, 2018). This value shows that the scale is highly reliable (Taber, 2018).

According to Crocker and Algina (2008) if the pilot test is conducted for small samples, the relatively large sampling errors may reduce the statistical power needed to validate the questionnaire (Crocker & Algina, 2008). This was a very important step that delayed very much the research, due to the fact that a negative Cronbach's alpha was obtained when all items are correctly scored and there were serious problems in the original design of the questionnaire of teachers with higher values indicating that items are more strongly interrelated with one another. Cronbach's $\alpha = 0$ indicates no internal consistency (i.e., none of the items are correlated with one another), whereas $\alpha = 1$ reflects perfect internal consistency (i.e., all the items are perfectly correlated with one another) (Taber, 2018). In practice, Cronbach's alpha of at least 0.70 has been suggested to indicate adequate internal consistency (Cronbach, 1951; Peterson & Kim, 2013). A low Cronbach's alpha value may be due to poor inter-relatedness between items; as such, items with low

correlations with the questionnaire total score should be discarded or revised (Peterson & Kim, 2013).

As it considers the validation of children's questionnaires, a pilot study of 23 students was made in order to achieve completeness and appropriate structure of the final questionnaire. It was carried out in a 45-minute lesson and provided the basis for the design of the questionnaires that were shared to the sample of the students. The researcher during the study was a full-time teacher at this school and had the 3rd class of the primary school and twenty three students. Due to this, the students were very well acquainted with the practitioner and they felt thus free to make comments on the process and ask for assistance when they needed it.

Referring to the pilot study, it was made at December of 2019. So the validation of questionnaires was completed before the pandemic. The pilot study about ICT evaluation of school through questionnaire was administered to 23 third grade students, who were 8 years old. The rationale behind the choice of the students belonging to that class was that they were in the average age of the students that took part in the research and also the researcher was the main teacher of the class, so there was more intimacy to correct and talk about mistakes; therefore, we decided it was appropriate for the pilot test to be conducted with students of the same level because of the convenience of researcher and the easy access to the sample. All students belonged to the same class, and the group included in total 13 girls and 10 boys.

To measure the reliability of the scale, Cronbach's Alpha coefficient was used (Taber, 2018). In our main study, the findings of this pilot study offered insight as to the user-friendliness of the process and allowed the researcher to tailor them accordingly. The reliability analysis conducted in student's questionnaire, fifteen (15) questions 5-point Likert-type scale was included, determined the scale's reliability value as 0,756 according to Cronbach's Alpha value (Taber, 2018). This value shows that the scale is reliable (Taber, 2018).

The outcome of this long and complex validation process was two questionnaires that target teachers (23 questions) and students (36 questions). The length of the teacher's tool is one of the factors that have caused the greatest problems in terms of both collecting data and their subsequent analysis. There had to be added questions in the first version and that was indicated through the pilot study. The questionnaires are made up of choice Likert to rate their degree of agreement on a 5-point Likert scale (Demetriou et al., 2015) for each item (i.e., 1= strongly disagree, to 5= strongly agree), to which the "yes/no" answer's option was added, especially in students questionnaire where there are 11 questions of "yes/no" option.

In conclusion, construct validity is the most important concept in evaluating a questionnaire that is designed to measure a construct that is not directly observable. If a questionnaire lacks construct validity, it will be difficult to interpret results from the questionnaire, and inferences cannot be drawn from questionnaire responses to a behaviour domain. The construct validity of a questionnaire can be evaluated by estimating its association with other variables (or measures of a

construct) with which it should be correlated positively, negatively, or not at all (Cronbach & Meehl, 2017). Correlation matrices are then used to examine the expected patterns of associations between different measures of the same construct, and those between a questionnaire of a construct and other constructs (Taber, 2018). It has been suggested that correlation coefficients of 0.1 should be considered as small, 0.3 as moderate, and 0.5 as large (Cohen, 2013). The pilot study helped us to refine and finalize the content and layout of questionnaires.

5.4.6. Procedures of research

One of the most important elements of the research is the design of the questionnaire, which is considered the greatest value for gathering data. These specific questionnaires were designed having a clear purpose for logical continuity and the objectives were defined clearly through the meaning of questions. Also, the questions were placed in such a way so not to create doubts or thoughts about their meaning and importance. Adding to the above and in relevance to the design of the questionnaire, it is obvious that there is an adequately capture of the concepts that were contained in the research questions in order to gain the credibility of the research.

To finish the pilot study in order to validate the questionnaires, the online form with the questions was sent to the teachers by email. As it considers students, after consultation with the school leader, the researcher took the pilot study participants and accompanied them to the computer classroom. Each child took his place at the computer. In the current moment, the researcher explained exactly the process of fulfilling the questionnaires and every question or doubt about it, was expressed and answered. An interactive whiteboard in the middle of the classroom was extremely useful. More specifically, the school has a computer laboratory and therefore, we had to ensure that at the time of our pilot testing no other teacher would need to make use of them.

After the validation of the questionnaire already explained in the previous sub-section, the final form was applied. For the collection of our data with the full group of participants in the primary school, an electronic questionnaire was forwarded by email to school, informing the principal of the school through a cover letter about the purpose and the aims of this survey research, ensuring also that the survey remained open until the end of June to 2020, in which period the schools close for summer vacation.

Also, a specific permission to conduct the research at students, was asked first from the Ministry of Education and then from students' parents, asking their kind permission to let their children participate in our study through an official paper. The researcher administrated this paper to every student and after one week they brought it back to school signed by their parents giving their consent about their children's' participation at the research.

The completion of the SELFIE questionnaires takes about 30 minutes. In order to cope with the Greek educational reality, the criterion of completion a research questionnaire is less time than the time suggested in the SELFIE tool. So, especially referring to the students, the approximate time of completing the research questionnaire was around 20 minutes. Younger children of the first, second and third grade of primary school, needed a more methodological to their abilities questionnaire in order to cope with their learning level and abilities.

Initially, the research was conducted at teachers and later to students. Questionnaires were adjusted through Google Forms and that made it easier for sharing. In the cover letter of each questionnaire the objectives were clearly stated and also the significance of the specific research. It was also stated that the answers were anonymous and that would be used exclusively for research purposes. At the end of each questionnaire, thankfulness for the time and effort was expressed to the respondents of the survey.

Specifically, the students' questionnaires were fulfilled in the computer classroom during the time of curriculum. For the above reason the researcher must had the relevant permission from the Greek Ministry of Education in order to conduct the research during the curriculum time at the school. To be given this specific permission, the process was time consuming and quite bureaucratic. At last, links were copied and distributed electronically in every student's computer and mailed to teachers.

After consultation with the school principal and the teacher of each class, the researcher took each grade and accompanied them to the computer classroom. Each child took his place at the computer. In the current moment, the researcher explained exactly the process of fulfilling the questionnaires and every question or doubt about it was answered. An interactive whiteboard in the middle of the classroom was extremely useful especially for the young ages of 6, 7 and 8 years old to explain according to their specific needs. After the clarifications, a public link was shared in the entire target group computer screen. The whole process extended over a school hour for each target group but the fulfilling of the questionnaire approximately 20 minutes. Completing the research with students meant that the researcher had to be present in the school, so this process happened during the curriculum time.

Referring to the teacher's questionnaire, the questionnaire was included to the Google Form application and sent via email to the school teachers during the period May to June 2020. Before the completion of the questionnaire, there was a cover letter that explained the participants the purpose of the research, the importance of their honesty responses, the thankfulness of the researcher for their participation and also ensured their anonymity (Robson, 2010).

5.5. Ethical Issues

The research took place in the school during the curriculum time. The researcher took the official permission from the Greek Education Ministry to conduct the inquiry and was authorized by all the participants and the parents of the students to publish the outcomes. Also, the researcher made clear to the students that they may excuse themselves from the participation in the study at any time, and that by doing so, this decision would not affect their relationship with the investigators, the institution, or any services that the institution provides (Booth, 2014).

Participants (both teachers and students) were informed that they were involved in a process of research and its aims and that the personal data of them would be processed in a safe manner, based on GDBR legislation, after the relevant approval by the Ministry of Education. Privacy and confidentiality of their names was insured with official documents.

Moreover the researcher informed the school director about all the research process and the implications for participants. The school director gave the permission to develop the process and to collect data with the aim of the research.

Once finished the research, the main recommendations and conclusions will be sent to the participants to inform them about the process and to try to improve the school, too, that is the sense of this research.

CHAPTER 6

RESULTS: ANALYSIS OF DATA

In this chapter the analysis of data is explained. Firstly, it is analysed the self perception of students regarding the areas of DigCompOrg and next teachers.

Referring to teachers' questionnaire, a detailed analysis of the indicator "Assessment Practices" is displayed and the explanation of the importance of it is referred in order to construct a DDDM model of school improvement.

Finally the correlations of each questionnaire are presented to value some relations between variables of study.

6.1. Results from student's questionnaire

Data analysis was conducted using descriptive statistics and correlation matrix. For all the research questions, frequencies, means and standard deviations of the collected data were calculated, while correlation analysis was performed to identify relations between variables. Spearman's rank correlation was used to find the significant relations between the ordinal variables, while Kruskal Wallis was used for non-parametric tests. The groups surveyed have participated in all the areas designated from "A" to "F" to which DigCompOrg model indicates. Likewise, the student group has only answered, within their areas, the questions related to the research areas as we have explained and showed in the Table 10 with the questionnaires.

6.1.1. Students' demographic information

The demographic information of participating students included gender, age, daily screen time on computer or tablet (depicted in Table 11). Out of 120 participants, nearly half of them (53.3%, f=64) were females and the rest of them were males. Also, the 40% of the students (f=48) were nine years old. Moreover, six out of ten students responding to the percentage of 56.6% (f=68) reported that they spent 1 to 2 hours a day in front of a computer's or tablet's screen and only 2.5% (f=3) and 1.7% (f=2) spent 4 to 5 hours and more than 5 hours a day respectively. The majority of the boys (57.1%, f=27) stated that they spent 1 to 2 hours a day in front of a screen and similarly, 56.3% (f=36) of the girls. Ages 7 to 10 mostly spent 1 to 2

hours a day in front of a screen while ages 11 and 12 mostly spent 3 to 4 hours a day.

Table 11
Student's demographic characteristics (f=120)

	Characteristics	F	%
Gender	Male	56	46.7
	Female	64	53.3
Age	*7*	7	5.8
	8	14	11.7
	9	48	40.0
	10	18	15.0
	11	19	15.8
	12	14	11.7
Daily screen time	*1 to 2 hours*	68	56.6
	3 to 4 hours	47	39.2
	4 to 5 hours	3	2.5
	More than 5 hours	2	1.7

6.1.2. Infrastructure and equipment

Students were asked to define what digital teaching equipment have their teachers in the classroom. As shown in Figure 10, the majority of the students with the percentage of 40.9% (f=49) answered that they have computers in the classrooms, a smaller percent of 20.4% (f=25) has interactive whiteboards and only 9.3% (f=11) has cameras.

Figure 10
What digital teaching equipment do you have in your classroom?

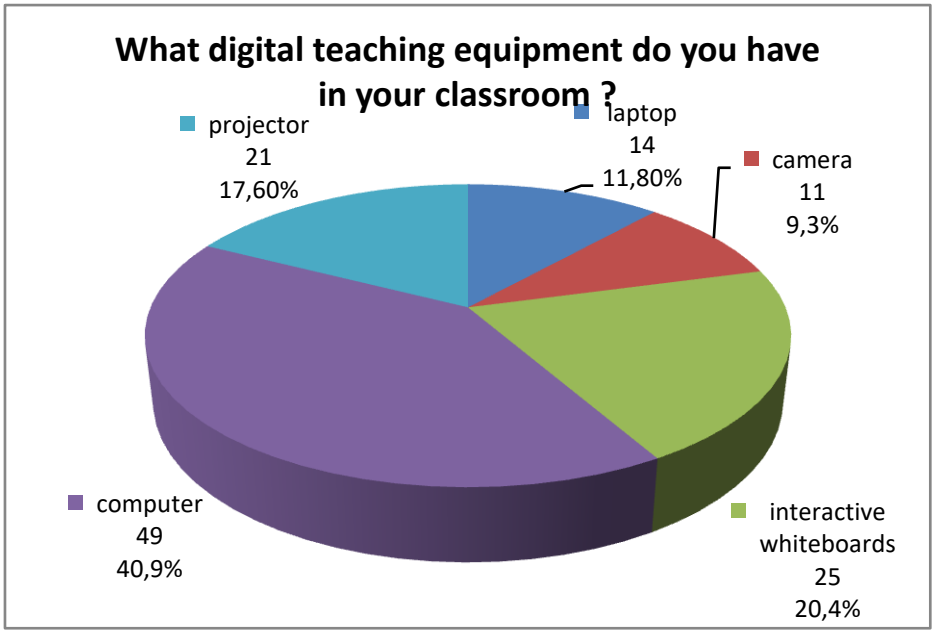


Table 12
How often does your teacher use the digital teaching equipment in your classroom?

Teaching aids/ Frequency of use	Never	Rarely	Somet.	Often	Always
Laptops	1	6	10	9	7
Cameras	3	3	8	6	6
Projectors	5	4	12	11	17
Computers	5	19	34	31	25
Interactive whiteboards	2	5	9	15	26

In the question "How often does your teacher use the digital teaching equipment in your classroom", students were asked to indicate on a five-point scale ranging from never (1) to always (5) their evaluation on the frequency of use in teaching aids. The results of this question, as presented in Table 12, show that teachers used more computers and laptops than other like interactive whiteboards and projectors computers and laptops. However, the use of a specific teaching digital equipment is related to the available infrastructure in each classroom.

As it is concluded from the information extracted from the self perception of students about the frequency of use in digital equipment the most depicted answer is about the use of computers. That is explained due to the fact that in the specific school there is one computer in each classroom and it is on the needs or the will of every teacher how often might use it during the curriculum time. As it is marked in this thesis dissertation, the use of digital equipment is not obligatory during the lessons in Greece, but it is only a matter of teacher's self perception how or how often will use it as an autonomous teaching unit (Karagiannidis et al., 2020). The most answers found in the use of the computers by students are also explained because the utilization of them can be seen in several activities outside of the framework of curriculum (Tsami, 2016). As it considers the difference in every resource of use, it is remarked that the answers were given according to the self perception of students which were in the age between 6 to 12 years old and some of the recourses were unanswered due to the fact that their teacher never used the specific resource in the field of the classroom or maybe due to their absence during the time of use.

6.1.3. Teaching and Learning

An interesting question considering this area was the one asking: "Do you contact your teacher via email?" The majority of the students responding to the percentage of 85% (f=102) answered to this question that they use the email to contact with their teachers as it is stated in Figure 11.

At the same time, to the question "How often do you contact your teacher via email" represented on Figure 12, most respondents referred to the percentage of 25% (f=30) stated that they contact their teachers via email sometimes and 22,5 % (f=27) answered that rarely use the email as a way to communicate with the teachers.

Figure 11
Do you contact your teacher via email?

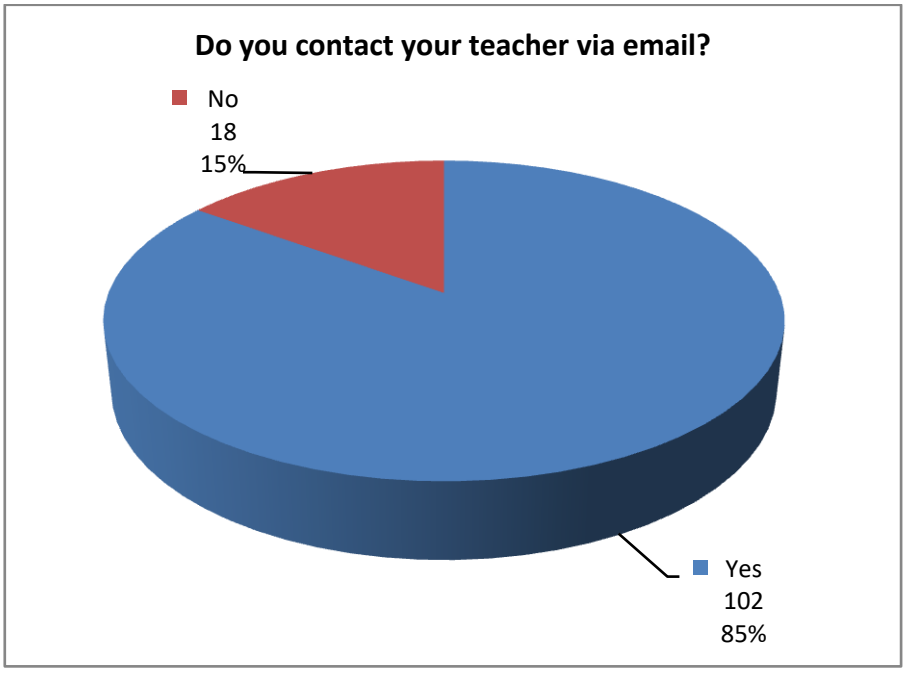
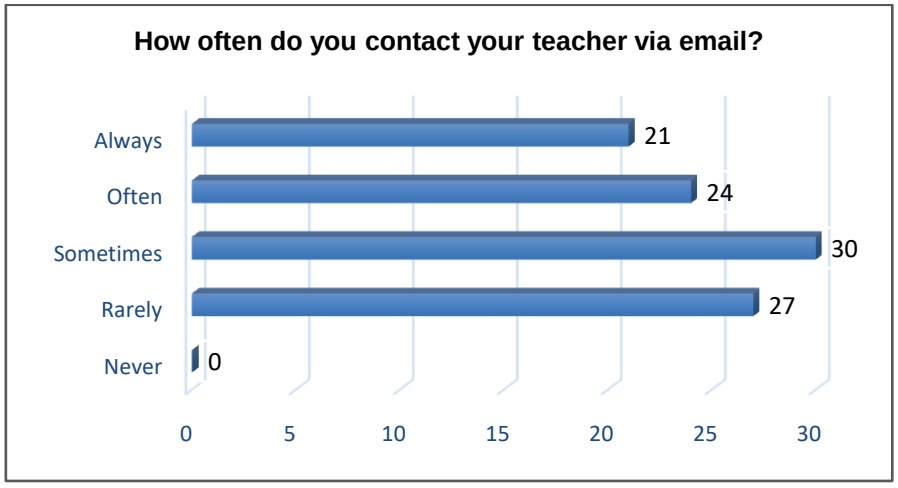
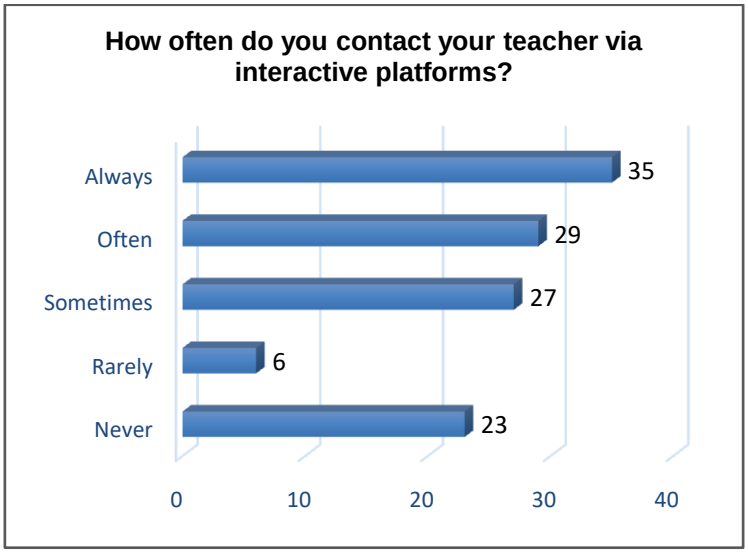


Figure 12
How often do you contact your teacher via email?



On the other hand, to the question "How often do you contact your teacher via interactive platforms" as seen in Figure 13, the majority of the students with the significant percent of 53% (f=64, adding data about always=35 plus often=29) responded positively that they choose interactive platforms as a way to communicate with the teachers.

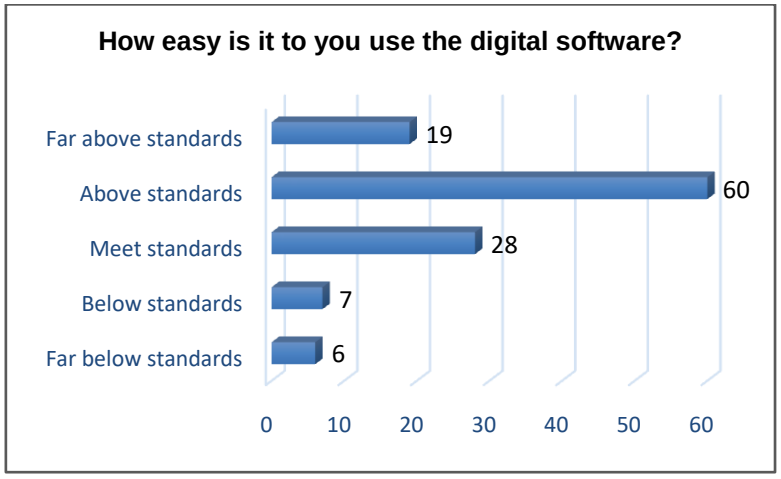
Figure 13
How often do you contact your teacher via interactive platforms?



6.1.4. Assessment Practices

Regarding area E, in the question: "Does your school organize any activities through digital software that is used to assess tasks?", the majority of the students responding to the percentage of 74.2% (f=89) answered "yes".

Figure 14
How easy is it to you use the digital software?



Additionally, regarding the level of easiness of digital software, the majority of the students, 65,8 % (f=79, adding data about above standards=60 plus far above standards=19), answered in a positive way and only 10,8 % (f=13, adding data about below standards=7 plus far below standards=6), of students stated the negative level of easiness. The level of easiness is presented in the Figure 14.

6.1.5. Students' digital competence

As it considers area C, we have the greatest valued results that give us a general view about ICT integration in this specific primary school. As shown in Table 13, the majority of the students (35.8%, f= 43) stated that the use of ICTs provides extremely level of motivation for learning and at the same time, 31.7% (f=38) believed that the critical thinking was not limited at all. Moreover, 61.7% (f= 74) respond that the use of ICTs has not at all a negative influence on their education. The ability for digital technology to support learners in this process was highlighted through the review and reported studies, but usually it is referred that learners lacked the competence to use digital technologies for educational purposes. Learners needed support, as it concerns the planning and self-directed learning, and also guidance in the way that digital technologies can be used effectively for educational purpose (Morris & Rohs, 2021). On the other hand, 32.5% (f= 39) of students answered that the use of ICTs had moderately a positive psychological influence and simultaneously they believed that moderately increased the cooperation with other students (Table 13).

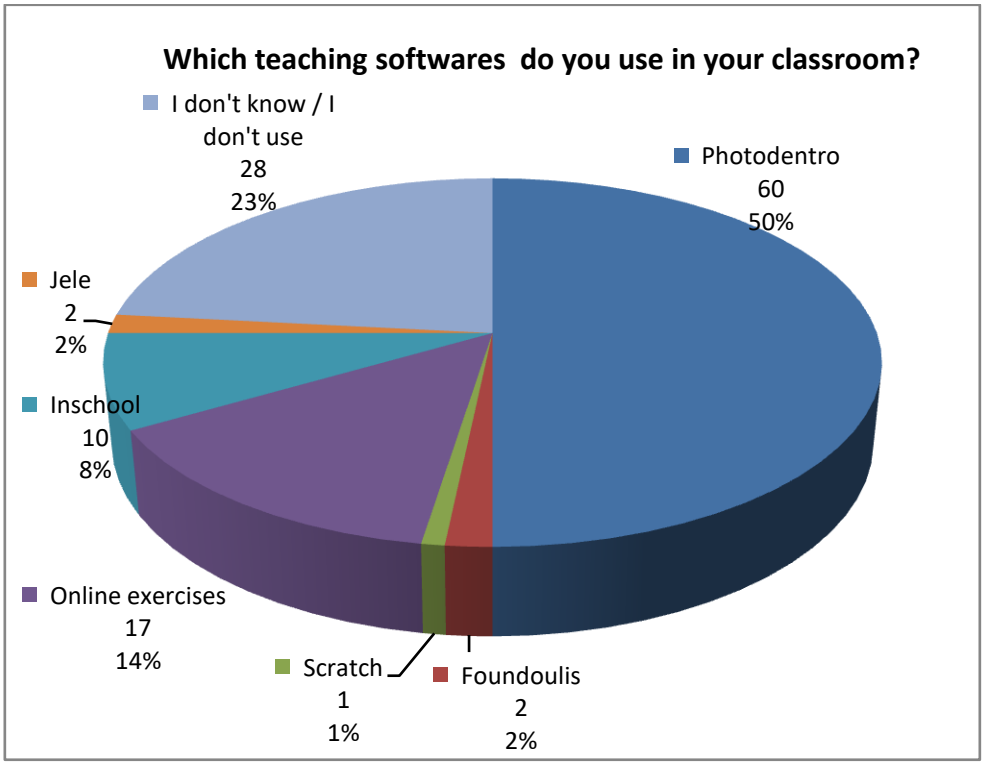
Table 13
The use of ICT in students' motivation

ITEMS	Not at all	Slightly	Moderately	Very	Extremely
Does the use of ICTs provides motivation for learning?	8 6.70%	14 11.70%	24 20%	31 25.80%	43 35.80%
Do you think that the use of ICTs limits critical thinking?	38 31.70%	26 21.70%	27 22.50%	16 13.30%	13 10.80%
Do you think that the use of ICTs has a positive psychological influence?	10 8.40%	12 10%	39 32.50%	27 22.50%	32 26.60%
Do you think that the use of ICTs has a negative influence on your education?	74 61.70%	16 13.30%	19 15.80%	8 6.70%	3 2.50%
Do you think that the use of ICTs increases your cooperation with others?	16 13.30%	10 8.40%	39 32.50%	28 23.30%	27 22.50%

The questionnaire also explored the student's opinion regarding the use of the teaching software in their classrooms as shown in Figure 15. The most commonly used teaching software was "Photodentro", 50% (f=60). The most significant and well formulated part of the Greek national infrastructure for digital educational content is the "Photodentro" provides easy access to students, teachers and parents. All resources of "Photodentro" are available for free to everyone and its repositories support browsing, free text search and faceted search, allowing users to narrow search results by applying multiple filters (Megalou & Kaklamanis, 2018

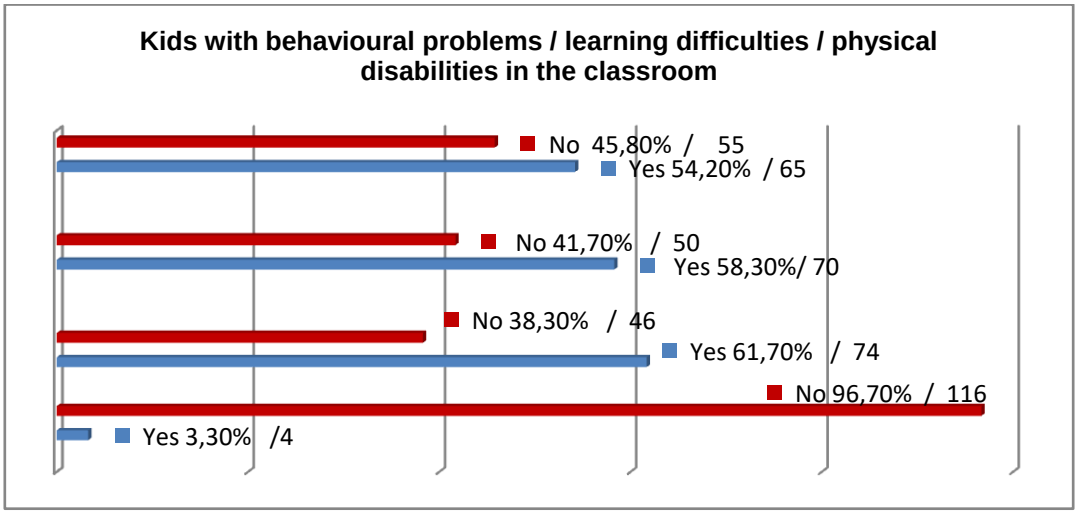
Students were also asked to describe the web application that they used in their classrooms. The results of the study revealed that they mostly with the percentage of 34% (f= 41) used "YouTube" as a web application.

Figure 15
Which teaching software do you use in your classroom?



Also, in the last part of the questionnaire was followed by questions of behavioural importance concerning the learning difficulties of the students of a class combined with the ICT integration. According to the results of the research, as shown in Figure 16, 58.3% (f= 70) of students had co-students with behavioural problems in their classroom, 61.7% (f= 74) had co-students with learning difficulties and only 3.3% (f= 4) had co-students with physical disabilities in the classroom.

Figure 16
Kids with behavioural problems / learning difficulties / physical disabilities in the classroom



As shown in Table 14, the majority of the students (41.5%, f= 50) stated that the use of software for children with special needs mildly increase the confidence and 37.9% (f= 45) believed that moderately increase the focus of students. Meanwhile, 30.3% (f= 36) of students answered that the use of software for children with special needs moderately limit the hyperactivity and at the same time, 51.5% (f= 62) believed that moderately increase the eagerness for participating in the course.

Table 14
How much does the use of software for children with special needs increase their abilities?

ITEMS	None	Very mild	Mild	Moderate	Severe
How much does the confidence of students increased by the use of software for children with special needs?	7 6,10%	18 15,40%	50 41,50%	13 10,80%	32 26,20%
How much does the focus of students improved by the use of software for children with special needs?	2 1,50%	9 7,60%	38 31,80%	45 37,90%	26 21,20%
How much is their hyperactivity limited by the use of software for children with special needs?	15 12,10%	15 12,10%	34 28,80%	36 30,30%	20 16,70%
How much does their eagerness for participating in the course increased by the use of software for children with special needs?	4 3%	7 6,10%	29 24,20%	62 51,50%	18 15,20%

In Figure 17 is highlighted that the majority of the students (36 %, f= 43) thought that the use of ICTs can be moderately developed their social skills, while 25.0% (f= 30) stated that their social skills could be increasingly developed. On the other hand, only 15.0% (f= 18) of students, responded that there is an absence of relationship between the use of ICTs in their classrooms and the development of social skills through the use of them.

Also, as shown in Figure 18 with regard to the question “How empowering is the use of ICTs in teaching?”, the majority of the students answered positively with the significant percent of 59% (f=56, adding data about severe=27 plus moderate=29) answered that the use of ICTs is empowering in teaching and 3% (f= 3) of students stated that is not empowering at all.

Figure 17
Do you think that through the use of ICTs, social skills can be developed?

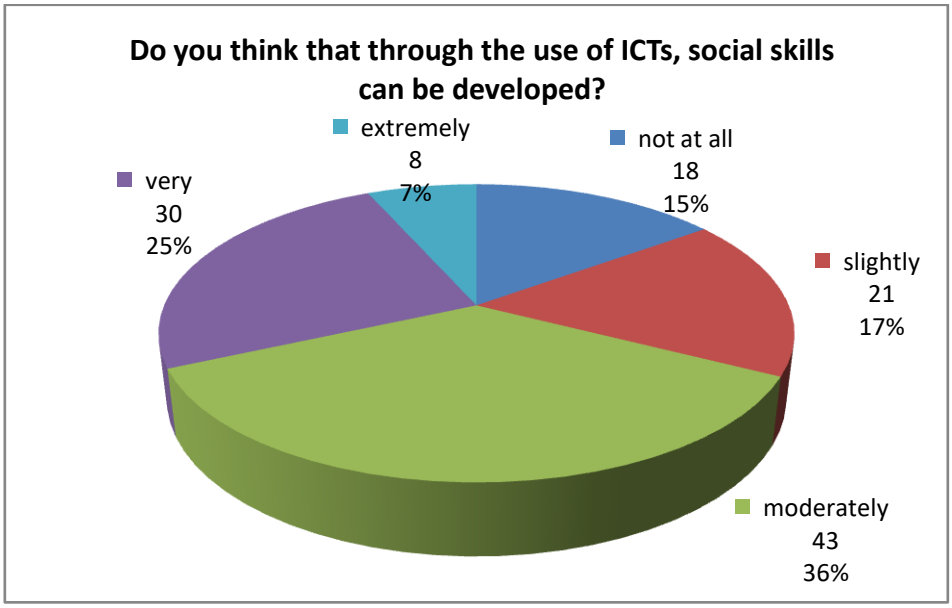
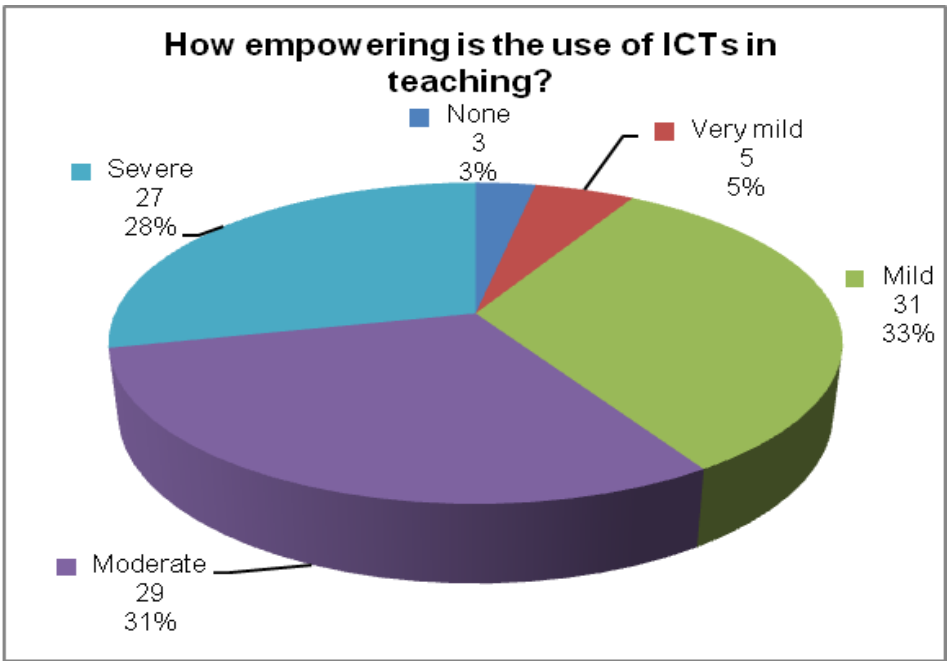


Figure 18
How empowering is the use of ICTs in teaching?



6.2. Correlations from students' questionnaire

This chapter examines the correlations from students' questionnaire that according to the correlation run check, have arised. Also, this part gives the opportunity to the research to examine how the evaluation of digital competences can have a positive phycological influence to the ICT use and how the ICT use gives a motivation for

students, which is also answering the research question “if it is possible through the evaluation of digital competences to have a motive in the use of them by students?”, exploring in this way the relationship of the added questions in our instrument with areas that concern more esoterically impact in the use of ICT and the evaluation of them. Motivation in the use of ICT is becoming very crucial (Hernandez et al., 2011; Perugini & Solano, 2020; Van den Beemt et al., 2011; Wang et al., 2011). There are also studies that consider the evaluation of digital competences from gender perspective (Casillas et al., 2017; Grande-de-Prado et al., 2020) so, this study another fundamental contribution is to explore the correlation between age and the use of email to contact with teachers and at last, the age and the grade of eagerness for participating in the course by the use of software for children with special needs

The questions “Does the use of ICTs provides motivation for learning?” and “Do you think that the use of ICTs has a positive psychological influence?” were weak positively correlated, rho(120)= 0.265, p=.003, indicating that students who had strong motivation, they had simultaneously a very positive psychological influence by the use of ICTs.

Also, there was a weak negative correlation, rho(120)= - 0.243, p=.008, between “Does the use of ICTs provides motivation for learning?” and “Do you think that the use of ICTs has a negative influence on your education?”, indicating that students who had high level of motivation by the use of ICTs, they had not a negative influence on their education.

Additionally, the high level of motivation for learning by the use of ICTs was weak positive correlated with the cooperation with other students by the use of ICTs, rho(120)= 0.207, p=.023.

Moreover, the analysis of the research results highlighted a moderate negative correlation between the positive psychological influence by the use of ICTs and the negative influence on students’ education by the use of ICTs, rho(120)= - 0.350, p=.0001 and a moderate positive correlation between the positive psychological influence by the use of ICTs and the cooperation with other students by the use of ICTs, rho(120)= 0.365, p=.0001 indicating that the use of ICTs enhanced the psychology of students and at the same time it was increased the cooperation between them.

A Kruskal-Wallis H test, as depicted in Table 15, showed that there was a statistically significant difference in students’ attitudes regarding the negative influence on their education by the use of ICTs between the students’ age, X2(5) = 13.865, p = .016, with a mean rank score of 50.36 for 7 years old, 77.79 for 8 years old, 57.78 for 9 years old, 70.06 for 10 years old, 44.08 for 11 years old and 67.61 for 12 years old. The older students got, the more they believed that the use of ICTs has a negative influence on their education.

Table 15

Kruskal-Wallis H-Test results regarding Differences in Students' Age and the negative influence on students' education by the use of ICTs

		variables	N	average	X^2	df	p
How much is their hyperactivity limited by the use of software for children with special needs ?	*Age*	7 years old	7	50.36	13.865	5	.016
		8 years old	14	77.79			
		9 years old	48	57.78			
		10 years old	18	70.06			
		11 years old	19	44.08			
		12 years old	14	67.61			

Results in Table 16, showed that there was a statistically significant difference in students' eagerness for participating in the course by the use of software for children with special needs between the students' age, X2(5) = 21.125, p = .001, with a mean rank score of 77.50 for 7 years old, 30.11 for 8 years old, 68.72 for 9 years old, 46.61 for 10 years old, 66.29 for 11 years old and 64.21 for 12 years old.

Table 16

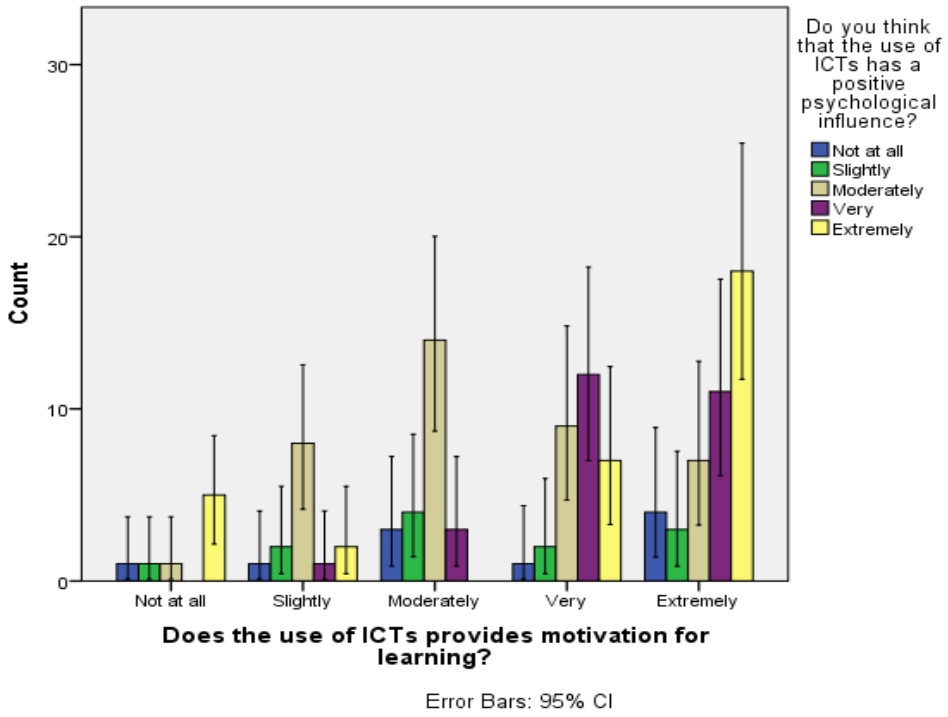
Kruskal-Wallis H-Test regarding Differences in Students' Age and the grade of eagerness for participating in the course by the use of software for children with special needs

		variables	N	average	X2	df	p
How much does their eagerness for participating in the course increased by the use of software for children with special needs?	*Age*	7 years old	7	77.50	21.125	5	.001
		8 years old	14	30.11			
		9 years old	48	68.72			
		10 years old	18	46.61			
		11 years old	19	66.29			
		12 years old	14	64.21			

Also, the chi-square independence test showed that ICT motivation differed significantly between different levels of ICT psychological influence X^2 (16, N=120) =39.100, p< .001., which means that student who believed that the use of ICTs provides extreme motivation for learning, they also stated a positive psychological influence by the use of ICTs in learning as shown in Figure 19.

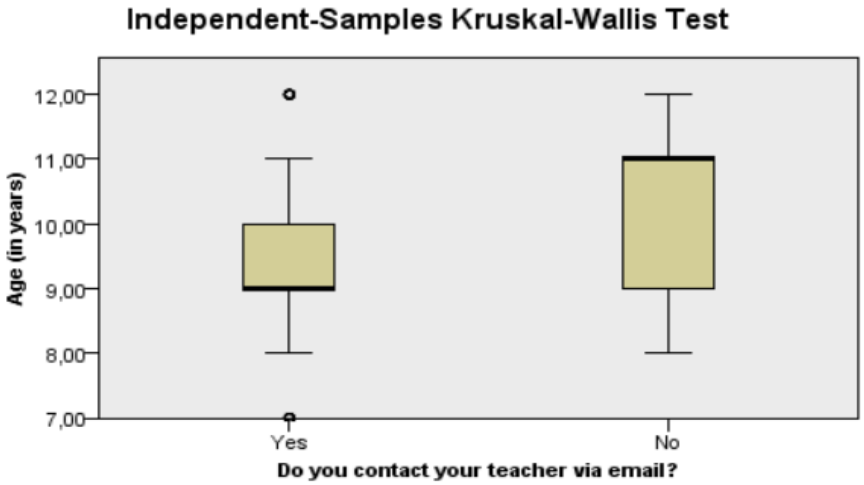
Figure 19

Does the use of ICTs provides motivation for learning? / Do you think that the use of ICTs has a positive psychological influence?



Kruskal-Wallis Test was conducted to examine the differences in ages of students according to the use of email to contact with teachers. Statistically significant differences (Chi-square= 7.069, p = .008, df = 1) were found among the use/not use of email to contact with teachers, with a mean rank of ages equals to 9 years old for students that use email and 11 years old for students that not use email On the other hand, no significant differences (Chi-square= 6.952, p = .138, df = 4) were found between the use of technologies in the classroom and age. The results are presented in Figure 20 below.

Figure 20
Do you contact your teacher via email? / age



In the next chapter are presented the results from teachers' questionnaire.

6.3. Results from teachers' questionnaire

This section presents the pertinence between the six dimensions of DigCompOrg and analysis of results from teachers' questionnaire in order to answer the second research objective; we proceed then to the analysis of the results of each one area indicating the most significant results.

6.3.1. School leadership

According to teachers perception the area "school leadership" of DigCompOrg has obtained a high score with an average of 3.24. Within this, the following Figures present very interesting results in the specific area.

Figure 21 shows the 38% (f=14, adding data about strongly agree=4 plus agree=10) of teachers of the specific primary school and their try to support the school leadership.

Figure 21

Do you use digital systems from the Ministry of Education whose aim is the administrative and management support of the schools of the Greek territory?

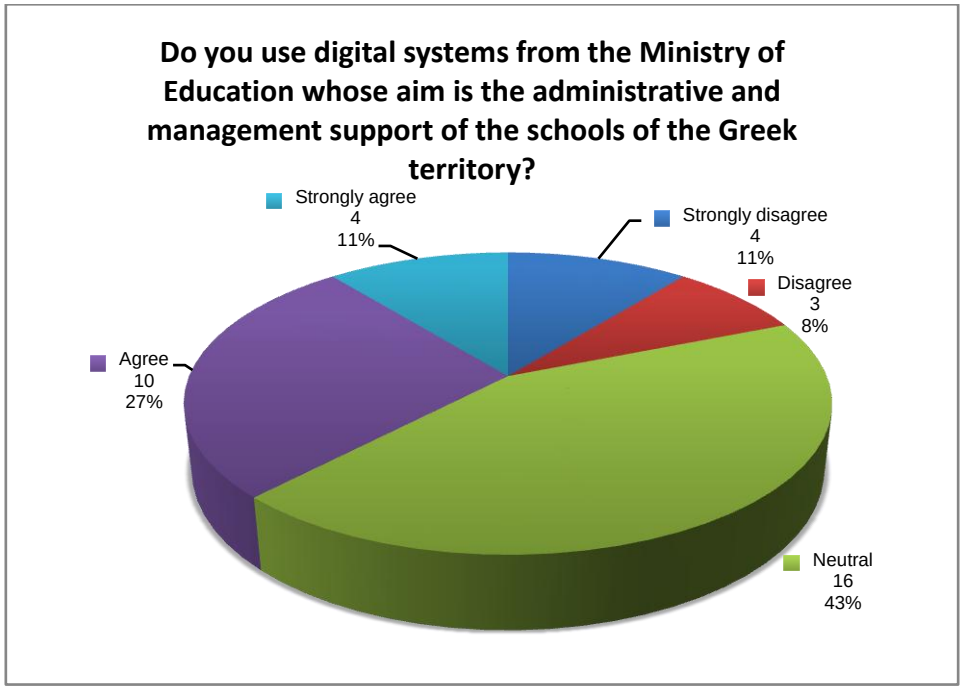
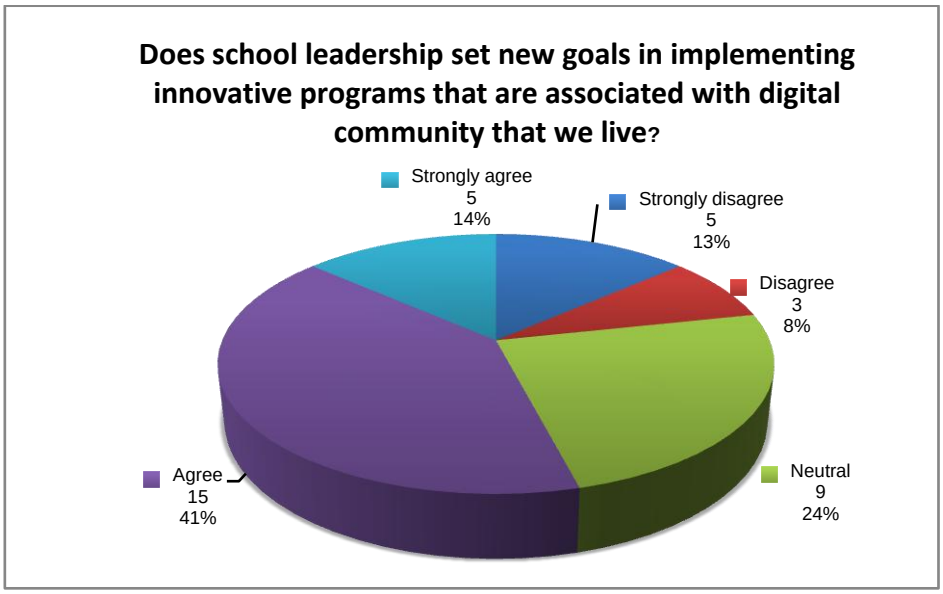


Figure 22

Does school leadership set new goals in implementing innovative programs that are associated with digital community that we live?



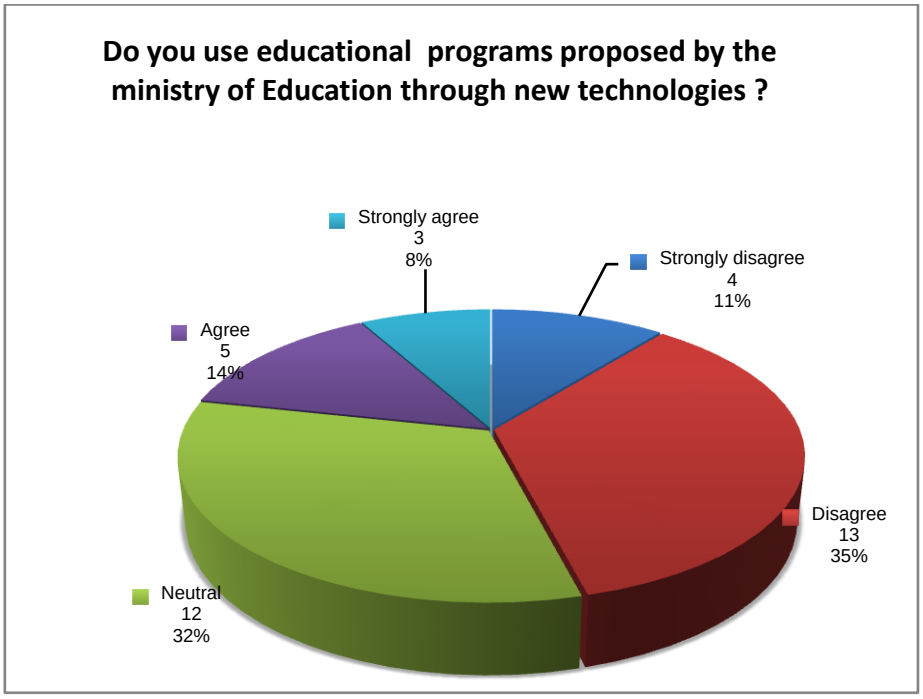
Teachers were also asked to define the grade of support the opinion that school leader sets new goals in implementing innovative programs that are associated with the digital community that we live. The results revealed that the majority of the teachers with the significant percent of 55% (f=20, adding data about strongly agree=5 plus agree=15) had a positive review about this fact as indicated in Figure 22.

6.3.2. Infrastructure and equipment

In the questions that concerns the area “infrastructure and equipment” the research came along with very interesting results. In Figure 23 is shown the high average of the teachers that do not use digital systems. This is also confirmed with the low score medium average of 2.29 in the specific area. The 46 % (f=17) of the teaching staff have shown a tendency in negativity of use digital educational programs.

Figure 23

Do you use educational programs proposed by the ministry of Education through new technologies?



6.3.3. Continuous Professional Development

Continuous Professional Development area comes with the average score of 3.31. As shown in Figure 24, the majority of teachers have a negative view of school leadership and its concern about the academic development of them. The results revealed that negativity with the significant percent of 46% (f=17, adding data about strongly disagree=7 plus disagree=10.

Figure 24

Is school leadership concerned about the academic development of the teachers and pushes for that?

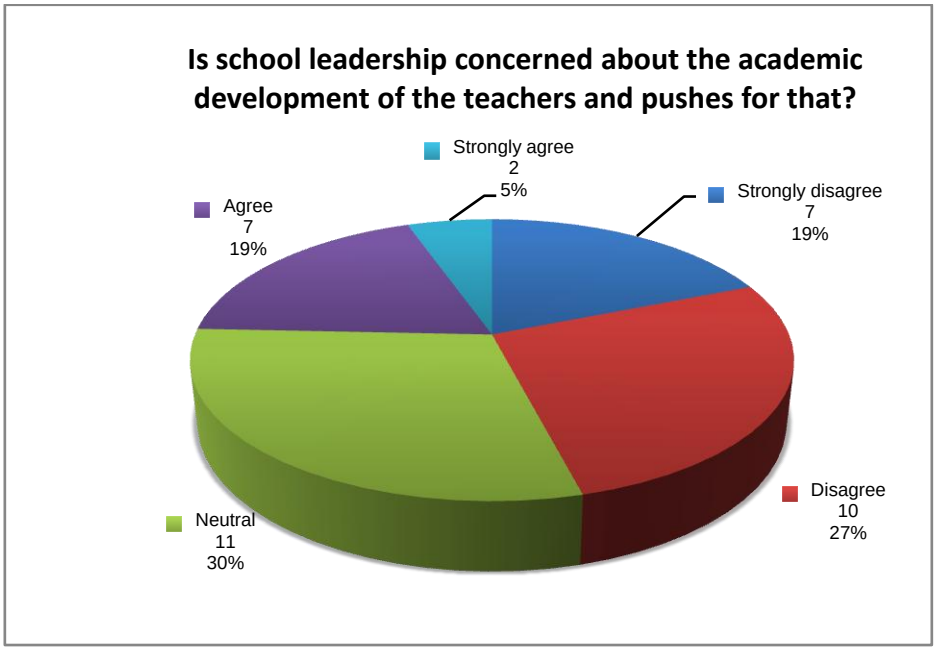
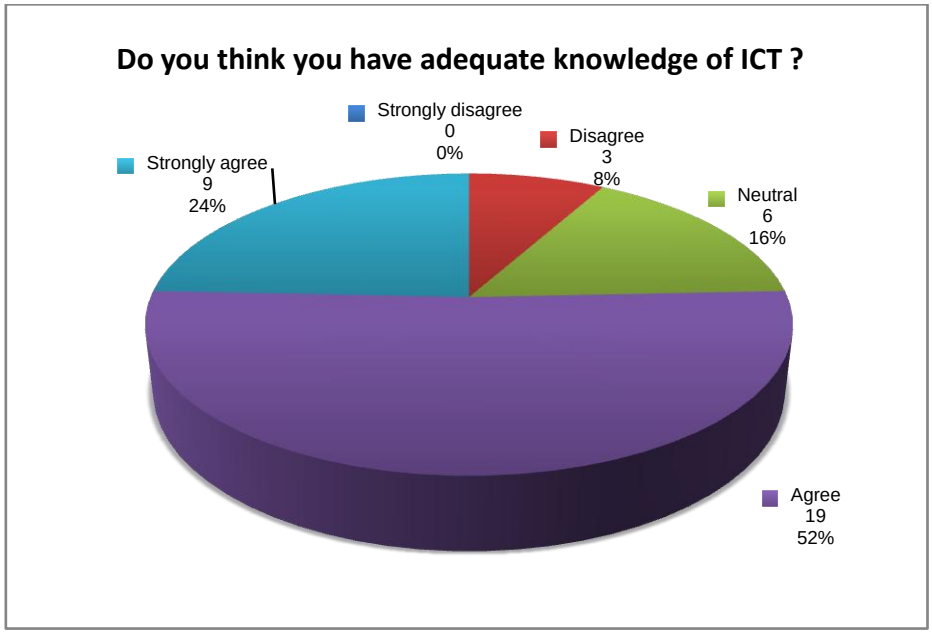


Figure 25

Do you think you have adequate knowledge of ICT?



Interesting are also the results from the question that concern teachers personal belief about their digital capability and assessment practices that concern their own way of fulfilling this non mandatory tasks, the capability of Greek educational system to support the use of ICTs educational programs . In the question “Do you think you have adequate knowledge of ICTs (Information Technology and Communication)?” teachers were asked to indicate on a five-point scale ranging from Not at all familiar (1) to extremely familiar (5) their evaluation on the level of knowledge of ICTs. As

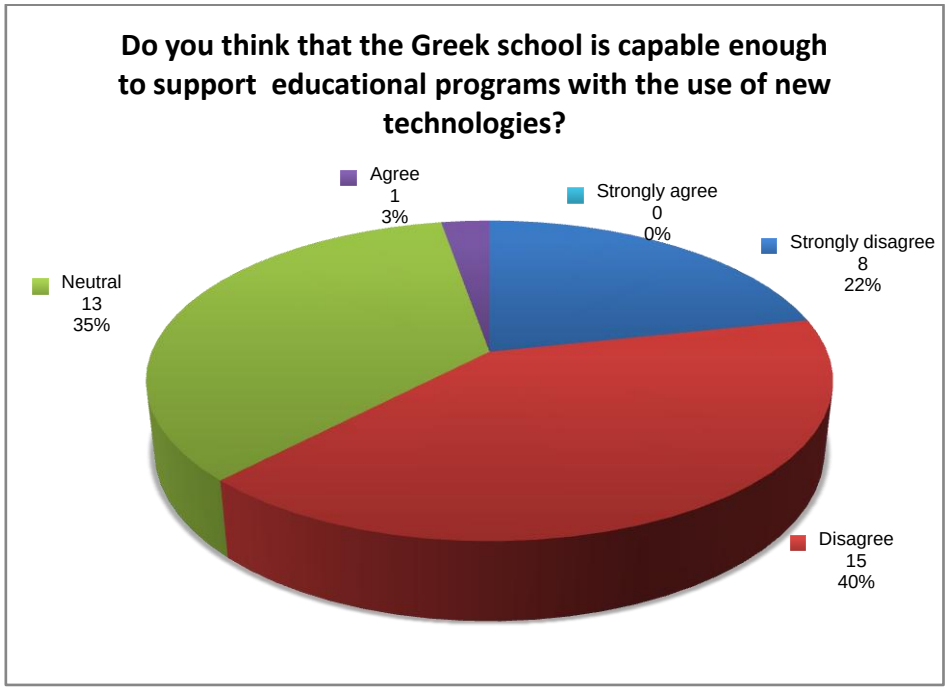
shown in Figure 25, the majority of the teachers (52 % f=19) evaluated themselves as familiar, one fourth (24 % f=9) stated that they are extremely familiar, while only 8% (f=3) of the teachers believed that their level is slightly familiar.

6.3.4 Teaching and Learning

The area of "Teaching and Learning" was valued with a low score of 2.28 from teachers. Despite of that, gave to the research a very interesting result regarding the question shown in Figure 26 about the self perception of teachers that refers to the capability of Greek school to support the educational programs through the use of ICT. The vast majority with the 62 % (f=23, adding data about strongly disagree=8 plus disagree=15) of teachers asked, had a negative perception for the ability of the specific Greek school to support the integration of educational programs that concern the use of ICT. Figure 26 is indicative of the results.

Figure 26

Do you think that the Greek school is capable enough to support the use of educational programs with the use of new technologies?



Adding to the above, research has shown that the majority of teachers with the 46% believe that the students' parents are capable of sustaining a digital communication (f=17, adding data about strongly agree=11 plus agree=6). Only 11% (f=4) of the teachers believed totally the opposite, as shown in Figure 27.

Figure 27

Do you consider your students' parents capable of sustaining a digital communication?

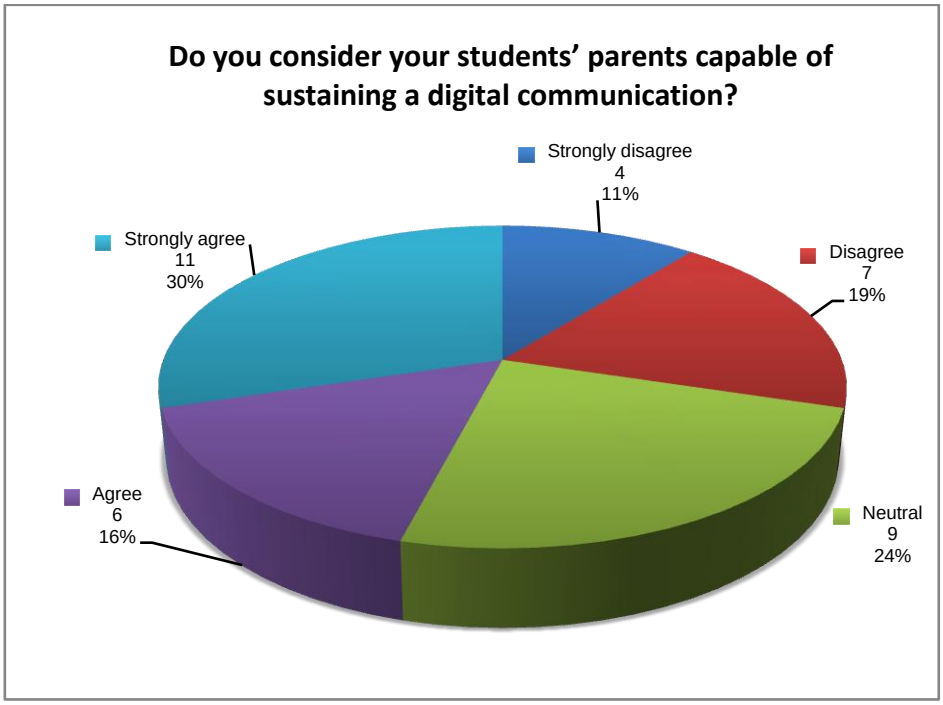
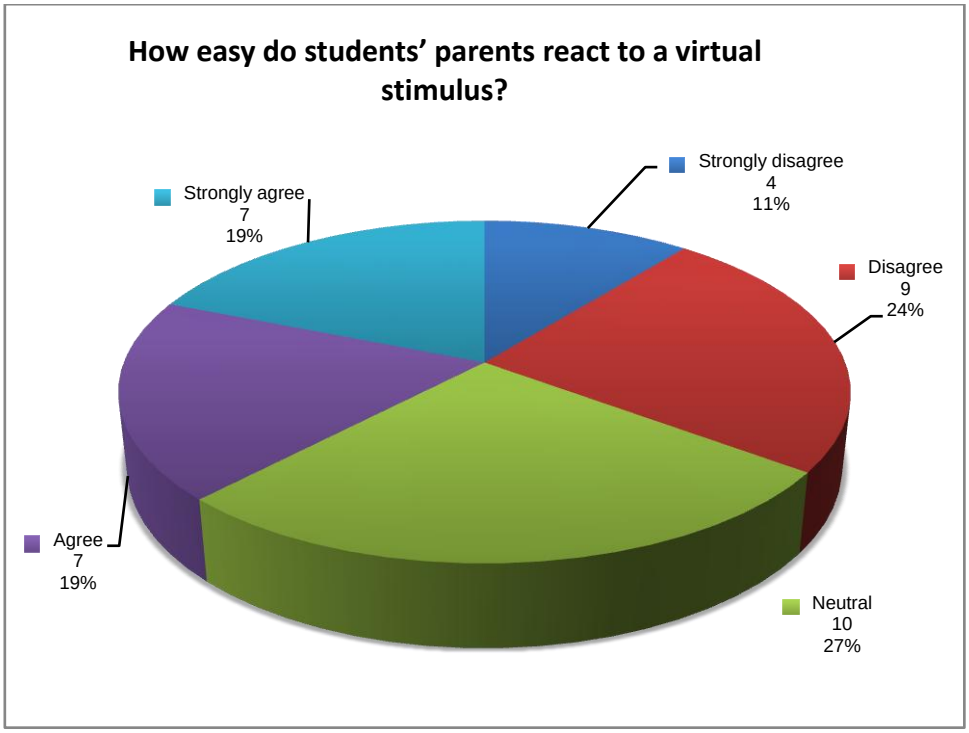


Figure 28

How easy do students' parents react to a virtual stimulus?



As depicted in Figure 28, the students' parents largely reacted to virtual stimulus. In particular, 38% (f=14, adding data about strongly agree=7 plus agree=7) of the teachers believed that their students' parents extremely reacted to virtual stimulus.It can be concluded that students' parents are ready enough to support the digital

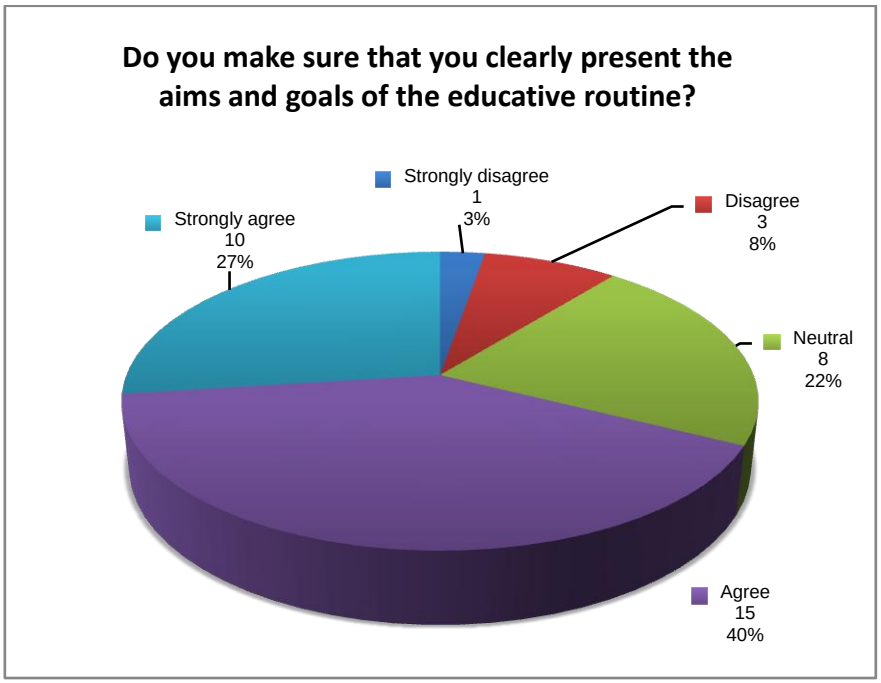
integration in a more depth way and they see themselves quite competent in digital contents.

As we conclude from teachers' dimension parents are very willing to the integration of a new digital age and we observe a growing acceptance of digital methods in school reality. Simple applications allow an easy communication between parents and educators that concern school activities or maybe activities of students assess. Those, can tighter the strength's between parents and school community.

6.3.5 Assessment Practices

Figure 29

Do you make sure that you clearly present the aims and goals of the educative routine?



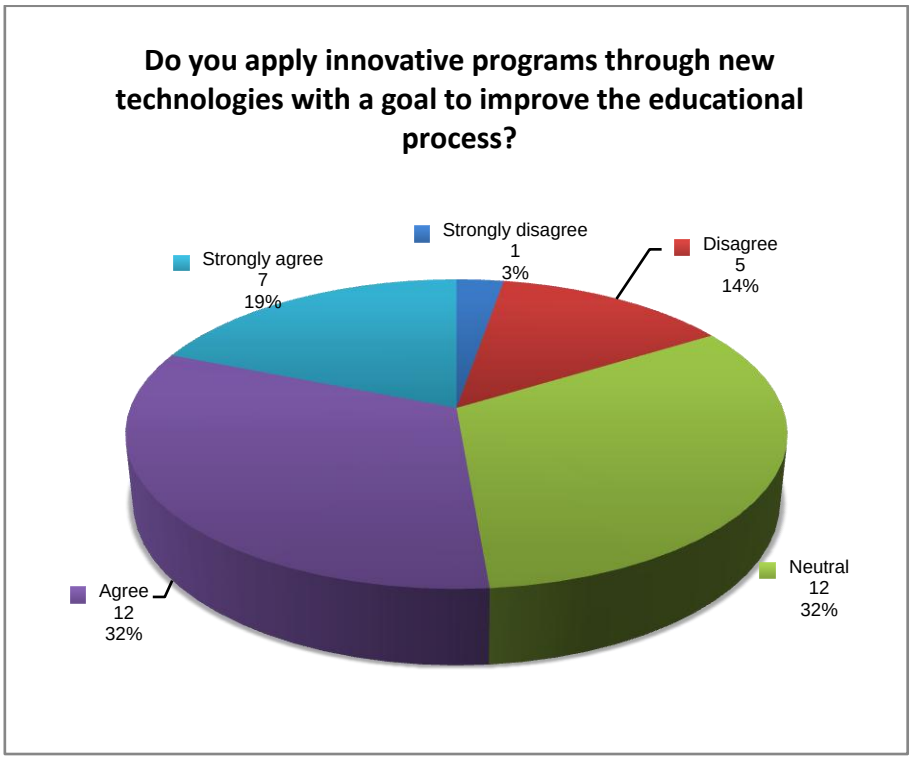
The area with the highest score was "Assessment Practices" with the best average valued score at 3.41. At the same time, in the question "Do you make sure that you clearly present the aims and goals of the educative routine?" (Figure 29), the results revealed that the majority of the teachers 67% (f=25, adding data about strongly agree=10 plus agree=15) often clearly presented the aims and goals of their educative routine, indicating that teachers had principles and almost always reported what they have done.

At the same time, the majority of teachers responding to 51% (f=19, adding data about strongly agree=7 plus agree=12) confirmed that they applied innovative programs through digital technologies in order to improve the educational process as shown in Figure 30 and only 17% do not apply innovative programs (f=6, adding data about strongly disagree=1 plus disagree=5). Concluding that it is a good value

for so many teachers responding positively and make the effort for the presentation of the aims and goals in the educative routine.

Figure 30

Do you apply innovative programs through new technologies with a goal to improve the educational process?



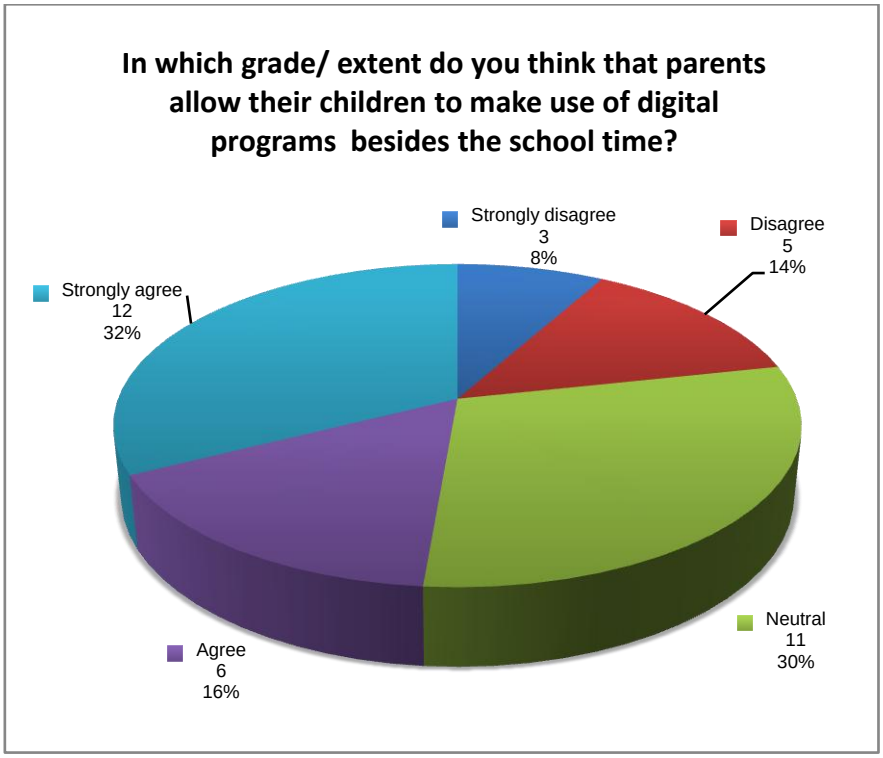
6.3.6.Students digital competence

The area "Students digital competence" was average valued with 3.20. Teachers were also asked to define the grade / extend that parents allow their children to make use of digital programs. The results revealed according to teachers' opinion that the majority of the students' parents with the percentage of 48% (f=18, adding data about strongly agree=12 plus agree=6) support and allow their children to make use of digital programs besides the school time. This result shown in Figure 31, reinforce that the students' parents and their children had a digital stimulus.

As it is referred before, the research was completed in June 2020 after the short and early covid-19 pandemic which means that students and parents had contact with distance education only two months. The results from percentages that concern teachers self perception of ICT use ICT in lessons, teachers' digital competence, digital content use, pedagogical evaluation, digital communication with parents and digital support of school leadership indicated that ICT integration significant changes still occur in the specific primary school ICT culture and most of its components. Above there is a proposal of the DDDM model based on the analysis from teachers questionnaire for school improvement.

Figure 31

In which grade / extend do you think that parents allow their children to make use of digital programs besides the school time?



6.4. Correlations from teachers questionnaire

This chapter examines the correlations from teachers' questionnaire that according to the correlation run check, have arised. Also, this part gives the opportunity to the research to examine the meaning point of the research questions that consider *the design of evaluation model based on DDDM and DigCompOrg at the same time* and if *the combination of both is a good way to evaluate the schools*, moreover the research objectives that are referred to the scores from teachers' dimension based on DigCompOrg areas in relation to a DDDM model, the rest of areas of DigCompOrg that affect the area "Assessment Practices" in order to have evaluation and also, teachers perception of digital competence that affects the use of ICT in their teaching.. So according to the above, the correlations are analysed below based on findings.

Mean scores and standard deviations of each DigCompOrg area are shown in Table 17. Area "Assessment practices" was rated with the highest mean score of 3.41 and "Teaching and Learning" area with the lowest mean score of 2.28.

Table 17
Means and standard deviations on the DigCompOrg model areas.

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

As shown in Table 18, Pearson's r parameter criterion was used to explore relations between "Assessment Practices" index and the other indexes of DigCompOrg model. "Assessment Practices" index is not related to the "Assessment Practices " r(37)=.279,p=.095. Only the "Teaching and Learning" index r(37)=.500,p=.002 is related to the " Assessment Practices ", but with a moderate correlation. Also, the "Continuing Professional Development" index r(37)=.383,p=.019, the "Infrastructure and Equipment" index r(37)=.410,p=.012, and the "Student Digital Competence" index r(37)=.367,p=.025 are related to the "Assessment Practices" index, with a low correlation.

Table 18
Correlations between "Assessment Practices" index and the other indexes of DigCompOrg model.

Degree of	Sig (2-tailed)	Correlation coefficient	Degree of correlation
Continuing Professional Development	.019*	.383	Low
Infrastructure and Equipment	.012*	.410	Low
Student Digital Competence	.025*	.367	Low
Teaching and Learning	.002**	.500	Moderate
Leadership	.095	.279	Not significant

Note: N=37, *p< .05, **p< .01, Degree of correlation : <= [+- 0.29] Non-existent correlation , [+-0.30] – [+-0.49] Low correlation , [+-0.50] – [+-0.69] Moderate correlation , [+-0.70] – [+-0.79] High correlation , [+-0.80] – [+-0.99] Very high correlation

The following diagrams show the control of linear relationship between the dimensions of the DigCompOrg model. From the scatterplots it is clear that there is no evidence of a non-linear relationship or significantly divergent values.

Figure 32

Correlation between assessment practices and continuing professional development.

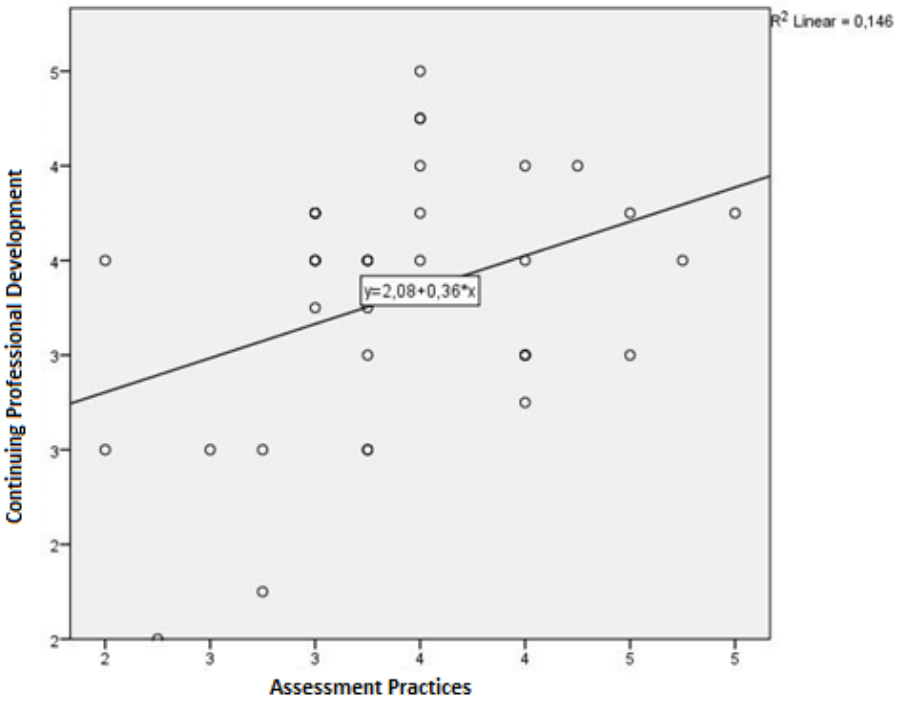


Figure 33

Correlation between assessment practices and infrastructure and equipment.

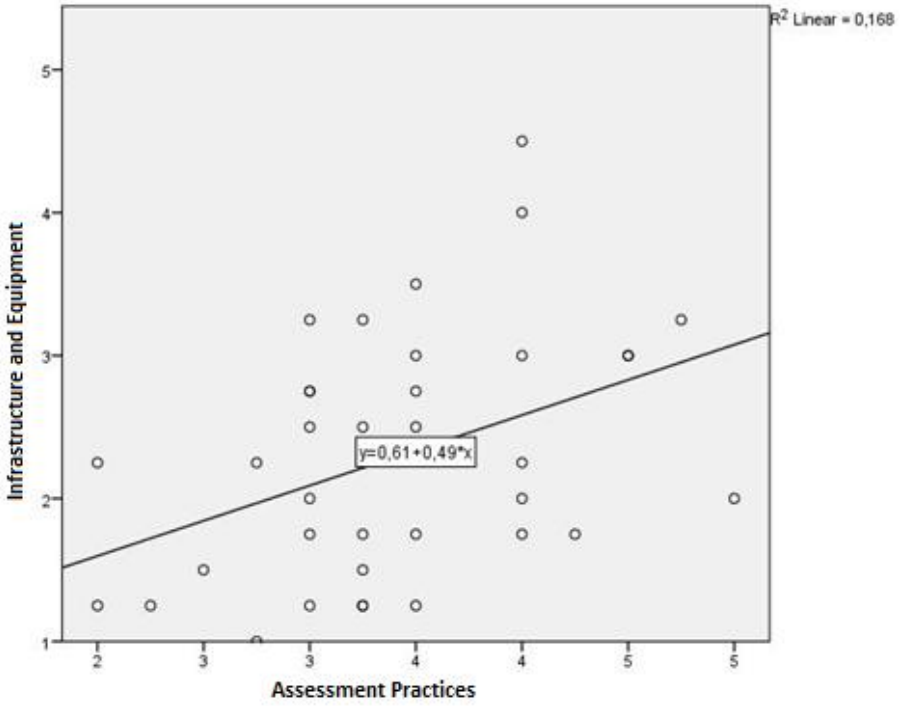


Figure 34

Correlation between assessment practices and student digital competence.

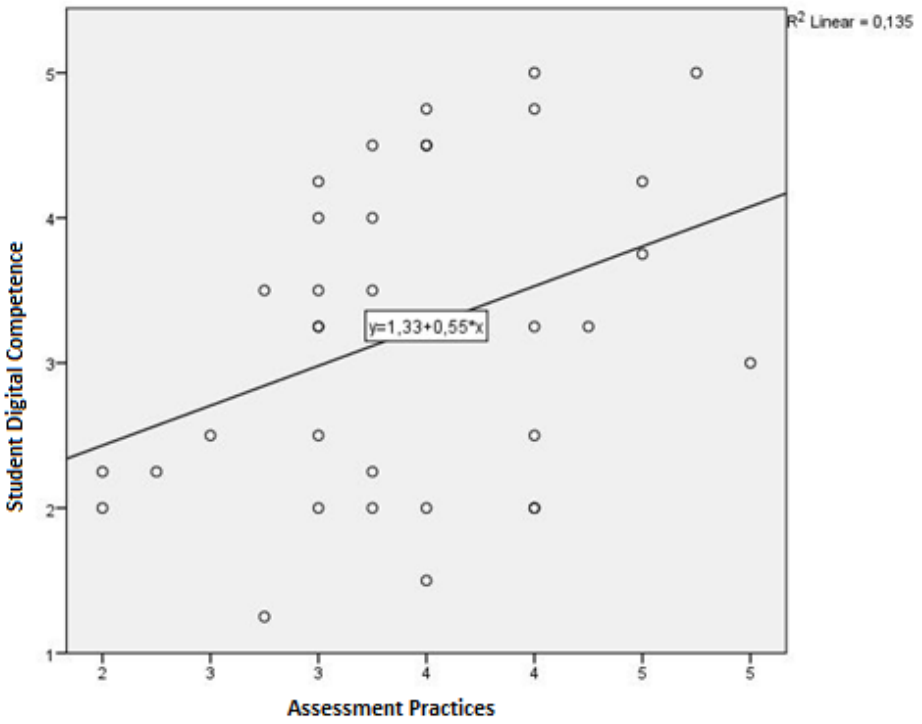


Figure 35

Correlation between assessment practices and Teaching and Learning.

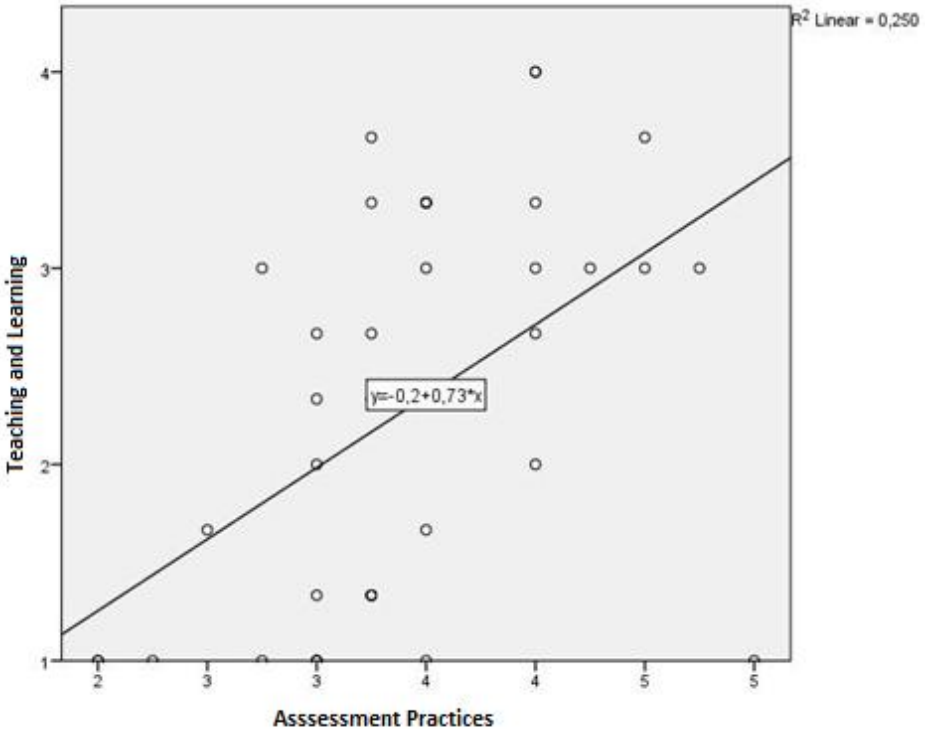
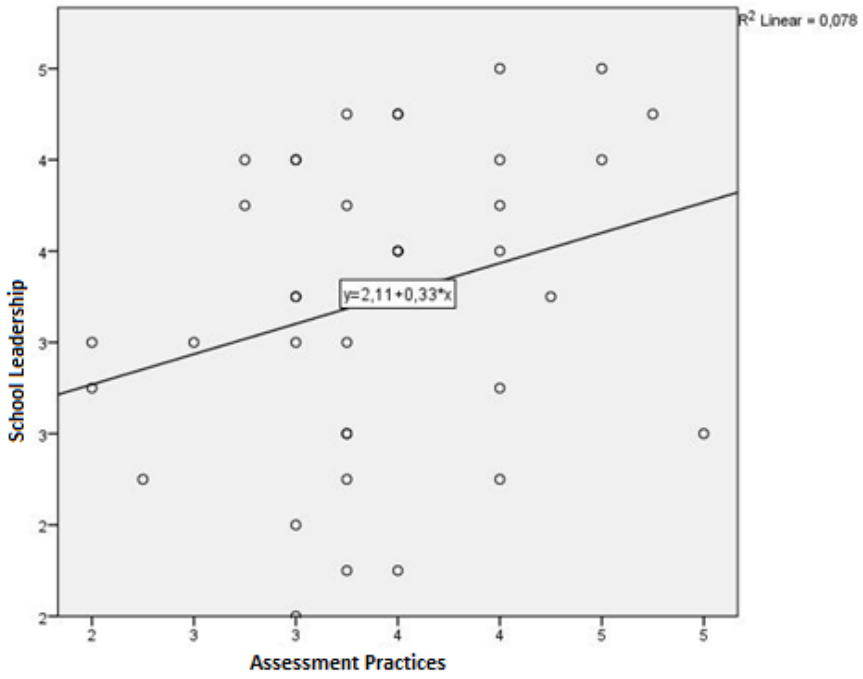


Figure 36

Correlation between assessment practices and school leadership.



Finally, as shown in Table 19, the regression analysis (method [enter]) was used to check the predictability of the "Assessment practices" indicator from the other "forecast" indicators. The multi-relevance index is equal to 0,527 and the adjusted R2 equal to 0,278, which indicates that approximately 30% of the dispersion of index values "Assessment practices" can be interpreted by the effect of the individual 2 indicators. The linear regression estimated is statistically significant, F(17,919)= 6,533, p=.004.

From the review of the regression coefficients, we find that the two independent variables of the DigCompOrg model contribute significantly to the DDDM model and the prediction of the "Assessment practices".

- Index "Infrastructure and equipment": **β=0,375, t= 3,068, p=004**

When the value of the ""Infrastructure and equipment" index increases by 1 point and the " School Leadership" index remains stable, then the "Assessment Practices" index is expected to increase by 0.375 points.

- Index " School Leadership": **β= 0,280, t=0,334, p=0,29**

Table 19

Regression analysis DigCompOrg model

Coefficient	B	t	Sig (2-tailed)
Infrastructure and equipment	.375	3.068	.004
School Leadership	.280	2.274	.029
p<.05			

When the value of the "School Leadership" index increases by 1 point and the "Infrastructure and equipment" index remains stable, then the "Assessment practices" index is expected to increase by 0.280 points.

6.5. Creation of the DDDM model based on the analysis from teachers questionnaire

In order to create and start the proposal for a DDDM plan that considers school improvement taking in account teachers' data through their questionnaire, the necessary steps had to be carefully explained by this thesis dissertation.

There are many types of DDDM models that can be used for creating a plan for an organization (Castellani & Carran, 2009; Mandinach & Honey, 2008; Marsh, 2012; Marsh et al., 2006; Schildkamp & Poortman, 2015). Each model can be adapted, in order to enhance the needs of a school organization. In the meaning of the above, this study proposes a DDDM plan for school improvement. All of the models are cyclical as like this study proposes, because of the changing nature of data (Castellani & Carran, 2009; Schildkamp, 2019) (see Figure 4).

The author of the plan highlights the importance of sources to effectively extract the data to answer the research questions developed and that resource, for the specific research, is teachers' questionnaire. According to the literature review, data could be gathered in many ways such as assessment results, surveys and systematic classroom observations (Coburn & Turner, 2011; Dunn et al., 2013; Ikemoto, & Marsh, 2007; Mandinach, 2012). Here it is chosen a formal way of data retrievement which is the distributed questionnaire.

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 et al., 2017, 2019). In conclusion, this thesis supports the below steps in order to have a DDDM plan for school improvement. These are:

1) Setting a vision
2) Choose the appropriate data resource
3) Collect the data
4) Analyse and evaluate the results.

According to the extracted data from teachers' questionnaire, the most important area that involves evaluation is "Assessment practices" as most high rated. So, the vision that has been set in this school is around the main problematic of this thesis dissertation: to investigate the digital competence of a primary school in Greece related to the DigCompOrg areas and to propose a data driven decision making plan for school improvement based to the extracted data from teachers. Second, choosing the appropriate data resource, which is teachers' questionnaire, is explicitly analysed in the next section according to the statements of laws in Greece. Third step includes the creation of the questionnaires based on the areas of

DigCompOrg. In the last step, the statistical analysis with SPSS package was made but the implementation of the action plan could be considered as a meta-analysis of this thesis and a proposal for a future research.

Also, based on the correlations from teachers questionnaire, is going to be answered the second and third objective of our research which is “to analyse how the variables of this model DigCompOrg affect each other from teachers dimension, in order to have self-evaluation and school improvement” and to “design a decision making plan based on a DDDM model and the results obtained by this research” the statistical analysis shows the mean scores and standard deviations of each dimension in Table 17. “Assessment practices” was rated with the highest mean score of 3.41 and the “Teaching and Learning” with the lowest mean score of 2.28.
As it is concluded from Table 17 and the highest rated mean score, the matter of assessment/evaluation is in great importance according to the self perception of the teachers of this specific school. That is the reason why all the other dimensions are studied carefully in order to explore relations between "Assessment Practices” index and the other indexes of the model, as the correlations have shown.

6.6. An action plan proposal based on a DDDM model

After the initial analysis and detection of needs, a model of improvement actions based on DDDM has been proposed. These actions have been graduated in four phases according to the previous analysis of DDDM section and are addressed in order to carry out a review and adjustment in the future that contribute to the digitalization process of the centre, thus responding to the third objective of the research and taking into account the dimensions of the DigCompOrg model. This type of study was very convenient for their implications on practice and its way on improvement of the educational reality (Salinas, 2012) because it provides us with valuable information that allows us to establish actions in order to improve the process of digitization that is taking place in each school.

These actions are based on the vision of the factors (Shildkamp, 2017) that are involved in school reality and the school as an organization. Fundamental, consists 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 digitals skills of educators and students (Fernández & Prendes, 2021) by recognising that school improvement in Greek reality can finally be done if it is supported by technology. In this way, the results can open new lines of research that are oriented to the development of constant evaluation for the own feasibility of the educational organism.

Before we come to the proposal of an action plan based on a DDDM cyclical model, it is very crucial to understand the law of Greece that considers the internal organising of the school year and thus we have a better understanding why the students cannot participate in the planning and implementation processes of a project that is going to be presented below. So, according to the new law

4189/B/09-10-21 of Greek Ministry of Education that considers internal coordination procedures and self-evaluation of schools the general responsibility of the procedures has the director/school leader of the school and all the teaching staff. So, there is a cooperation between them in every year coordination and planning. Students are not involved at all. Especially it refers that "It concerns the annual collective planning of the educational work of the school, which includes setting training goals and designing corresponding collective actions to prevent, monitor and address any problems, in order to improve the quality of its teacher project. The teaching staff sets goals and forms groups of teachers who prepare action plans for the implementation of these goals. The annual collective planning of the educational project is registered by each school" (Circulars 4189/B/09-10-21).

Based on the most significant scores obtained from the first stage of data retrieve, as shown in Table 17 analysis, a table corresponds to an action level, manager (the Greek school has only one) and teachers directly involved in. A Figure (37) analysis based on the cyclical models that the international bibliography proposes is made by the writer of this thesis. Above, in Table 20 there is an analysis of every face and stage according to the data that are observed.

Figure 37
An action plan based on a DDDM model

Table 20
Analysis of the phases of the DDDM model

Phases of the DDDM model	Improvement actions	Based on the score of teachers' dimension
Phase 1	Creation of a common digital strategic plan based on school improvement-Setting a vision. Proposal: teaching staff could suggest for targets: a) Implementation in the curriculum activities as a lesson that concern augment reality. b) promoting the digital integration of special education programs by the Ministry of Education g) promotion of digital programs concerning the learning of the Greek language by the refugees that Greece has absorbed d) Integration of digital programs in the daily life of the school in everything that concerns the contact to the local community and the communication of the school with the external bodies. e) Internal training of school teachers in the integration of the digital programs.	"Teaching and Learning" that has the lowest score 2.28 and "Continuous Professional Development" with a great score at 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" 3.20
Phase 3	Implementation of the created questionnaire which will be flexible and tailored to the needs of the particular school and evaluation of the extracted data with spss tool, based on the setted vision.	"Assessment Practices" with the highest score 3.41.
Phase 4	Self reflection: The school manager as a leader with the cooperation of teachers should set a discussion and externalization of the exported data to students and their parents or the local community in order to implement a new improvement plan for the next academic year. Adapt learning processes to needs individual students and discussion about the use of technology would be a creative way to externalize the needs of school improvement to the directly interested.	"Student Digital Competence" with the lowest score at 2.28 and "School Leadership" 3.24.

In conclusion we would highlight how much internal planning with the integration of digital competence in the internal regulations of the school is as important as strategic action. Taking a DDDM model and setting the goals that we ourselves want to externalize within as a school, we have a database that helps us act much 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 of Greek reality.

Using the areas of DigCompOrg and the correlations that have emerged through the data check from "Assessment Practices" index and the other indexes of DigCompOrg model, it is observed that only the "Teaching and Learning" index is linked to the " Assessment Practices", but with a moderate relation. Also, the "Continuing Professional Development", the "Infrastructure and Equipment" and the "Student Digital Competence are related to the "Assessment Practices" area, with a low correlation.

Taking as granted these relations in the specific primary school, and also regarding from the review of the regression coefficients that the two independent variables of the DigCompOrg model contribute significantly to the DDDM model and the prediction of the "Assessment practices". So, if the "Infrastructure and equipment" is increased and the "School Leadership" index remains stable, then the "Assessment Practices" index is expected to increase in this primary school.

When the value of the "School Leadership" is increased and the "Infrastructure and equipment" index remains stable, then the "Assessment practices" index is expected to increase. By these findings, we conclude that if we boost in our theoretical proposal of DDDM with improvement actions the areas of "Infrastructure and equipment" and the "School Leadership" we will have as an outcome the empowerment of the area of “Assessment practices” which considers in general the evaluation. By that, this thesis dissertation improves that we will have school improvement.

CHAPTER 7

CONCLUSIONS

7.1. Discussion

This chapter aimed to address the results of our research work, in particular for providing answers to our research questions by analyzing the questionnaires of students and teachers in combination with the proposed DDDM model oriented at ICT and enhance their capacity to engage in self-evaluation and evaluation related to sustainable school improvement. Therefore, additional research is deemed necessary so as to propose methods and systems to support a school as an organization in engaging in these processes, and to extend them within the digitally supported context.

The DigCompOrg model aims to encourage self-reflection and self-assessment in educational organizations while that reinforce their involvement in the development of the digital competence of the organization itself (Fernández & Pendes, 2021).This engagement includes organizational aspects, but also personal aspects of the factors that are involved.

Based on the above, specific focus was placed on studying the potential of a theoretical proposed DDDM model oriented at ICT to facilitate teachers and all the factors that are involved in a school to engage in more effective course design and delivery using ICT resources, by considering school improvement. In this context, the specific research introduced a new model for providing recommendations to schools based on their ICT elicited from their relevance feedback data. More specifically, the proposed model system was based in six areas that DigCompOrg suggests. Overall, index shows that although the Greek school seems digitally ready, in practice none of the areas proposed in the model of the specific thesis dissertation position is used, both individual evaluations, as well as in combination (as a holistic system), provided with evidence that the proposed approach can generate to schools. The second very important element we obtained is that by recognizing “Assessment practices” as a dependent variable we concluded that digital readiness/effectiveness is clearly related to the evaluation of the educational project that leads to improvement.

Therefore, the evaluation results show that the proposed DDDM model has the potential to be used for assisting teachers and generally school evaluation oriented at ICT, in their everyday school life as DigCompOrg proposes in six areas, by facilitating the process of selecting and retrieving appropriate data. Based on the

insights and according to Table 17 there is a reasonable argue that incorporating all the six areas of the proposed model, presents a promising approach. The data which are extracted show us that the correlation in such a small sample indicates that only the B area “Infrastructure and Equipment” and E area “School Leadership” areas are affected by F “Assessment Practices” sector. Further research should aim to expand these findings and investigate how they could scale up to support evaluation decision making, but also holistic school strategic planning for evaluation.

Additionally it is observed that according to teachers, “Assessment practices” obtain the highest score (3.41) and “School Leadership” (3.24) follows. “Assessment practices” and their high score express the need of Greek Teaching staff and generally school to have an objective evaluation system which will aim at issues of a practical nature (Kolokotronis & Tsiga, 2015) but also will be a reflection of the school (Theofilidis, 2012).

As it considers the “School Leadership”, according to Saitis (2008) during the evaluation of a project, the role of the principal is considered to be important as it encourages teachers to take initiatives based on their interests, take into account the behaviour of teachers with parents and students, take into account the level of the classroom, be informed through convergence of regular meetings on the course, achieving the goals and in the end of the school year and prepare together with the teachers the evaluation report (Saitis, 2008).

These data reflect that more efforts have been invested in promoting practices aimed at the implementation of measures in order to proceed with the evaluation of the school and promotion of the centralized role of school leadership, rather that teaching process and student learning or professional development. This is also confirmed by the evaluation report of OECD (2020) that confirms the lack of investment by the Greek government in infrastructure and equipment and the complete lack of national design in digital integration by primary schools.

As it considers the lack of digital planning and integration of ICT according to OECD (2017) study for Greece and the last objective of our research “dropout rates are low, educational outcomes remain weak and the system is highly centralized” (OECD, 2017, p.7). The economic crisis has affected everything and had dramatic changes, which includes unemployment and poverty. Public funding for education has also declined (OECD, 2017). The result findings from our report as it considers students dimension highlight also a highly percentage of digital equipment use, but as it is referred to the limitations of this study, we investigated a specific school of Rhodes that acts under provision of Aegean University of Rhodes. In this way, the specific school is equipped with digital infrastructure and equipment but this cannot be generalized for all schools in Greece. Literature review marks the great impact on the Greek educational system and the lack of a strategic plan for integration of ICT was very obvious in the Greek educational reality until the pandemic of COVID-19. In the latest OECD report (OECD, 2020) there is no reference at all about Greece and investment at digital equipment and infrastructure.

Meanwhile, according to teachers self perception there it is observed a negativity in the willing of use infrastructure and equipment. This may happens for many reasons. Among the main endogenous factors that seem to hinder the integration of ICT in teaching is the lack of time, the sense of low self competence, lack of technical or pedagogical self-efficacy and effective professional development, classroom management difficulties, lack of motivation and negative attitudes against the use of ICTs and finally but very important is hindered by poor infrastructure and equipment (Depover et al., 2010; Harrel & Bynum, 2018; Pelgrum, 2001). However it has to be remarked that in a previous question where teachers were asked to specify what technologies they use in the classroom it appears that they mostly use digital devices such as tablets, smartphones, projectors and interactive whiteboards compared to digital tools such as e-platforms, open badges etc. This comes in accordance with the results observed in previous questions that concern students that showed on the one hand that teachers use digital devices but digital programs are not so popular when it comes to teaching and learning activities.

Important fact in Greece that needs to be studied carefully, is that all school that concern early childhood and school education are operating with a major number (14%) of paid-by- hour teachers with nine month (academic year) and no contracts instead of teachers with a permanent position in a school (Eurydice, 2017). After the academic year comes to an end, paid-by-hour teachers don't return to the same school. In order to have sustainable development and school improvement, it is necessary for a school to have a stable teaching staff, so this staff can have the opportunity the next academic year to become a valuable member of the school planning in order to have school improvement.

As it is concluded from our results, the continuous professional development in a school as an organization is totally connected with the concern of school leadership in academic development of teachers (Akkerman & Bruining, 2016; Harris, 2003). Also , the Ministry of Education urged Greek teachers of primary school to participate in the program "Training of Teachers for the Utilization and Application of ICT in Teaching Practice" (Papatsoris, 2015) between the years 2007-2022 with the aim of contributing as much as possible to the educational process.This program set as a goal the minimum digital alphabetise for Greek teachers and covered the familiarity with the basic concepts and use of computers (basic ICT concepts, use of a personal computer, processors text, spreadsheets, internet, electronic communication, etc.), especially regarding the applications of the above in the educational process, first acquaintance with educational software products with the aim of getting just a first idea of the possibilities provided by the digital technologies to support the teaching The program is continued until the year of 2022 with the same content (Circulars 15708/2022). Teachers seem to be confident with using digital devices and are willing to be trained and extra educated (Athanatou & Yfantopoulos, 2021). It is very important to enrich their digital skills and also there is a great need for training opportunities and extra education for teachers in order to enhance and strengthen their digital skills and furthermore , to be able to

integrate digital technologies in such ways in order to offer a better digital educational experience to their students.

The results of the specific area are also supported by several studies. The international literature suggests that teachers' self perception is a major factor in determining the use of computers during their teaching (Deng et al., 2014; Fokides, 2017; Fokides & Kosta, 2020). Also, the matter of usefulness, the level of easiness, computer self-efficacy and belief toward computer use are important determinants of the intention to use computers (Fokides, 2017).In the statement of the above, it is concluded that teachers' resistance to fully adopt ICT use is a part of their negative views and beliefs (Teo, 2011) as well as due to their unsatisfactory competence in computers (Fokides, 2016). From this analysis it can be deduced that, although in the teaching is stated that they use different digital strategies, teachers have a more negative perception about their support in use. It can be assumed that not only is it a matter of personal interest but also that there is no tactical guidance and training to help teachers to foster this kind of technologies in their lessons.

Meanwhile the integration of ICT has caused a change in the paradigms of teaching and learning (Ramírez-Martinell & Maldonado, 2015) and also in the way that parents and teachers communicate (Bordalba & Bochaca, 2019).

Digital strategy across the nation with obligatory evaluation in digital competences and the implementation of an action plan through a digital models like DigCompOrg or as this thesis proposes, DDDM models that concerns each school individually, seems to be the only lifeline to promote digital integration and school improvement through this. This thesis concludes that the evaluation of the ICT integration in education is a lengthy process with many variables and different aspects that require a multi-faced investigation in order to conclude in results.

With the daily use of new technologies and familiarity with them, school and family emails can be exchanged via email (Heath et al., 2015). In an effective school, communication is very important. With the support of ICT, communication practices and behaviours can be characterized by immediacy, speed and reliability. Also, with the proper application of new technologies there is increased and more effective involvement of parents with the school community. It is confirmed through literature review that many families want and choose digital communication with the school environment, as this does not create stress as it does with lifelong contact. In addition, teachers can send group messages with information and updates about events that take place at school. Parents and teachers should cooperate in order to increase the responsible use of ICT (Monks et al., 2016) with the promising that there are gap space between the responsible use of ICT at home and school (Gudmundsdottir et al., 2020). Children's screen time has soared in the pandemic (Richtel, 2021) but before that parents in Greece didn't allow their children to spend many hours on screens. According to the study of Eales et al. (2021) 71% of parents of children under 12 years old reported that they were somewhat or very concerned that their child spends too much time in front of screens, even though the majority also reported confidence in knowing appropriate limits (Auxier et al., 2020).

Family and school alliance plays an essential role in the integration of ICT (Bacigalupa, 2016). In the enlighten of the above, parents' attitudes and beliefs towards the use of technology have been taken into account in this research , because especially Greek parents support their children in the educational process and also can work as influencers in students attitude meeting technology (Cheng, 2017; Kong et al., 2019; Valcke et al., 2010). These conceptions have not been investigated enough (Ramírez-Rueda et al., 2021) although the research focuses on parents' concerns about the use of ICT (Keane & Keane, 2018).

Also, messages are sent individually about the progress of their students in a faster way (Kosaretskii & Chernyshova, 2013), without the problem of time that this update will take place. Also we observe some advantages from this point such is the development of trust, the facilitation of communication, the reduction of costs in some cases and the environmental impact, strengthening the environmental attitudes (Hoffman et al., 2015). The sending decisions and updates are made immediately via the e-mail from the ministry of education to the local regional offices and from there they are notified to the school units and so on.

7.2. Conclusion

This thesis was placed within the overarching field of DigCompOrg and data driven decision support and evaluation oriented at information and communication technologies. In this field, the thesis critically capitalized on the existing state-of-the-art (DigCompOrg) and proposed framework (DDDM) and method to both capture the complex ecosystem of schools and the tasks that school factors perform within these ecosystems, as well as assist with data driven decision making aspects, which were currently under-investigated (Sergis, 2017). A very basic process is the collection and analysis of data from a variety of sources. These sources can facilitate leaders, teachers, parents, students and other members of the school community know how to adjust their efforts towards for school improvement. Ongoing analysis of data provides schools with a comprehensive picture of its strengths and challenges, enabling the school community to make informed and targeted decisions (Huber & Helm, 2020).

For this purpose has took place this survey in order to find out if it is possible to improve decision making processes in schools using DigCompOrg to evaluate the digital competence and using a DDDM model.

Firstly, to the research question about the digital competences being a key factor to improve the development of our educational organizations, as we conclude from the research, digital competences are a major key factor to improve the development of our educational organizations and has emerged the following.

As it considers students digital competence in general, not only agree with the fact that digital competences are a mean for school development but also the majority stated that (35.8%) digital competences provide an extremely level of motivation for

learning and also 32.5% of students support that had moderately a positive psychological influence on them. On the other hand, the results from teachers' self perception about digital competences indicated that ICT integration significant changes still occur in the specific primary school ICT culture and most of its components. Despite to that, digital competences according to them (38%) are a major key factor in order to support school leadership in the path for school improvement and also the 55% of the teachers had a positive review about the fact of using digitalization for administration and management support.

According to Pettersson (2018) the most studies about digital competences focuses on teachers and therefore a neglecting of broader contextual conditions in the wider school setting is observed (Pettersson, 2018). On the review, three suggestions for further research can be provided. Petterson (2018) based on a literature review made some suggestions for future study and these indicate more research on organizational infrastructures and digital competent leadership has to be done, to study and suggest more theoretical frameworks that can close the gap between research on policy, organizational infrastructures, strategic leadership and teaching practices and last is for researchers to become involved in the development of new approaches that can enhance digital competence in educational contexts (Pettersson, 2018).

In the second research question that considers the possibility to improve schools through evaluation of digital competences, as depicted especially from teachers' self perception, the area that concerns the evaluation practices and digital competences is the most high valued with the significant score of 3.41 underlying the importance of evaluation of digital competences in order to have school improvement. Also, the majority of teachers referring to 51% confirmed the application and use of innovative programs through digital technologies in order to evaluate and improve the educational processes. That fact has a major impact and shows that the evaluation of digital competences is a vital key in order to proceed in school improvement through internal adequacy evaluation procedures.

Other or our research questions was: is DigCompOrg useful to evaluate Greek schools? The research has emerged the following answers: DigCompOrg is a fully structured tool, completed and totally easy to use which gives the user the convenience to adapt in to the needs that he considers vital and crucial for a school as an organization and thus to that, to exceed all the data that he needs for further investigation and research. In the specific research the researcher had to change some specific question that did not reflect the Greek education reality but despite to that DigCompOrg has emerged as a fully helpful tool in order to record the digital reality of the primary school.

21st century Greek public school is called to optimize the educational process by cultivating students' digital competence, which is recognized as a vital competence throughout Europe, in order to enable them to meet the new challenges and demands of the digital age (Eurydice, 2019). As digital technologies and digital social networks are an integral part of our lives in a 21st century globalized society,

young people are facing a number of challenges in the digital age in order to live and work as global and digital citizens.

According to the OECD (2016b), the development of digital competence within the globalized environment, facilitates the critical management of issues of global and intercultural interest, as well as engaging in open interactions with people from different backgrounds, encouraging the cultivation of mutual respect. Similarly, UNESCO (2013) promotes digital literacy as an elementary literacy of the 21st century for the empowerment of people, communities and nations in the age of the globalized knowledge society. The concept of 'digital citizen' encompasses a range of skills, characteristics and behaviours that enhance the benefits and opportunities of the cyber-world, while erecting walls of resistance to potential risks (Council of Europe, 2019).

Eurydice (2019) refers that the Greek educational system has already included digital literacy in the curriculum, both as a compulsory subject and as an interdisciplinary subject for students. In primary schools, the process of changing the curriculum for the integration of digital competence is underway, especially in the last decade. In addition, Greece, like most European countries, has developed projects that invest in digital school infrastructure, as clearly stated in the objectives of the national strategy for digital education, while implementing the development of digital learning resources that are available and accessible to teachers and students through officially approved platforms and networks of the Ministry of Education, such as digital educational materials and open educational resources (Eurydice, 2019). The need for the integration of ICT in teaching and learning has proved to be as urgent and necessary as the case of the Covid-19 pandemic has emerged.

In the increasingly globalized environment of school, where special emphasis is placed on the education of the global citizen (Eurydice, 2012; UNESCO, 2014; 2015b), the Greek public school faces significant challenges as the learning environment is no longer limited to walls of a classroom but expands to the wider European and global community (Tzotzou et al., 2021). To date, in Greece, initiatives, strategies and actions related to the European and international dimensions of 21st century education have already been developed European educational programs such as ERASMUS. These programs provide Greek teachers and students with opportunities to learn about global challenges while participating in alternative learning environments and collaboration networks with members of the European and global educational community, experiencing the value of real-world experience and real-life skills through activities carried out collaboratively in the context of mobility and the creation of a transnational learning and development community for students and teachers from different countries of the world. For example, since 2005, Greek public school teachers and students have been actively involved in the eTwinning community12 in order to interact and collaborate with partners inside and outside Europe to build new knowledge through mutual respect and acceptance, thus developing key 21st century skills.

The implementation of exchange programs and international collaborations, expand the concept and perception of globalization in the 21st century, highlighting the growing and evolving interdependence and interconnection between the countries of the world in the economic, cultural and social fields. The creation of learning communities through networking and mobility is directly linked to the major stake of the 21st century in achieving global prosperity, through the awareness and understanding that the global affects the well-being of peoples at national and international level (UNESCO, 2016b).

In the next research question (can we design a model of evaluation based on DDDM and DigCompOrg at the same time?) has emerged that the combination of both models due to their flexibility are extremely useful in the design of a completed evaluation model that extracts real data and then puts the target through them, in order to achieve the evaluation of a school as an organization that leads to improvement. Firstly, the DigCompOrg framework due to the uses of it, and by that meaning the unique functions that it serves which are: the construction of one's own (Balaban et al., 2018; Jugo et al., 2017; Redep et al., 2019); the preparation of digital implementation plans (Brolpito et al., 2016; Giunti et al., 2018); for the detection of specific areas that needs improvement (Malach & Kostoloányová, 2017) or even for the building of an evaluation model (Campelj et al., 2019), which was the part that made this model most suitable for the current research, DigCompOrg model was successfully selected in order to extract real data from a primary school. Secondly, the DDDM plan in order to achieve school improvement is based to the need that we need an effective use of data in order to make targeted decisions (Lai et al., 2014; McNaughton et al., 2012; Poortman & Schildkamp, 2016; Van Geel et al., 2016; Schildkamp et al., 2016) and in this research the target is to have school improvement. Decision making targeting to school improvement that is based on real data and are extracted through internationally admissible of their great importance and value frameworks like DigCompOrg, gives a gravity to the quality of data that this research extracted. In the meaning of the above, DDDM model plan for school improvement based on extracted data through DigCompOrg was a value way and a great deal of combination of both.

The above sentence also gives the answer to the research question that refers to if is the combination of both models a good way to evaluate the schools. According to the above, the proposed theoretical 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 organization could more efficiently (a) design the 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 that exist in a school in order to achieve internal stability and school improvement.

The research question that concerns the design and adaption of instruments to involve teachers and students, totally agrees with the research in the specific primary school in which were selected students and teachers for the sample. According to teachers' self perception there is a try from theirs' perspective, to support school leadership by valuating the specific area with a high score of 3.24. Despite to that and as it is observed later, school leadership does not have the same concern about teachers' continuous professional development, as the results revealed. That result came along with the significant percent of 46% of them highlighting the negative view of school leadership and its concern about the academic development of them in digitalization. That means that the school leadership does not support the development of teachers' digital competences in the context of their professional life (regarding the time that they work at school) but more in the context of their private life. Teachers' belief is that continuous professional development should happen in the context of school time with the support of Greek Ministry of Education and school leadrership. The role of School leader in Greek schools belongs only to one person and as it concerns the matter of digital competences, the general review by the time that research was completed is that he/she has a more bureaucratic role in those matters. Teachers and students, who also believe with the massive percentage of 59% that the use of ICT is very empowering, are the driving force in the internal procedures of the school.

Moreover, placing a particular focus on teachers since they presented a largely under-investigated target group in existing works on decision support (Sergis, 2017) and data driven decision making fields, the main insights and conclusions are: (a) if the teacher staff is digitally competent is completely related and correlated to the evaluation of the educational project, (b) the teacher's digital ability affects school evaluation and self-evaluation , (c) teachers have received a limited level of research attention in terms of decision support methods and tools and data driven fields, to facilitate them engage in their daily tasks (Sergis, 2017), (d) additional research needs to be done in order of designing data driven decision making models for evaluation and self-evaluation. This view agrees with the global challenge of effectively supporting teachers' data-driven self-improvement (Lockyer et al., 2013; Sergis, 2017).

Teacher's capacity to use data is an underdeveloped field (Datnow & Hubbard, 2016) as teachers are frequently grouped together for structured collaboration focused on data use. Commonly, teachers engage in these structured collaboration opportunities with other teachers from their grade level and/ or subject area. In some cases, teacher collaboration for data use also involves principals, instructional coaches, university researchers, or consultants who serve as facilitators but not in the example of Greece. When teachers conduct data use as part of a research and are able to contribute with deep knowledge of instruction and data use themselves, it is much more likely that their involvement has a positive impact on their building the circumstances about evaluation (Sergis, 2017).

Last in the research question, if it is possible through the evaluation of digital competences to have a motive in the use of them by students it is observed that: the majority of students referring to the massive percentage of 61,6 % supports the fact that provides them with motivation and the 49,1 % that has a positive psychological influence for them. By that it is concluded that students have the ability to judge in a positive way the fact that active participation in the procedures of evaluating digital competences filled them with a positive feeling and concern. The unpretentious and creative spirit of students led us conducting the result that students lusted ardently their participation on the evaluation procedures.

Summarizing all the above, as it considers the implementation of the decision making model, this thesis proposal made the basis for its building, considering a theoretical data driven decision making model, oriented at digital evaluation practices which can evaluate the school or the school can be self-evaluated, involving teachers and students. When a user specifies a decision's context, he uses objects (Schildkamp, 2019). The context's ancho may be modified and be adjusted at a decision which in our figure means the target. Involving context at this higher level of abstraction enables the user to easily create a complete decision scenario (Duggan, 2014; Schildkamp, 2017) and comforts the selection of relevant data. The context builder, which in our case is a group of teachers in association with school leader, begins with the target, which it shares with the data picker, also, in our case a valuated questionnaire based on SELFIE instrument. Decision models supply a schema for their input and output. Their input is a mediated schema, spanning both the context and relevant data (Duggan, 2014).

From the research emerged the model that this thesis proposes and comprises a set of six areas based on the DigCompOrg and is related to the tangible assets of school institutions, which can be populated and measured using Likert scales. The metric categories used to capture actual data on the current state and school and perceived data on the levels of use and efficiency of the different asset categories.

The steps of decision-making process begin with setting the vision (Schildkamp, 2019). A school's vision is based upon what students should know and be able to do, what teachers and leadership can do upon this capacities (Johnson,2020) and what the rest of the members of the school community want their school to be like or expect from this specific school (Ishimaru, 2019). Their collective answers become the vision for the school, providing a collective identity and direction (Shildlkamp, 2019).

Another important fact in the way of school improvement is the communication of the problem itself. When the whole community or factors that are involved in a school is aware of the effort and trying by all means to solve it by facing the challenges, school improvement can be succeeded (Dolph,2017) . Final, the last step encourages all the human factors that are involved in a school to engage in annual assessment (Schildkamp, 2019). This can be an action plan for every school.

Consequently considering the above, teachers' Digital competence during the process of the research and building of the theoretical model of DDDM, has led to

more focused suggestions to teachers. Even though further research should complement and corroborate these initial findings due to the limitations that our research has, the results support that teachers' digital competences can be a major factor in the evaluation of digital competences and decision making oriented at the evaluation of school as an organization and therefore evaluation practices need to explicitly consider these characteristics in order to offer more meaningful school improvement.

7.3. Limitations

Study limitations represent weaknesses within a research design that may influence outcomes and conclusions of the research (Ross & Bidler, 2019). Complete and honest presentation of limitations is an obligation by the researcher. A meaningful presentation of study limitations should describe the potential limitation, explain the implication of the limitation, provide possible alternative approaches, and describe steps taken to mitigate the limitation. A more complete presentation will enrich the readers' understanding of the study's limitations and support future investigation (Ross & Zaidi, 2019).

Limitations represent weaknesses within the study that may influence outcomes and conclusions of the research (Ross & Zaidi, 2019) and supports proper interpretation and validity of the findings (Ioannidis, 2007), specifically threats to internal or external validity (Price & Murnan, 2004). The goal of presenting limitations is to provide meaningful information to the reader. Also, by providing study limitations is an important part of this scholarly process and without them, research readers cannot understand properly the exclusion areas or other biases that may affect the outcomes and conclusions of the study (Greener, 2018). Study limitations should intrigue reader's opinion about opportunities to engage in probable improvements by underlying gaps and extant literature, cultivating the idea of expanding and improving the research (Greener, 2018). Also, it is an ethical element of studies (Drotar, 2008) and it ensures transparency of both the research and the researchers (Chasan-Taber, 2014), as well as provides transferability (Eva & Lingard, 2008) and reproducibility of methods. A study's limitations should place research findings within their proper context to ensure readers are fully able to discern the credibility of outcomes and conclusions and also can add to the generalization of findings (Ioannidis, 2007).

The presented limitations of the study originate from conscious choices made by the researcher (also known as delimitations) to narrow the scope of the study (Price & Murnan, 2004).The conscious choice of the researcher is to study all the teaching staff of the schools but this observed to be a limitation to our variables in the process of an analysing the data with SPSS. The researcher have designed the study for a particular group, geographically defined region (Rhodes) that would limit to whom the findings can be generalized. Among the main limitations of the study, it is necessary to emphasize that a single case of a school is presented, which makes

it impossible to generalize the results. Such delimitations involve conscious exclusionary and inclusionary decisions made during the development of the study plan, which may represent a systematic bias intentionally introduced into the study design or instrument by the researcher (Price & Murnan, 2004).It is very important to specify in this study, external validity is challenged because results cannot be generalized to its larger population (Price & Murnan, 2004).Therefore, the researcher in a future study should apply to a larger sample of teachers in order to avoid threats.

Also, the data were collected in January 2020, thus they do not reflect the impact of the COVID-19 pandemic on the ICT competencies of teachers, the perceived competencies, the actual use of ICTs, or the barriers that teachers encounter. All three areas analyzed in this paper would have probably a different outcome to a various degree. The intensity of social, educational, and economic changes happening due to COVID-19 has been already described in current studies that are emerging constantly.

7.4. Future research

Future work in the research areas addressed in this thesis should capitalize on the aforementioned conclusions and further investigate the potential of decision making methods to support school engage in continuous school self-improvement.

To extend our study in the future, it would be interesting to use a bigger sample, since this one offered us many limitations and the impossibility of the application on the DDDM model in general. Running further analysis requires a minimum of 150 responses in teachers' questionnaire but in this descriptive study the author could not use more than the actual number of teachers working at this selected school. This would help us evaluate the most debated items and enable the instrument to be applied in Greece and around Europe, and the external validity of the instrument to be further explored. The instrument also needs to be studied in samples of on duty teachers and in relation to other demographic information. It would be very interesting to apply DigCompOrg in many schools around Greece and extract data about digital competences of the schools as an organization. Also, may be interesting to continue studying data driven decision making models that would allow us to take a step forward in terms of evaluation oriented at ICT.

The process of evaluating and developing is complex and, as well as using the self-evaluation tool reported, we shall also have to help and train students also, to use better and more accurately. This means that teachers have to be sufficiently digitally competent to know how and when to use digital resources in their teaching practice so as students can learn. The low rate at "Teaching and Learning" area led us to remark that.

We believe that the work presented in this thesis is a valid contribution to evaluating Digital competences through a DDDM model. Starting from certain subjects on the

undergraduate curriculum, training in management of data should envisage reflection on professional practice as a fundamental part of the process. Formative evaluation has a fundamental role in the development process of future digital competent teachers and students (Rodríguez et al., 2021). This process of reflecting on daily teaching experiences, as real or simulated problems involving the use of DDDM, will allow teachers to improve in many areas of their professional careers (Schilkamp, 2019). Finally, a proposal to the Greek Ministry of Education on the way forward to digital transformation is to build capacity in areas such as design and evaluation of relevant policy. This can be achieved by training teachers in an every year institutional framework. Education on digital education is something that Greek teachers eagerly desire, especially after upon arrival of COVID-19 pandemic (Athanatou & Yfantopoulos, 2021).

Teachers' low data literacy competences need to transform data into information and ultimately into actionable knowledge (Koltay, 2015; Mandinach & Gummer, 2013). So, in this context, a key globally identified challenge relates to supporting teachers to effectively engage in a systematic process of data-driven reflection on their teaching practice (Wasson et al., 2016). For this reason, this process can guide reflection and improvement in a systematic and evidence-based manner (Dana & Yendol-Hoppey, 2014).

The "Digital Transformation" of the Greek educational environment and the digital empowerment of the educational community were the subjects that their conversation has just begun on May 18th 2021[34]. As it is concluded, much time has been lost for digital education and development of digital skills in Greece. For that matter, the lifelong education and enhancement of teachers' digital capacity should be an important targeted action, as in countries all over Europe there are developed digital frameworks for students and teacher according to OECD (2020). The integration of digital technologies, through the promotion of the "Digital Skills for Digital Greece"[35] in all educational levels, could contribute towards the above direction. At the same time, a major matter of importance is no doubt the investment in infrastructure and technological equipment at schools by the government (OECD, 2020). Schools have a great lack of infrastructure and equipment. In addition to this, actions across the educational fields as well as to take measures for the maintenance and technical support of new equipment and infrastructure (OECD, 2020).

This context of the digitally competent organization will contribute to the skills of the school factors that are involved by being supported from an educational organization that leads innovation processes supported by technology (Fernández & Prendes, 2021). In this way, the results open new lines of research that point to the development of longitudinal studies that show conclusions of a great depth in digital competency of a school as an organization.

[34] https://studyingreece.edu.gr/greek-education-goes-digital/
[35] https://www.nationalcoalition.gov.gr

References

Ae-MoYS. (2011). Assessing the e-maturity of your school. Available at: http://e-mature.ea.gr/

Aesaert, K., Van Braak, J., Van Nijlen, D., & Vanderlinde, R. (2015). Primary school pupils' ICT competences: Extensive model and scale development.*Computers and Education, 81*, 326-344. Available at: doi:10.1016/j.compedu.2014.10.021

Ahadi, A., Lister, R., Haapala, H., & Vihavainen, A. (2015). Exploring Machine Learning Methods to Automatically Identify Students in Need of Assistance. Sydney: University of Technology. Available at: https://doi.org/10.1145/2787622.2787717

Akinci, M., & Erdogan, K. O. S. E. (2021). Research trends of program evaluation studies conducted between 2010-2019 in Turkey. *Cukurova University Faculty of Education Journal, 50(*1), 77-120. Available at: https://dergipark.org.tr/en/pub/cuefd/issue/59484/688142

Akkerman, S., & Bruining, T. (2016). Multilevel boundary crossing in a professional development school partnership. *Journal of the Learning Sciences, 25*(2), 240-284. Available at: https://doi.org/10.1080/10508406.2016.1147448

Alkin ,M. (2013). *Evaluation Roots: A Wider Perspective of Theorists' Views and Influences,* 2nd edn.London: SAGE.

Alkin, M. C., & Christie, C. A. (2004). An evaluation theory tree. *Evaluation roots: Tracing theorists' views and influences, 2*(19), 12-65.

Alkin, M. C., & King, J. A. (2017). Definitions of evaluation use and misuse, evaluation influence, and factors affecting use. *American Journal of Evaluation*, *38*(3), 434-450. Available at: https://doi.org/10.1177/1098214017717

Alkin, M. C., & Woolley, D. C. (1969). A Model for Educational Evaluation.

Alstrup, S., Hansen, C., Hansen, C., Hjuler, N., Lorenzen, S., Pham, N. (2017). DABAI: A data driven project for e-Learning in Denmark. In: P. Peres, & A. Mesquita (eds.), *ECEL17 - Proceedings of the 16th European Conference on e-Learning* (pp. 18-24). Wood Ln, Sonning Common: Academic Conferences and Publishing International.

Altalhi, A. H., Luna, J. M., Vallejo, M. A., & Ventura, S. (2017). Evaluation and comparison of open source software suites for data mining and knowledge discovery. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, 7*(3), e1204. Available at: https://doi.org/10.1002/widm.1204

Amagoh, F. (2008). Perspectives on organizational change: systems and complexity theories. *The Innovation Journal: The public sector innovation journal, 13*(3), 1-14.

Amagoh, F. (2016). Systems and Complexity Theories of Organizations. In: Farazmand, A. (eds) Global Encyclopedia of Public Administration, Public Policy, and Governance*. Springer, Cham*. Available at: https://doi.org/10.1007/978-3-319-31816-5_73-1

Anh, V. (2018). Evaluation models in educational program: Strengths and weaknesses. *VNU Journal of Foreign Studies, 34*(2), 2525-2445. Available at: https://doi.org/10.25073/2525-2445/vnufs.4252

Athanatou, M. (2018). *School and community partnership: the principal's role in crisis management.* 2018-02. Master thesis, Aegean University. Available at: http://hdl.handle.net/11610/18515

Athanatou M., & Yfantopoulos N. (2021). Distance Education during the period of the COVID-19 pandemic and the views of Primary Education teachers. In: *Proceedings of the 1st International Online Education Conference from the 20th to the 21st Century in 15 Days*, (1), 401-413. Available at: https://doi.org/10.12681/online-edu.3250.

Bacigalupa, C. (2016). Partnering with families through photo collages. *Early Childhood Education Journal, 44*(4), 317-323. Available at: doi: http://dx.doi.org/10.1007/s10643-015- 0724-3

Bacigalupo, M. (2022). Competence frameworks as orienteering tools. *RiiTE Revista Interuniversitaria de Investigación en Tecnología Educativa, 12*, 20-33. Available at: http://dx.doi.org/10.6018/riite.523261

Bakharia, A., & Dawson, S. (2011). SNAPP: a bird's-eye view of temporal participant interaction. In: *Proceedings of the 1st international conference on learning analytics and knowledge* (pp. 168-173). Available at: https://dl.acm.org/doi/proceedings/10.1145/2090116

Balaban, I., Redjep, N. B., & Calopa, M. K. (2018). The analysis of digital maturity of schools in Croatia. *International Journal of Emerging Technologies in Learning, 13*(6), 4-15. Available at: https://doi.org/10.3991/ijet.v13i06.7844

Bamberger, M. (2016). *Integrating big data into the monitoring and evaluation of development programmes.* New York, NY: United Nations Global Pulse.

Basilotta-Gómez-Pablos, V., Matarranz, M., Casado-Aranda, L. A., Otto, A. (2022). Teachers' digital competencies in higher education: a systematic literature review. *Int J Educ Technol High Educ, 19*, 8. Available at: https://doi.org/10.1186/s41239-021-00312-8

BECTA. (2008). *Measuring e-maturity in the FE sector - Technical report.* Available at: http://dera.ioe.ac.uk/8299/2/ematurity_fe_final_report.pdf

Begicevic Redjep, N., Balaban, I., & Zugec, B. (2021). Assessing digital maturity of schools: framework and instrument. *Technology, Pedagogy and Education, 30*(5), 643-658. Available at: https://doi.org/10.1080/1475939X.2021.1944291

Bertrand, M., & Marsh, J. A. (2015). Teachers' sensemaking of data and implications for equity. *American Educational Research Journal*, *52*(5), 861-893.

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. V. (2013). Digital business strategy: toward a next generation of insights. *MIS quarterly, 2013*, 471-482.

Bocconi, S., Panesi, S., & y Kampylis, P. (2020). Fostering the digital competence of schools: piloting SELFIE in the Italian education context. *IEEE Revista Iberoamericana de Tecnologias del Aprendizaje, 15*(4), 417-425. Available at: https://doi.org/10.1109/RITA.2020.3033228

Bonniol, J., & Vial, M. (2007). *The evaluation models. Fundamental texts with interpretive comments.* Athens: Metaichmio.

Borich, G. D. (1977). Sources of invalidity in measuring classroom behavior. *Instructional Science*, *6*(3), 283-318.

Bresfelean, V. P. & Ghisoiu, N. (2010). Higher education decision making and decision support systems. *WSEAS Trans Adv Eng Educ, 7*, 43–52. Available at: http://mpra.ub.uni-muenchen.de/26698/

Broek, S., & Buiskool, B. J. (2020). *Adapting the SELFIE tool for work-based learning systems in Vocational Education and Training. A feasibility study.* EUR, 30079. Luxembourg: Publications Office of the European Union.

Brolpito, A., Lightfoot, M., Radišic, J., & y Ščepanovic, D. (2016). Digital and Online Learning in Vocational Education and Training in Serbia: A Case Study. Available at: https://bit.ly/36Y20Se

Brown, C., & Greany, T. (2018). The evidence-informed school system in England: Where should school leaders be focusing their efforts?. *Leadership and Policy in Schools*, *17*(1), 115-137. Available at: doi:10.1080/15700763.2016.1270330.

Brown, C. D. (2015). *Leading the Use of Research and Evidence in Schools*. Institute of Education Press. Available at: https://www.ucl-ioe-press.com/books/research-methods/leading-the-use-of-research-and-evidence-in-schools/

Bruzos, A. (2009). *The teacher as counselor: a humanistic view of education.* Athens: Gutenberg.

Bryceson, N., & Sheridan L. (2022) "The whole elephant": "What works best" consultation practices of learning support teams in primary schools, *Australian Journal of Learning Difficulties*,Available at: DOI: 10.1080/19404158.2022.2085755

Burner, T. (2018). Why is educational change so difficult and how can we make it more effective? *Forskning og Forandring, 1*(1), 122. Available at: DOI: 10.23865/fof.v1.1081

Bydžovska, H. (2016). A comparative analysis of techniques for predicting student performance. In *Proceedings of the 9th International Conference on Educational Data Mining, EDM 2016, 2,* (pp. 306–311).

Cabero-Almenara, J., Fernández Romero, C. y Palacios Rodriguez, A. D. P. (2020). La competencia digital educativa en Andalucía (España). El programa# PRODIG. *Temas de Comunicación, 41*, 103429. Available at: https://bit.ly/2V7b44w

Cabero-Almenara, J., & Llorente-Cejudo, C. (2020). Covid-19: transformación radical de la digitalización en las instituciones universitarias. *Campus virtuales, 9*(2), 25-34.

Calvet Linán, L., & Juan Pérez, Á. A. (2015). Educational Data Mining and Learning Analytics: differences, similarities, and time evolution. RUSC*. Universities and Knowledge Society Journal, 12(*3). pp. 98-112.Available at: doi: http://dx.doi.org/10.7238/rusc.v12i3.2515

Campbell, N.C., Murray, E., Darbyshire, J., Emery, J., Farmer, A., Griffiths, F.,… Kinmo nth, A. L. (2007). Designing and evaluating complex interventions to improve health care. *BMJ*, *334*, 455–459. Available at: doi:10.1136/bmj.39108.379965

Campbell, B. S., & Feldmann, A. (2017). The power of multimodal feedback. Journal of Curriculum, Teaching, *Learning and Leadership in Education, 2*(2), 1.

Campbell, C., & Levin, B. (2009). Using data to support educational improvement. EducationalAssessment, *Evaluation and Accountability, 21*(1), 47–65.

Campelj, B., Karnet, I., Brodnik, A., Jereb, E., & y Rajkovič, U. (2019). A multi-attribute modelling approach to evaluate the efficient implementation of ICT in schools. *Central European Journal of Operations Research, 27*(3), 851-862. Available at: https://doi.org/10.1080/15700763.2015.1024328

Carless, D., Joughin, G., & Mok, M. M. C. (2006). Learning-oriented assessment: principles and practice. *Assessment & Evaluation in Higher Education, 31*(4), 395-398. Available at: doi:10.1080/02602930600679043

Carpenter, R. (2009). Boundary negotiations: Electronic environments as interface. *Computers and Composition, 26*(3), 138-148. Available at: doi:10.1016/j.compcom.2009.05.001

Carretero,S., Vuorikari, R., & y Punie, Y. (2017). DigComp2.1. *The digital Competence Framework for Citizens. With eight proficiency levels and examples of use.* Luxembourg: Publications Office of the European Union. Available at: https://doi.org/10.2760/38842

Carvalho, J. V., Pereira, R. H., & Rocha, A. (2018). Maturity models of education information systems and technologies: a systematic literature review. In: *2018 13th Iberian Conference on Information Systems and Technologies (CISTI)* (pp. 1-7). IEEE. Available at: https://ieeexplore.ieee.org/document/8398634/

Casillas, S., Cabezas, M., Ibarra, M. S., & Rodríguez, G. (2017). Evaluation of digital competence from a gender perspective. In *Proceedings of the 5th international conference on technological ecosystems for enhancing multiculturality* (pp. 1-5).

Castaño-Muñoz, J., Weikert García, L., & y Herrero Rámila, C. (2021). *Analysing the digital capacity of Spanish schools using SELFIE.* EUR 30735 EN. Luxembourg: Publications Office of the European Union, Luxembourg. Available at: https://doi.org/10.2760/947402

Castellani, J. & Carran, D. (2009). Creative decision-making strategies through technology-based curriculum tools. In: T. J. Kowalski & T. J. Lasley II (eds.), *Data-based decision making in education* (pp. 304-316). New York, NY: Taylor & Francis.

Castillo, O., Melin, P., Kacprzyk, J., & Pedrycz, W. (2007). Type-2 fuzzy logic: theory and applications. In *2007 IEEE international conference on granular computing (GRC 2007)* (pp. 145-145). IEEE.

Cech, T. G., Spaulding, T. J., & Cazier, J. A. (2018). Data competence maturity: developing data-driven decision making. *Journal of Research in Innovative Teaching & Learning, 11*(2), 139-158. Available at: https://doi.org/10.1108/JRIT-03-2018-0007

Chaparro-Peláez, J., Acquila-Natale, E., Iglesias-Pradas, S., & Suárez-Navas, I. (2015). A web services-based application for LMS data extraction and processing for social network analysis. In: *Annual Conference of the Global Innovation and Knowledge Academy* (pp. 110-121). Cham: Springer.

Chapman, C., & Sammons, P. (2013). *School Self-Evaluation for School Improvement: What Works and Why?*. CfBT Education Trust. 60 Queens Road, Reading, RG1 4BS, England.

Chasan-Taber, L. (2014). *Writing dissertation and grant proposals: Epidemiology, preventive medicine and biostatistics.* Boca Raton, FL: CRC Press.

Chatti, M. A., Dyckhoff, A. L., Schroeder, U., & Thüs, H. (2012). A reference model for learning analytics. *International journal of Technology Enhanced learning, 4(*5-6), 318-331.

Chau, V. T. N., & Phung, N. H. (2012) A knowledge driven education decision support system. In: *2012 IEEE RIVF international conference on computing communication technologies, research, innovation, and vision for the future* (pp. 1–6).

Cheetham, G., & Chivers, G. E. (2005). *Professions, competence and informal learning*. Edward Elgar Publishing.

Chen, X., Ye, Y., Williams, G., & Xu, X. (2007). *A survey of open source data mining systems. In Pacific-Asia Conference on Knowledge Discovery and Data Mining.* Berlin/Heidelberg: Springer.

Chopra, N. (2019). E-governance Framework to Measure Digital Competence of HEIs in India. *European Scientific Journal, 15*(11), 181-193. Available at: http://dx.doi.org/10.19044/esj.2019.v15n11p181

Coburn, C. E., & Turner, E. O. (2011). Research on data use: A framework and analysis. *Measurement: Interdisciplinary Research & Perspective, 9*(4), 173-206. Available at: https://doi.org/10.1080/15366367.2011.626729

Coburn, C. E., Touré, J., & Yamashita, M. (2009). Evidence, interpretation, and persuasion: Instructional decision making at the district central office. *Teachers College Record*, *111*(4), 1115-1161.

Coburn, C. E., & Turner, E. O. (2011). Research on data use: A framework and analysis. *Measurement: Interdisciplinary Research & Perspective*, *9*(4), 173-206. Available at : https://doi.org/10.1080/15366367.2011.626729

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Routledge.

Comisión Europea (2017). *Una agenda digital para Europa.* Bruselas: Parlamento Europeo. Available at: https://bit.ly/3i8nxho

Comisión Europea (2009). *Marco estratégico para la cooperación de la Unión Europea en el ámbito de la educación y la formación (ET2020).* Bruselas: Diario oficial de la Unión Europea, (2009/C 119/02). Available at: https://bit.ly/3l5c58u

Comisión Europea (2018a). Recomendación relativa a las competencias clave para el aprendizaje permanente. *Diario Oficial de la Unión Europea, 4*(6). Available at: https://bit.ly/3ia76RQ

Comisión Europea (2018b). *SELFIE, Self-reflection on Effective Learning by Fostering the use of Innovative Educational Technologies.* Bruselas: Parlamento Europeo. Available at: https://bit.ly/3x9gN7o

Comisión Europea (2020). *Plan de Acción de Educación Digital (2021-2027).* Bruselas: Unión Europea. Available at: https://bit.ly/2VceC5H

Cone, L., Brøgger, K., Berghmans, M., Decuypere, M., Förschler, A., Grimaldi, E., ... & Vanermen, L. (2022). Pandemic Acceleration: Covid-19 and the emergency digitalization of European education. European Educational Research Journal, 21(5), 845-868.

Costa, P., Castaño-Muñoz, J., & y Kampylis, P. (2021). Capturing schools' digital capacity: Psychometric analyses of the SELFIE self-reflection tool. *Computers & Education, 162*, 104080. Available at: https://doi.org/10.1016/j.compedu.2020.104080

Council of the European Union. (2018*). Recomendación del Consejo, de 22 de mayo de 2018, relativa a las competencias clave para el aprendizaje permanente.* Brussels: Official Journal of the European Union.

Cousins, J. B., Goh, S. C., Elliott, C. J., & Bourgeois, I. (2014). Framing the capacity to do and use evaluation. *New Directions for Evaluation, 2014* (141), 7-23.

Cox, B. E., Reason, R. D., Tobolowsky, B. F., Brower, R. L., Patterson, S., Luczyk, S., & Roberts, K. (2017). Lip service or actionable insights? Linking student

experiences to institutional assessment and data-driven decision making in higher education. *The Journal of Higher Education, 88*(6), 835-862. Available at: https://doi.org/10.1080/00221546.2016.1272320.

Creemers, B., & Kyriakides, L. (2015). Developing, testing, and using theoretical models for promoting quality in education. *School Effectiveness and School Improvement*, *26*(1), 102-119.

Crocker, L., & Algina, J. (2008). *Introduction to classical and modern test theory.* Mason, OH: Cengage Learning.

Cronbach, L. J., & Meehl, P. E. (2017). Construct validity in psychological tests. In: P. Leavy (ed.), *Research Design* (pp. 225-238). Abingdon-on-Thames: Routledge.

Daniel, B. (2015). Big Data and analytics in higher education: Opportunities and challenges. *British journal of educational technology, 46*(5), 904-920.Available at: https://doi.org/10.1111/bjet.12230

Darling-Hammond, L., Schachner, A., & Edgerton, A. K. (2020). Restarting and Reinventing School: Learning in the Time of COVID and Beyond. *Learning Policy Institute.*

Datnow, A., Greene, J. C., & Gannon-Slater, N. (2017). Data use for equity: Implications for teaching, leadership, and policy. *Journal of Educational Administration,4,* 354–360. Available at: doi:10.1108/JEA-04-2017-0040.

Datnow, A., & Hubbard, L. (2015). Teachers' use of assessment data to inform instruction: Lessons from the past and prospects for the future. *Teachers College Record*, *117*(4), 1-26.

Datnow, A., & Hubbard, L. (2016). Teacher capacity for and beliefs about data-driven decision making: A literature review of international research. *J Educ Change, 17*, 7–28.

Datnow, A., & Park, V. (2018). Opening or closing doors for students? Equity and data use in schools. *Journal of Educational Change*, *19*(2), 131-152. Available at: doi:10.1007/s10833-018-9323-6.

Datnow, A., Park, V., & Kennedy-Lewis, B. (2013). Affordances and constraints in the context of teacher collaboration for the purpose of data use. *Journal of Educational Administration, 3,* 341–362. Available at: doi:10.1108/09578231311311500.

Dawson, A. (2021). Robotic wireless sensor networks, big data-driven decision-making processes, and cyber-physical system-based real-time monitoring in sustainable product lifecycle management. Economics, *Management and Financial Markets, 16*(2), 95-105.

De Grauwe, A., & Naidoo, J. P. (2004). School Evaluation for Quality Improvement. *Meeting of the Asian Network of Training and Research Institutions in Educational Planning (ANTRIEP)*, Kuala Lumpur, Malaysia, July 2-4, 2002. Paris: International Institute for Educational Planning (IIEP) UNESCO. 7-9 rue Eugene-Delacroix, 75116 Paris, France.

Deng, F., Chai, C. S., Tsai, C. C., & Lee, M. H. (2014). The relationships among Chinese practicing teachers' epistemic beliefs, pedagogical beliefs and their beliefs about the use of ICT. *Journal of Educational Technology & Society, 17*(2), 245-256.

Deniz D.Z., & Ersan I. (2002). An academic decision support system based on academic performance evaluation for student and program assessment. *Int J Eng Educ, 18*(2), 236–244.

Departamento de Educación del Gobierno Vasco (2011). *Modelo de Madurez Tecnológica de Centro Educativo.* Bilbao: Departamento de Educación del Gobierno Vasco.

Depover, C., Karsenti, T., & Komis, V. (2017). *Pour comprendre les MOOCs: nature, enjeux et perspectives.* Québec City: PUQ.

Dhillon, B. S. (2008). *Mining equipment reliability* (pp. 57–70). London: Springer.

Dias, S. B., & Diniz, J. A. (2013). FuzzyQoI model: A fuzzy logic-based modelling of users' quality of interaction with a learning management system under blended learning. *Computers & Education, 69*, 38-59.

Dieronitou, E., & Sofou, E. (2015). Teacher's training and professional development through school self-evaluation processes and practices: Case study. *Scientific Educational Magazine "educational circle", 3*(1), 61.

Digital School of Distinction (2013). Digital schools of distinction. Lisboa: InScience Press.Available at: http://www.digitalschools.ie/criteria.

Digital Skills For Digital Greece (2019). *Action Plan 2019 for the promotion of innovation and digital skills.* Available at: https://www.nationalcoalition.gov.gr/wp-content/uploads/2019/06/NC-Action-Plan-2019_ENv5_272178237_signed.pdf.

Domingo, M., Bosco, A., Carrasco, S., & Sánchez, J. A. (2020). Fomentando la competencia digital docente en la universidad: Percepción de estudiantes y docentes. *Revista De Investigación Educativa, 38*(1), 167–782. Available at: https://doi.org/10.6018/rie.34055

Doretskaya, I. V. (2018). On the formation of a common vision on the use of ICT in academic work at school. Science and school, (5), 127-132. Available at: https://bit.ly/2TFsWTX

Drotar, D. (2008). Thoughts on establishing research significance and preserving scientific integrity. *Journal of Pediatric Psychology, 33*(1), 1-5.

Duggan, J. (2014). The case for personal data-driven decision making. Proceedings of the VLDB Endowment, 7(11), 943-946.

Dugan, K. E., Mosyjowski, E. A., Daly, S. R., & Lattuca, L. R. (2021). Systems thinking assessments: Approaches that examine engagement in systems thinking. *ASEE Annual Conference & Exposition.* Virtual Conference

Dulock, H. L. (1993). Research design: Descriptive research. *Journal of Pediatric Oncology Nursing, 10*(4), 154-157.

Dunn, K. E., Airola, D. T., Lo, W. J., & Garrison, M. (2013). What teachers think about what they can do with data: Development and validation of the data driven decision-making efficacy and anxiety inventory. *Contemporary Educational Psychology, 38*(1), 87-98.

Durán Cuartero, M., Gutiérrez Porlán, I., & Prendes Espinosa, M. P. (2016). Análisis conceptual de modelos de competencia digital del profesorado universitario. *Revista Latinoamericana de Tecnología Educativa, 15*(97–114), 1–16. https://doi.org/10.17398/1695

Durán Cuartero, M., Prendes Espinosa, M. P. & Gutiérrez Porlán, I. (2019). Certificación de la Competencia Digital Docente: propuesta para el profesorado universitario. *RIED. Revista Iberoamericana de Educación a Distancia, 22(*1), 187-205. Available at: http://dx.doi.org/10.5944/ried.22.1.22069

Durando, M., Blamire, R., Balanskat, A., & Joyce, A. (2007). E Mature schools in Europe.Available at: http://www.eun.org/documents/411753/817341/emature_schools_in_europe_final.pdf/e5d4b90e-24ff-454f-9722-167b402ce7f4

Durek, V., Redep, N. B., & Divjak, B. (2017). Digital maturity framework for higher education institutions. In: *Central European Conference on Information and Intelligent Systems* (pp. 99-106). Varazdin: Faculty of Organization and Informatics.

Dvoretskaya, I. V., & y Uvarov, A. Y. (2020). A combined methodology to assess innovative ict-supported teaching methods based on quantitative data. *МатериалыIV МеждународнойнаучнойконференцииКрасноярск*, 6–9октября, 2020г., 553. Retrieved from https://bit.ly/3iYSgg6

Dyckhoff, A. L., Zielke, D., Bültmann, M., Chatti, M. A., & Schroeder, U. (2012). Design and implementation of a learning analytics toolkit for teachers. *Educational Technology & Society, 15*(3), 58-76.

Eales, L., Gillespie, S., Alstat, R. A., Ferguson, G. M., & Carlson, S. M. (2021). Children's screen and problematic media use in the united states before and during the covid-19 pandemic. *Child Development, 92*(5), e866-e882.

Ebner, M., Khalil, M., Schön, S., Gütl, C., Aschemann, B., Frei, W. & Röthler, D. (2017). How Inverse Blended Learning Can Turn Up Learning with MOOCs? In: *Proceedings of the International Conference MOOC-MAKER 2017*. Antigua Guatemala, Guatemala, November 16-17, 2017 (pp. 21-30).

Ehlers,U. D., Bonaudo, P. (2020). DIGI-HE–A Strategic Reflection Tool on Digitalization at European Higher Education Institutions. In: *EDEN Conference Proceedings* No. 1 (pp. 289-298). Available at: https://doi.org/10.38069/edenconf-2020-ac0027

Eisner, E. W. (1979). The Use of Qualitative Forms of Evaluation For Improving Educational Practice. *Educational Evaluation and Policy Analysis*, *1*(6), 11–19. Available at: https://doi.org/10.3102/01623737001006011

eLEMER. (2010). ICT and School Development. Retrieved from http://ikt.ofi.hu/english/

ePOBMM. (2013). The ePortfolios & Open Badges Maturity Matrix. Retrieved from http://www.eportfolio.eu/matrix

Epstein, J. & Sheldon, S. (2002). Present and accounted for improving students attendance through family and community involvement. *The Journal of Educational Research, 95*(5), 308-318.

European Commission/EACEA/Eurydice (2019). Digital education at school in Europe. Luxembourg: Publications Office of the European Union. Retrieved

from:https://eacea.ec.europa.eu/nationalpolicies/eurydice/sites/eurydice/files/en_digital_education_n.pdf

European Commission/EACEA/Eurydice (2019). *Digital Education at School in Europe.* Eurydice Report. Luxembourg: Publications Office of the European Union.

European Schoolnet (2006). *Policy Peer Reviews ICT in Schools. Framework for the Evaluation of ICT in Education.* Brussels: European Schoolnet.

European schoolnet (2019). *SELFIE. Self-reflection on Effective Learning by Fostering the use of Innovative Educational Technologies.* Brusells: European Commission.

Eurydice (2004). *Evaluation of schools providing compulsory education in Europe.* Brussels: Eurydice European Unit. Available at: http://www.eurydice.org

Eurydice (2017). Conditions of Service for Teachers Working in Early Childhood and School Education. Available at: https://eurydice.eacea.ec.europa.eu/national-education-systems/italy/conditions-service-teachers-working-early-childhood-and-school

Eva, K. W., & Lingard, L. (2008). What's next? A guiding question for educators engaged in educational research. *Med Educ, 42*(8), 752-754.

Farrell, A. D., Sullivan, T. N., Sutherland, K. S., Corona, R., & Masho, S. (2018). Evaluation of the Olweus Bully Prevention Program in an urban school system in the USA. *Prevention Science, 19*(6), 833-847.

FCMM. (2010). Future classroom maturity model. Available at: http://fcl.eun.org/hr/toolset2

Fedeli, L. (2017). School, curriculum and technology: the whatand how of their connections. *Education Sciences & Society-Open Access Journal, 8*(2). Available at: https://bit.ly/3iYU8p8

Feghali, T., Zbib, I., & Hallal, S. (2011). A web-based decision support tool for academic advising. *Journal of Educational Technology & Society, 14*(1), 82-94.

Ferguson, R., Brasher, A., Clow, D., Cooper, A., Hillaire, G., Mittelmeier, J., & Rienties, B. (2016). *Research Evidence on the Use of Learning Analytics.* Seville: Joint Research Centre.

Ferrari, A. (2012). *Digital competence in practice: An analysis of frameworks.* Seville: Joint Research Centre.

Fletcher, A., & Shaw, G. (2012). How does student-directed assessment affect learning? Using assessment as a learning process. *International Journal of Multiple Research Approaches, 6*(3), 245-263.

Fokides, E. (2017). Pre-service teachers' intention to use MUVEs as practitioners–A Structural Equation Modeling Approach. *Journal of Information Technology Education. Research, 16*, 47.

Fokides, E., & Kostas, A. (2020). Pre-service teachers and computers: a (still) troubled relationship. In: D. D. Carbonara (ed.), *Handbook of research on diverse teaching strategies for the technology-rich classroom* (pp. 15-31). Hershey, PA: IGI Global.

Fornell, R., & Vivancos, J. (2009). *El Pla TAC de Centre.* Barcelona: Departament d'Ensenyament. Generalitat de Catalunya.

Forss, K., Marra, M., & Schwartz, R. (eds.). (2011). *Evaluating the complex: Attribution, contribution, and beyond* (Vol. 1). New Jersey, NJ: Transaction Publishers.

Fowler Jr, F. J., & Cosenza, C. (2009). Design and evaluation of survey questions. *The SAGE handbook of applied social research methods, 2*, 375-412.

Ftacnik, M., Sveda, D., & y Kires, M. (2020). Digital transformation of education in Slovakia within the context of European documents. In: *2020 18th International Conference on Emerging eLearning Technologies and Applications (ICETA)* (pp. 113-118). IEEE. Available at: https://doi.org/10.1109/ICETA51985.2020.9379154

Funnell, S. C., & Rogers, P. J. (2011). *Purposeful program theory: Effective use of theories of change and logic models* (Vol. 31). New York, NY: John Wiley & Sons.

García-Barriocanal, E., Sicilia, M. A., & Sánchez-Alonso, S. (2012). Computing with competencies: Modelling organizational capacities. *Expert systems with applications*, *39* (16), 12310-12318.

Garwe, E. C., & Gwati, L. (2018). The role of international and regional quality assurance bodies. *Higher Education Research, 3*(1), 15-22.

Gelderblom, G., Schildkamp, K., Pieters, J., & Ehren, M. (2016). Data-based decision making for instructional improvement in primary education. *International journal of educational research, 80,* 1-14. Available at: https://doi.org/10.1016/j.ijer.2016.07.004

Giannoulis, C., & Ishizaka, A. (2010). A Web-based decision support system with ELECTRE III for a personalised ranking of British universities. *Decision Support Systems*, *48*(3), 488-497.

Giles, C., & Hargreaves, A. (2006). The sustainability of innovative schools as learning organizations and professional learning communities during standardized reform. *Educational administration quarterly*, *42*(1), 124-156.

Gisbert, M., Gonzalez, J., & Esteve, F. (2016). Competencia digital y competencia digital docente: una panorámica sobre el estado de la cuestión. RIITE. *Revista Interuniversitaria de Investigación En Tecnología Educativa, 0*, 74–83.Available at: https://doi.org/10.6018/riite2016/257631

Giunti, Ch., Naldini, M., & y Orlandini, L. (2018). Professional development to support teaching innovation. The experiences of the schools leading the Avanguardie Educative Movement. *Form@ re-Open Journal per la formazione in rete, 18*(2), 103-115. Available at: http://dx.doi.org/10.13128/formare-23109

Godfrey, D. (2020). *From external evaluation, to school self-evaluation, to peer review. In School Peer Review for Educational Improvement and Accountability.* Cham: Springer.

Govaerts S., Verbert K., Klerkx J., Duval E. (2010) Visualizing Activities for Self-reflection and Awareness. In: Luo X., Spaniol M., Wang L., Li Q., Nejdl W., Zhang W. (eds.) *Advances in Web-Based Learning – ICWL 2010. ICWL 2010. Lecture Notes in Computer Science*, vol 6483 (pp.91-100). Berlin/Heidelberg: Springer. Available at: https://doi.org/10.1007/978-3-642-17407-0_10

Grammatikopoulos, V. (2006). Educational Evaluation: Evaluation Models of Educational Programs. *Research in Physical Education & Sports, 4(*2), 237-246.

Grande-de-Prado, M., Cañón, R., García-Martín, S., & Cantón, I. (2020). Digital competence and gender: Teachers in training. A case study. *Future Internet, 12*(11), 204. Available at: https://doi.org/10.3390/fi12110204

Greener, S. (2018). Research limitations: the need for honesty and common sense. *Interactive Learning Environments, 26*(5), 567-568. Available at: https://doi.org/10.1080/10494820.2018.1486785

Grissom, J. A., Rodriguez, L. A., & Kern, E. C. (2017). Teacher and principal diversity and the representation of students of color in gifted programs: Evidence from national data. *The Elementary School Journal*, *117*(3), 396-422.

Guàrdia, L., Crisp, G., & Alsina, I. (2017). Trends and challenges of e-assessment to enhance student learning in Higher Education. In: E. Cano & G. Ion (eds.),

Innovative practices for higher education assessment and measurement (pp. 36-56). Hershey, PA: IGI Global.

Guba E. G. (1978). *Toward a methodology of naturalistic inquiry in educational evaluation* (CSE Monograph Series in Evaluation No. 8). Los Angeles: Center for the Study of Evaluation, University of California.

Godmundsdottir, G. B., & Hathaway, D. M. (2020). 'We always make it work': Teachers' agency in the time of crisis. *Journal of Technology and Teacher Education, 28*(2), 239-250. Available at: https://www.learntechlib.org/primary/p/216242/

Gutiérrez Castillo, J. J., Cabero Almenara, J., & Estrada Vidal, L. I. (2017). Diseño y validación de un instrumento de evaluación de la competencia digital del estudiante universitario. *Revista Espacios, 38*(10), 54725.

Hakansson Lindqvist, M. (2015). *Conditions for technology enhanced learning and educational change: a case study of a 1:1 initiative*. (Dissertation). Umea: Department of Education, Umea University.

Hamilton, L., Halverson, R., Jackson, S. S., Mandinach, E., Supovitz, J. A., Wayman, J. C., Pickens, C., Martin, E., & Steele, J. L. (2009). Using Student Achievement Data to Support Instructional Decision Making. *United States Department of Education,* Retrieved from: https://repository.upenn.edu/gse_pubs/279.

Hamilton, V. M., & Reeves, T. D. (2022). Relationships between course taking and teacher self-efficacy and anxiety for data-driven decision making. *The Teacher Educator, 57*(2), 136-154.

Hammond, R.L. (1973). Evaluation at the local level. In B. Worthen, και J. Sanders (Eds), *Educational evaluation: Theory and practice* (pp. 123-134). Ohio, OH: Jones.

Hargreaves, A. & Braun, H. (2013). *Data-Driven Improvement and Accountability.* Boulder, CO: National Education Policy Center. Retrieved from

http://nepc.colorado.edu/publication/data-driven-improvement accountability/.

Hargreaves, A., Morton, B., Braun, H., & Gurn, A. M. (2015). The changing dynamics of educational judgment and decision making in a data-driven world. In S. Chitpin & C. W. Evers (Eds.), *Decision making in educational leadership: Principles, policies and practices* (pp. 3–20). NY: Routledge.

Harrell, S., & Bynum, Y. (2018). Factors affecting technology integration in the classroom. *Alabama Journal of Educational Leadership, 5*, 12-18.

Harris, R. (2007). *Unravelling the notion of organizational capability: What do writers say it is and VET providers think it is*? PhD dissertation, AVETRA.

Harris, A. (2003). Teacher leadership as distributed leadership: heresy, fantasy or possibility?. *School leadership & management, 23*(3), 313-324.

Hauge, T. E., Norenes, S. O., & Vedoy, G. (2014). School leadership and educational change: Tools and practices in shared school leadership development. *Journal of Educational Change, 15*(4), 357-376

Hawkins, C., & Bailey, L. E. (2020). A New Data Landscape: IR's Role in Academic Analytics. *New Directions for Institutional Research*, *2020* (185-186), 87-103. Available at: https://doi.org/10.1002/ir.20331

HEInnovate. (2013). [Home Page]. Available at: https://www.heinnovate.eu/en

Helenius, K., Linko, L., & y Pirttilä, H. (2019). Viitekehys digikyvykkyyden jäsentämiseksi: DigCompOrg. AMK-lehti/UAS Journal. Available at: https://bit.ly/2Wyl1ch

Helfenberger, M., Prendes-Espinosa, M., & Gutiérrez-Porlán, I. (2019). Attesting and Certificating university teachers' professional and digital competencies. In *The Online, Open and Flexible Higher Education Conference 2019 – Proceedings,* EADTU, Madrid (Spain), 25.

Hernandez, B., Montaner, T., Sese, F. J., Urquizu, P. (2011). The role of social motivations in e-learning: How do they affect usage and success of ICT interactive tools? *Computers in Human Behavior, 27*(6), 2224–2232. Available at: 10.1016/j.chb.2011.07.001.

Hogan, K., & Weathers, K. C. (2003). Psychological and ecological perspectives on the development of systems thinking. In *Understanding urban ecosystems* (pp. 233– 260). New York, NY: Springer. Available at: https://doi.org/10.1007/0-387-22615-X_15

Hong, J., Snell, R., y Rowley, C. (2017). *Organizational learning in Asia. Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado (INTEF).* Marco Común de Competencia Digital Docente. Atlanta: Elsevier. Available at: https://bit.ly/2WuNuj5

Hoogland, Hoogland, I., Schildkamp, K., van der Kleij, F., Heitink, M., Kippers, W., Veldkamp, B. & Dijks-tra, A. M. (2016). Prerequisites for data-based decision making in the classroom: Rese-arch evidence and practical illustrations. Teaching and Teacher Education, 60, S. 377–386. Available at: https://doi.org/10.1016/j.tate.2016.07.

Huber, S. G., & Helm, C. (2020). COVID-19 and schooling: evaluation, assessment and accountability in times of crises—reacting quickly to explore key issues for policy, practice and research with the school barometer. *Educational Assessment, Evaluation and Accountability, 32*(2), 237-270.

IEP (2016). "Experts' Reports", report prepared by the IEP and academic experts for the OECD review team, March 2016.

Ifenthaler, D., & Schumacher, C. (2016a). Learning Analytics im Hochschulkontext. *WiSt - Wirtschaftswissenschaftliches Studium, 4*, 172–177. Available at: https://doi.org/10.15358/0340-1650- 2016-4-176.

Ifenthaler, D., & Schumacher, C. (2019). Releasing personal information within learning analytics systems. In: D. G. Sampson, J. M. Spector, D. Ifenthaler, P.

Isaias, & S. Sergis (eds.), *Learning technologies for transforming teaching, learning and assessment at large scale* (pp. 3–18). New York, NY: Springer. Available at: https://doi.org/10.1007/978-3-030-15130-0_1.

Ikemoto, G. S., & Marsh, J. A. (2007). Cutting through the "data-driven" mantra: Different conceptions of data-driven decision making. *Teachers College Record, 109*(13), 105-131. Available at: https://doi.org/10.1177/016146810710901310

Ioannidis, J. P. (2007). Limitations are not properly acknowledged in the scientific literature. *Journal of clinical epidemiology, 60* (4), 324-329.

Jarvela, S., Jarvenoja, H., Malmberg, J., Isohatala, J., & Sobocinski, M. (2016). How do types of interaction and phases of self-regulated learning set a stage for collaborative engagement? *Learning and Instruction, 43*, 39–51. Available at: https://doi.org/10.1016/j.learninstruc. 2016.01.005

Jarvela, S., Kirschner, P. A., Panadero, E., Malmberg, J., Phielix, C., Jaspers, J., Järvenoja, H. (2014). Enhancing socially shared regulation in collaborative learning groups: designing for CSCL regulation tools. *Educational Technology Research and Development, 63*(1), 125–142. Available at: https://doi.org/10.1007/s11423-014-9358-1

Jarvela, S., Malmberg, J., Haataja, E., Sobocinski, M., & Kirschner, P. A. (2019). What multimodal data can tell us about the students' regulation of their learning process? *Learning and Instruction, 72*, 101203. Available at: https://doi.org/10.1016/j.learninstruc.2019.04.004

JISC. (2010). Jisc strategic ICT toolkit. Available at: https://www.jisc.ac.uk/g

Johnson, D., & Kress, G. (2003). Globalisation, literacy and society: Redesigning pedagogy and assessment. Assessment in Education: Principles. *Policy & Practice, 10*(1), 5-14.

Joseph, F. H. J. R., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate data analysis*. (7th ed.). London: Pearson Education.

Jovanovic, J., Gasevic, D., Brooks, C., Devedzic, V., Hatala, M., Eap, T., & Richards, G. (2008). LOCO-Analyst: semantic web technologies in learning content usage analysis. *International Journal of Continuing Engineering Education and LifeLong Learning, 18*(1), 54-76.

Jugo, G., Balaban, I., Pezelj, M., & y Redjep, N. B. (2017). Development of a Model to Assess the Digitally Mature Schools in Croatia. *IFIP World Conference on Computers in Education* (pp. 169-178). Available at: https://doi.org/10.1007/978-3-319-74310-3_19.

Jukić, T., Pevcin, P., Benčina, J., Dečman, M., & Vrbek, S. (2019). Collaborative innovation in public administration: Theoretical background and research trends of co-production and co-creation. *Administrative Sciences, 9(*4), 90.

Kahneman, D., & Frederick, S. (2007). Frames and brains: Elicitation and control of response tendencies. *Trends in Cognitive Sciences*, *11*(2): 45–46.

Kampylis, P., Punie, Y., Devine, J. (2015). *Promoting Effective Digital-Age Learning: A European Framework for Digitally-Competent Educational Organizations.* EUR 27599 EN. Luxembourg: Publications Office of the European Union. Available at: https://doi.org/10.2791/54070

Karagiannidis, C., Mostert, C., Hentschker, C., Voshaar, T., Malzahn, J., Schillinger, G., ... & Busse, R. (2020). Case characteristics, resource use, and outcomes of 10 021 patients with COVID-19 admitted to 920 German hospitals: an observational study. *The Lancet Respiratory Medicine*, *8*(9), 853-862.

Kaufman, T. E., Graham, C. R., Picciano, A. G., Popham, J. A., & Wiley, D. (2014). Data-Driven Decision Making in the K-12 Classroom. In J.M. Spector, M.D. Merrill, J. Elen, & M.J. Bishop, (Eds.) *Handbook of Research on Educational Communications and Technology* (pp. 337-346). New York: Springer

Khalil, M., & Ebner, M. (2016) Clustering patterns of engagement in Massive Open Online Courses (MOOCs): the use of learning analytics to reveal student categories. *Journal of Computing in Higher Education, 29*, 114-132. Available at: https://doi.org/10.1007/s12528-016-9126-9

Khalil, M., & Ebner, M. (2016) De-Identification in Learning Analytics. *Journal of Learning Analytics, 3*(1), 129 – 138. Available at: https://doi.org/10.18608/jla.2016.31.8

Khalil, M., & Ebner, M. (2016). Learning Analytics in MOOCs: Can Data Improve Students Retention and Learning? In: *Proceedings of EdMedia: World Conference on Educational Media and Technology 2016* (pp. 569-576). Miramar, FL: Association for the Advancement of Computing in Education (AACE).

Khalil, M., & Ebner, M. (2016). What is Learning Analytics about? A Survey of Different Methods Used in 2013-2015. In: *Proceedings of Smart Learning Conference*, Dubai, 14-16 December 2015 (pp. 294-304).

Khalil, M., Ebner, M., & Admiraal, W. (2017). How can Gamification Improve MOOC Students Engagement? In: *Proceedings of the European Conference on Game Based Learning*, Graz (pp. 819-828).

Kimber, K., & Wyatt-Smith, C. (2010). Secondary students' online use and creation of knowledge: Refocusing priorities for quality assessment and learning. *Australasian journal of educational technology, 26*(5), 1054.

King, J., & South, J. (2017). *Reimagining the role of technology in higher education: A supplement to the national education technology plan.* Washington, DC: US Department of Education.

Klašnja-Milićević, A., Ivanović, M., & Budimac, Z. (2017). Data science in education: Big data and learning analytics. *Computer Applications in Engineering Education, 25*(6), 1066-1078.

Koedinger, K. R., Stamper, J. C., Leber, B., & Skogsholm, A. (2013). Learnlab's datashop: A data repository and analytics tool set for cognitive science. *Top Cogn Sci, 5*(3), 668-669.

Kolokotronis, D., & Tsiga, G. (2015). Educational evaluation from a scientific and historical perspective: tool for improvement or threat? In *Proceedings of the 1st Panhellenic Conference on Educational Innovation (volume A),* 8-18, Larisa.

Kools, M., & Stoll, L. (2016). *What Makes a School a Learning Organization?* OECD Education Working Papers, No. 137. Paris: OECD Publishing. Available at: http://dx.doi.org/10.1787/5jlwm62b3bvh-en

Kotsiantis, S. (2012). Use of machine learning techniques for educational proposes: a decision support system for forecasting students' grades. *Artif Intell Rev, 37*, 331–344.

Kowalski, T. J., & Lasley, T. J., II. (eds.) (2009). *Handbook of data-based decision making in education.* New York, NY: Routledge

Kraja, E., Taraghi, B. & Ebner, M. (2017). The Multiplication Table as an innovative Learning Analytics Application. In: J. Johnston (ed.), *Proceedings of EdMedia: World Conference on Educational Media and Technology 2017* (pp. 810-820). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Kyriakides, L., & Creemers, B. P. (2008). Using a multidimensional approach to measure the impact of classroom-level factors upon student achievement: A study testing the validity of the dynamic model. *School effectiveness and school improvement*, *19*(2), 183-205.

Kyriakides, L., & Campbell, R. J. (2004). School self-evaluation and school improvement: A critique of values and procedures. *Studies in educational evaluation, 30*(1), 23-36.

Krumsvik, R. J. (2011). Digital competence in the Norwegian teacher education and schools. *Hogre utbildning*, *1*(1), 39-51.

Kurilovas, E. (2020). On data-driven decision-making for quality education. *Computers in Human Behavior, 107*, 105774.

Ladden, B. (2015). *School evaluation: an exploration of the impact of evaluation processes on the staff ın an Irish post-primary school.* (The unpublished dissertation). Dublin City University, Ireland.

Lai, M.K., & Schildkamp, K. (2013). Data-based Decision Making: An Overview. In K. Schildkamp, M.K. Lai, L. Earl (eds.), *Data-based Decision Making in Education* (pp. 9-21), Dordrecht: Springer.

Lamb, J. (2018). To boldly go: Feedback as digital, multimodal dialogue. *Multimodal technologies and interaction, 2*(3), 49.

Lavertu, S. (2014). We All Need Help: "Big Data" and the Mismeasure of Public Administration.*Public Administration Review 76, 6,* 864–872. Available at: doi:10.1111/puar.12436.

Lemire, S., Peck, L. R., & Porowski, A. (2020). The growth of the evaluation tree in the policy analysis forest: Recent developments in evaluation. *Policy studies journal, 48*, S47-S70.

Lennox, J., Reuge, N., & Benavides, F. (2021). UNICEF's lessons learned from the education response to the COVID-19 crisis and reflections on the implications for education policy. International Journal of Educational Development, 85, 102429.

Levin, J. A., & Datnow, A. (2012). The principal role in data-driven decision making: Using case-study data to develop multi-mediator models of educational reform. *School effectiveness and school improvement, 23*(2), 179-201 Available at: doi:10.1080/09243453.2011.599394

LIKA. (2013). Ledning, infrastruktur, kompetens, användning. Retrieved from: http://www.iktpedagogerna.se/lika-it-tempen-pa-skolan/

Liles, R. T., & Mustian, R. D. (2004). Core competencies: A systems approach for training and organizational development in extension. *The Journal of Agricultural Education and Extension, 10*(2), 77-82.

Lima Nogueira, A. C., & Bataglia, W. (2012). Transaction costs and organizational competences: Explaining the governance structure for manufacturing stage. *Journal of technology management & innovation*, *7*(1), 159-174.

Linko, L., Kantola, M., & Friman, M. (2016). An online journal promoting digital collaboration in Finnish higher education institutions. *EAPRIL 2016*, 228.

Linoff, G. S., & Berry, M. J. (2011). *Data mining techniques: for marketing, sales, and customer relationship management.* New York, NY: John Wiley & Sons.

Livieris, I. E., Drakopoulou, K., Mikropoulos, T. A., Tampakas, V., & Pintelas, P. (2018). An ensemble-based semi-supervised approach for predicting students' performance. In *Research on e-Learning and ICT in Education* (pp. 25-42). Springer, Cham.

Livieris, I. E., Mikropoulos, T., & Pintelas, P. (2016). A decision support system for predicting students' performance. *Themes Sci Technol Educ, 9*, 43–57.

Livieris, I.E., Drakopoulou, K., Pintelas, P. (2012). Predicting students' performance using artificial neural networks.In *8th Panhellenic Conference with International Participation Information and Communication Technologies in Education*, Volos, 28-30 September 2012.

Livieris, I. E., Kotsilieris, T., Tampakas, V., & Pintelas, P. (2019). Improving the evaluation process of students' performance utilizing a decision support software. *Neural Computing and Applications, 31*(6), 1683-1694.

Livingston, K., & Flores, M. A. (2017). Trends in teacher education: a review of papers published in the European journal of teacher education over 40 years. *European Journal of Teacher Education, 40* (5), 551-560.

Lockyer, L., Heathcote, E., & Dawson, S. (2013). Informing pedagogical action: Aligning learning analytics with learning design. *American Behavioral Scientist*, *57* (10), 1439-1459.

Long, P., Siemens, G., Conole, G., & Gašević, D. (2011). *Proceedings of the 1st International Conference on Learning Analytics and Knowledge*. Banff, Alberta, Canada. Available at: doi: http://dx.doi.org/10.1145/2090116

Loo, B. (2018). *Education in the United States of America.* World Education News and Reviews. Available at: https://wenr.wes.org/2018/06/education-in-the-united-states-of-america

Lucas, M., & Moreira, A. A. (2017). Information and communication overload: Can digcomp help?. In *Information and communication overload in the digital age* (pp. 157-175). IGI Global.

Luna, J. M., Castro, C., & Romero, C. (2017). MDM tool: A data mining framework integrated into Moodle. *Computer Applications in Engineering Education, 25*(1), 90-102.

MacBeath, J. (2005). *Schools must speak for themselves: The case for school self-evaluation*. Routledge.

MacBeath, J. (2010). Self-evaluation for school improvement. In: A. Hargreaves, A. Lieberman & D. Hopkins (eds.) *International handbook of educational change.* (2nd ed.). NewYork, NY: Springer.

MacBeath, J., & McGlynn, A. (2004). *Self-evaluation: What's in it for Schools?*. Routledge.

MacBeath, J., & Mortimore, P. (2001). *Improving school effectiveness.* Buckingham: Open University Press.

MacBeath, J. E., Schratz, M., Jakobsen, L., & Meuret, D. (2000). *Self-evaluation in European schools: A story of change*. Psychology Press.

MacDonald, D. (2003). Curriculum Change and the Post-Modern World: Is the Curriculum-Reform Movement an Anachronism? *Journal of Curriculum Studies, 35*(2), 139–49.

MacGilchrist, B. Myers, K., & Reed, J. (2004). *The intelligent School, Edition.* (2nd ed.) London: SAGE Publications Ltd. eBook.

Maghnouj, S., Salinas, D., Kitchen, H., Guthrie, C., Bethell, G., & Fordham, E. (2020). *OECD Reviews of Evaluation and Assessment in Education.* Paris: OECD.

Mandinach, E., & Gummer, E. (2013). A systemic view of implementing data literacy in educator preparation. *Educational Researcher, 42*, 30–37.

Mandinach, E., & Gummer, E. (2015). Data-Driven Decision Making: Components of the Enculturation of Data Use in Education. *Teachers College Record, 117*(4), 1-8.

Mandinach, E. B., & Jackson, S. S. (2012). *Transforming teaching and learning through data-driven decision making*. Corwin Press.

Mandinach, E. B., & Honey, M. (Eds.). (2008). *Data-driven school improvement: Linking data and learning*. Teachers College Press.

Mandinach, E. B., & Schildkamp, K. (2021). Misconceptions about data-based decision making in education: An exploration of the literature. *Studies in Educational Evaluation*, *69*, 100842.

Mandinach, E. B. (2012). A perfect time for data use: Using data-driven decision making to inform practice. *Educational Psychologist*, *47*(2), 71-85.

Mao, J., Ifenthaler, D., Fujimoto, T., Garavaglia, A., & Rossi, P. G. (2019). National policies and educational technology: a synopsis of trends and perspectives

from five countries. *TechTrends, 63*(3), 284–293.Available at: https://doi.org/10.1007/s11528-019-00396-0.

Marsh, J. A. (2012). Interventions promoting educators' use of data: Research insights and gaps. *Teachers College Record*, *114*(11), 1-48.

Marsh, J. A., & Farrell, C.C. (2014). How leaders can support teachers with data-driven decision making A framework for understanding capacity building. *Educational Management Administration & Leadership*, 1-21.

Marsh, J. A., Sloan McCombs, J., & Martorell, F. (2010). How instructional coaches support data-driven decision making: Policy implementation and effects in Florida middle schools. *Educational policy*, *24*(6), 872-907

Marshall, S. (2010). A Quality Framework for Continuous Improvement of E-Learning: The E-Learning Maturity Model. *Journal of Distance Education, 24*(1), 143-166.

Martelo, S., Barroso, C., & Cepeda, G. (2013). The use of organizational capabilities to increase customer value. *Journal of Business Research. 66(*10*)*, 2042–2050.

Matthewman, S., Blight, A., & Davies, C. (2004). What does multimodality mean for English? Creative tensions in teaching new texts and new literacies. *Education, Communication & Information, 4*(1), 153-176.

McKay, T., Miller, K., & Tritz, J. (2012). What to do with actionable intelligence: E2Coach as an intervention engine. In: *Proceedings of the 2nd international conference on learning analytics and knowledge* (pp. 88-91).

Means, B., Padilla, C., & Gallagher, L. (2010). Use of education data at the local level: From accountability to instructional improvement. *US Department of Education*.

Megalou, E., & Kaklamanis, C. (2018). Open content, OER repositories, interactive textbooks and a digital social platform: The case of Greece. In M. Carm (Ed.), *Proceedings of END 2018 International Conference on Education and New*

Developments (pp. 146-150). Lisbon: inSciencePress. Retrieved from: http://dschool.edu.gr/dschool2project/promotion/publications/

Metfessel, N. & Michael, W. B. (1967). A paradigm involving multiple criterion for the evaluation of the effectiveness of school programs. *Educational and Psychological Measurement, 27,* pp. 931-943

Microsoft IF & SRT. (2009). Microsoft Innovation framework & self-reflection tool. Retrieved from http://www.is-toolkit.com/self_reflection.html

Miranda, J., Rey, P. A., & Robles, J. M. (2012). udpSkeduler: A Web architecture based decision support system for course and classroom scheduling. *Decision Support Systems, 52*(2), 505-513.

Miravete, Á. D. F., & Espinosa, M. P. P. (2021). Evaluación de la competencia digital de un centro de enseñanza secundaria a partir del modelo DigCompOrg. *Revista Complutense de Educacion, 32*(4), 651-662.

Monks, C. P., Mahdavi, J., & Rix, K. (2016). The emergence of cyberbullying in childhood: Parent and teacher perspectives. *Psicología Educativa*, *22*(1), 39-48.Available at: https://doi.org/10.1016/j.pse.2016.02.002

Morgan, D. E. (2015). *An Unbroken Educational Apartheid Legacy: Chicago's South Suburban Predominantly Black Communities of Color.* Bloomington, IN: AuthorHouse.

Morris, T. H., & Rohs, M. (2021). The potential for digital technology to support self-directed learning in formal education of children: A scoping review. *Interactive learning environments, January 2021*, 1-14.

Mourshed, M., Chijioke, C., & Barber, M. (2010). *How the world's most improved school systems keep getting better*. London: McKinsey & Company.

NACCE SRF. (2005). Self-review Framework (SRF). Retrieved from https://www.naacesrf.com/

Narine, L., & Harder, A. (2021). Comparing the Borich model with the Ranked Discrepancy Model for competency assessment: A novel approach. *Advancements in Agricultural Development, 2*(3), 96-111.

Naxakis, A. (2002). *Teacher evaluation. Evaluation in Education. Who, whom and why.* Athens: Savvalas.

NAEYC (National Association for the Education of Young Children) (2009). *NAEYC Standards for Early Childhood Professional Preparation Programs.* Available at: https://www.naeyc.org/files/naeyc/file/.../PSDAP.pdf.

NCTE (2009). Elearning roadmap. (2009). Available at: http://www.ncte.ie/elearningplan/roadmap/.http://www.ncte.ie/elearningplan/roadmap/

Nevo, D. (2013). The conceptualization of educational evaluation: An analytical review of the literature. *New directions in educational evaluation,* 15-29.

Newland, B., & Trueman, P. (2017). *Learning Analytics in UK HE 2017 A HeLF Survey Report*. Heads of eLearning Group.Available at: https://drive.google.com/file/d/0Bx5p8mXFK743dWFvdGFranZSUk0/view

Ng, I. C., & Wakenshaw, S. Y. (2017). The Internet-of-Things: Review and research directions. *International Journal of Research in Marketing, 34*(1), 3-21.

Nouri, J., Ebner, M., Ifenthaler, D., Saqr, M., Malmberg, J., Khalil, M., Bruun, J., Viberg, O., Ángel Conde González, M., Papamitsiou, Z., & Dalvad Berthelsen,U., (2019). Efforts in Europe for Data-Driven Improvement of Education: A Review of Learning Analytics Research in Seven Countries. *International Journal of Learning Analytics and Artificial Intelligence for Education, 1*(1), 8-27. Available at: https://doi.org/10.3991/ijai.v1i1.11053

Nouri, J., Zhang, L., Mannila, L. & Norén, E. (2019). Development of computational thinking, digital competence and 21st century skills when

learning programming in K-9. *Education Inquiry, 11*(1), 1-17. Available at: https://doi.org/10.1080/20004508.2019.1627844.

Ochoa-Urrego, R. L., & Peña-Reyes, J. I. (2021). Digital Maturity Models: A Systematic Literature Review. *Management for Professionals*, 71–85. Available at: https://doi.org/10.1007/978-3-030-69380-0_5

OECD (2001), *Education at a Glance 2001: OECD Indicators*, OECD Publishing, Paris, Available at: https://doi.org/10.1787/eag-2001-en.

OECD (2011). *Education Policy Advice for Greece, Strong Performers and Successful Reformers in Education,* OECD Publishing, Paris, Available at: http://dx.doi.org/10.1787/9789264119581-en.

OECD (2013), *Education at a Glance 2013: OECD Indicators*, OECD Publishing, Paris, Available at: https://doi.org/10.1787/eag-2013-en.

OECD (2015). Education at a Glance 2015: OECD Indicators, OECD Publishing, Paris, Available at: http://dx.doi.org/10.1787/eag-2015-en.

OECD. (2017). Education policy in Greece: A preliminary assessment. Available at: http://www.oecd.org/education/Education-Policy-in-Greece-Preliminary-Assessment-2017.pdf.

OECD (2018), *Education at a Glance 2018: OECD Indicators*, OECD Publishing, Paris, Available at: https://doi.org/10.1787/eag-2018-en.

OECD (2019), *Education at a Glance 2019: OECD Indicators*, OECD Publishing, Paris, Available at: https://doi.org/10.1787/f8d7880d-en.

OECD (2020), *Education at a Glance 2020: OECD Indicators*, OECD Publishing, Paris, Available at: https://doi.org/10.1787/69096873-en.

Olafsdottir, B., Jónasson, J. T., Sigurðardóttir, A. K., & Aspelund, T. (2022). The mechanisms by which external school evaluation in Iceland influences

internal evaluation and school professionals' practices. *Nordic Journal of Studies in Educational Policy*, 1-16.

Omidinia, S., Masrom, M., & Selamat, H. (2013, July). An examination of the concept of smart school: An innovation to address sustainability. In *2nd International Conference on Advances in Computer Science and Engineering* (CSE 2013) (pp. 328-331). Atlantis Press.

OPEKA. (2012). *Opeka System Design.*Available at: http://opeka.fi/Opeka-SystemDesign-1.0.pdf

OpenLearn, (2006). Understanding organizational capabilities [online] Available at: http://www.open.edu/openlearn/money-management/management/human-resources/strategic-view-performance/content-section-3.1

Osifo, S. J., & Omoregbe, O. (2011). Organizational change with the system and complexity theories in mind. *Knowledge Review*, *22*(2), 52-58.

Owston, R. (2008). Models and methods for evaluation. In *Handbook of research on educational communications and technology* (pp. 605-617). Routledge.

Page, L. C., Fullerton, J., Bacher-Hicks, A., Owens, A., Cohodes, S. R., West, M. R., & Glover, S. (2013). The Strategic Data Project's Strategic Performance Indicators. *Education Finance and Policy, 8*(3), 435-456.

Palaiokrasas, S., Dimitropoulos, S., Kostakis, A., & Vretakou, B. (1997). Evaluation of education: European trends and a proposal for a Greek policy framework. *Athens, Center for Political Research and Education, 1st*.

Pandey, P., & Pandey, M. M. (2015). *Research methodology tools and techniques.* Romania: Bridge Center.

Panesi, S., Bocconi, S., & y Ferlino, L. (2020). Promoting Students' Well-Being and Inclusion in Schools Through Digital Technologies: Perceptions of Students, Teachers, and School Leaders in Italy Expressed Through SELFIE Piloting

Activities. *Frontiers in Psychology, 11*, 1563. Available at: https://doi.org/10.3389/fpsyg.2020.01563

Papadogiannis, I., Poulopoulos, V. & Wallace, M. (2020). A critical review of data mining for education: What has been done, what has been learnt and what remains to be seen. *International Journal of Educational Research Review, 5*(4), 353-372.

Papatsoris, I. (2015).*Electronic governance in the field of Primary and Secondary Education.* Master thesis. University of Patras. Available at: http://nemertes.lis.upatras.gr/jspui/bitstream/10889/9092/1/ELECTRONIC%20GOVERNANCE%20PAPATSORIS.pdf

Park, V., & Datnow, A. (2009). Co-constructing distributed leadership: District and school connections in data-driven decision-making. *School leadership and Management, 29*(5), 477-494.

Pashiardis, P., & Brauckmann, S. (2009). Evaluation of school principals. In: J. Lumby, G. M. Crow & P. Pashiardis (eds.), *International handbook on the preparation and development of school leaders* (pp. 281-297). Abingdon-on-Thames: L Routledge.

Paz, A. M., Gerardo, B. D., & Tanguilig III, B. T. (2014). Academic decision support system for college completion model. *International conference on advances in computer and electronics technology*, Hong Kong, 26-27 August 2014.

Pearson, W. R. (1998). Empirical statistical estimates for sequence similarity searches. *Journal of molecular biology, 276*(1), 71-84.

Peck, L. R., & Gorzalski, L. M. (2009). An evaluation use framework and empirical assessment. *Journal of Multi Disciplinary Evaluation*, *6*(12), 139-156.

Peck, L. R. (2015). Using impact evaluation tools to unpack the black box and learn what works. *Journal of Multi-Disciplinary Evaluation, 11*(24), 54-67.

Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: results from a worldwide educational assessment. *Computers & education, 37*(2), 163- 178. Available at: http://users.ntua.gr/vvesk/ictedu/article5_pelgrum.pdf

Perugini, M. L. L., & Solano, A. C. (2021). Normal and maladaptive personality traits as predictors of motives for social media use and its effects on well-being. *Psychological reports, 124*(3), 1070-1092. Available at: 10.1177/0033294120922495323755 34

Peterson, R. A., & Kim, Y. (2013). On the relationship between coefficient alpha and composite reliability. *Journal of applied psychology, 98*(1), 194.

Petropoulou, O., Kasimati, A., & Retalis, S. (2015). *Contemporary educational assessment with the use of educational technologies.* Available at: http://hdl.handle.net/11419/233

Petterson, F. (2017). On the issues of digital competence in educational contexts: a review of literature. *Education and information technologies, 23*(3),1005-1021. Available at: https://doi.org/10.1007/s10639-017-9649-3

Pettersson F. (2018). On the issues of digital competence in educational contexts–a review of literature. *Education and Information Technologies*, 23(3), 1005–1021. Available at: https://doi.org/10.1007/s10639-017-9649-3.

Picciano, A. G. (2012). The Evolution of Big Data and Learning Analytics in American Higher Education. *Online Learning*, *16*(3). Available at: https://doi.org/10.24059/olj.v16i3.267

Plaatjies, B. (2019). Investigating principal capacity in literacy instructional leadership at selected primary schools. *Journal of Social Studies Education Research, 10*(3), 136-160.

Prendes Espinosa, M.P. (2018). The Educational Technology in the Pedagogy of the 21st century: a 3D vision. *RiiTE Interuniversity Journal of Research in*

Educational Technology, (4). Available at: https://doi.org/10.6018/riite/2018/335131

Prendes Espinosa, M. P., Castañeda, L., Solano, I., Roig, R., Mª Victoria, A., & Serrano Sánchez, J. L. (2016). Validation of a questionnaire on work and learning habits for future professionals: Exploring personal learning environments. *Revista Electronica de Investigacion y Evalucation Educativa, 22*(2), 1-46.

Prendes, E., García, R., & y González, C. (2020). Enfoque integrado de análise da competência digital em instituições de ensino superior: professores e alunos no contexto organizacional. *Revista Panorâmica-ISSN, 32*(12), 2238-9210. Available at: https://bit.ly/3f6T8OH

Prendes-Espinosa, P., Solano-Fernández, I. M., & García-Tudela, P. A. (2021). EmDigital to Promote Digital Entrepreneurship: The Relation with Open Innovation. *Journal of Open Innovation: Technology, Market, and Complexity, 7*(1), 63. Available at: doi:10.3390/joitmc7010063

Price, J. H., & Murnan, J. (2004). Research limitations and the necessity of reporting them. *American Journal of Health Education, 35*(2), 66.

Print, M. (1993). *Curriculum development and design*. St. Leonards, NSW, Australia: Allen & Unwin.

Provus, M.M. (1971). *Discrepancy evaluation*. Berkeley, CA: McCutcham

Ramírez-Rueda, M. C., Cózar-Gutiérrez, R., Roblizo Colmenero, M. J., González-Calero, J. A. (2021). Towards a coordinated vision of ICT in education: A comparative analysis of Preschool and Primary Education teachers' and parents' perceptions. *Teach. Educ., 100*, 103300.

Ramploud, A., Funghi, S., & Mellone, M. (2022). The time is out of joint. Teacher subjectivity during COVID-19. Journal of Mathematics Teacher Education, 25(5), 533-553.

Rea, L. M., & Parker, R. A. (2014). *Designing and conducting survey research: A comprehensive guide.* New York, NY: John Wiley & Sons.

Redecker, C. (2017). European framework for the digital competence of educators: DigCompEdu (No. JRC107466). Joint Research Centre (Seville site).

Ređep, N. B., Balaban, I., Žugec, B., Čalopa, M. K. & Divjak, B. (2019). Framework for digitally mature schools. *European Journal of Open, Distance and E-learning*, 22(1), 360-371. Available at: http://www.eurodl.org/?p=special&sp=articles&inum=10&article=783

Redep, N. B. (2021). Comparative overview of the digital preparedness of education systems in selected CEE countries. *Center for Policy Studies. CEU Democracy Institute.*

Reeves, T. D., & Chiang, J. L. (2018). Online interventions to promote teacher data-driven decision making: Optimizing design to maximize impact. *Studies in Educational Evaluation, 59*, 256-269.

Reeves, P. M., Pun, W. H., & Chung, K. S. (2017). Influence of teacher collaboration on job satisfaction and student achievement. *Teaching and Teacher Education, 67*, 227-236.Available at: Available at: https://doi.org/10.1016/j.tate.2017.06.016.

Richtel, M. (2021). Children's screen time has soared in the pandemic, alarming parents and researchers. *New York Times*, 06-22.

Ristic, M. (2017). E-maturity in Schools. *Croatian Journal of Education: Hrvatski časopis za odgoj i obrazovanje, 19* (Sp. Ed. 3), 317-334.

Robson, C. (2010). Real-World Research—A Tool for Social Scientists and Professional Researchers (Translated by Dalakou, V., Vasilikou, K.). Gutenberg (1993 Edition), Athens.

Rodríguez, M. U., Cantabrana, J. L. L., & Cervera, M. G. (2021). Validation of a tool for self-evaluating teacher digital competence. *Educación XX1, 24*(1), 353-373.

Romero, C., & Ventura, S. (2020). Educational data mining and learning analytics: An updated survey. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, *10*(3), e1355. Available at: https://doi.org/10.1002/widm.1355

Romero, C., Espejo, P. G., Zafra, A., Romero, J. R., & Ventura, S. (2013). Web usage mining for predicting final marks of students that use moodle courses. *Comput Appl Eng Educ 21*(1), 135–146.

Ross, P. T., & Zaidi, N. L. B. (2019). Limited by our limitations. *Perspectives on medical education, 8*(4), 261-264.

Saalman, D. R. (2020). Objectives driven participatory evaluation model. *Journal of Modern Applied Statistical Methods, 18*(2), 14.

Sadoux, M. (2010). Generic online multimodal feedback on summative assessments. *Investigations in university teaching and learning, 6*(1), 86-92.

Sager, F. & Mavrot, C. (2021). Participatory vs Expert Evaluation Styles. In: M. Howlett & Tosun, J. (eds.), *Routledge Handbook of Policy Styles.* London/New York, NY: Routledge.

Saitis, C. A. (2000). *Organization and Administration of Education*. Athens: Atrapos.

Saitis, C. A. (2008a). *The Principal at the Public School*. Athens: Ministry of National Affairs of Education and Religion - Pedagogical Institute.

Salkind, N. J. (ed.). (2010). *Encyclopedia of research design* (Vol. 1). London: Sage.

Sampson, D., & Fytros, D. (2008). Competence models in technology-enhanced competence-based learning. In H. Adelsberger, Kinshuk, J. Pawlowski (Eds.)

Handbook on Information Technologies for Education and Training (pp. 155-177). Springer Berlin Heidelberg

Sanchez, R. (2004). Understanding competence-based management: Identifying and managing five modes of competence. *Journal of Business Research, 57(5)*, 518-532.

Scale CCR. (2012). Up-scaling creative classrooms in Europe. Retrieved from: http://is.jrc.ec.europa.eu/pages/EAP/SCALECCR.

Scheerens, J., & Blömeke, S. (2016). Integrating teacher education effectiveness research into educational effectiveness models. *Educational research review, 18*, 70-87.

Scheerens, J., Ehren, M., Sleegers, P., & de Leeuw, R. (2012). *OECD review on evaluation and assessment frameworks for improving school outcomes.* Country background report for the Netherlands. Paris: OECD.

Schelling, N., & Rubenstein, L. D. (2021). Elementary teachers' perceptions of data-driven decision-making. *Educational Assessment, Evaluation and Accountability, 33*(2), 317-344.

Schifter, C., Natarajan, U., Ketelhut, D. J., & Kirchgessner, A. (2014). Data-driven decision-making: Facilitating teacher use of student data to inform classroom instruction. Contemporary Issues in Technology and Teacher Education, 14(4), 419-432.

Schildkamp, K., & Kuiper, W. (2010). Data-informed curriculum reform: Which data, what purposes, and promoting and hindering factors. *Teaching and Teacher Education, 26*(3), 482–496.

Schildkamp, K., & Poortman, C. (2015). Factors influencing the functioning of data teams. *Teachers college record, 117(*4), 1-42.

Schildkamp, K., Poortman C. L., Luyten J. W., & Ebbeler J. (2017). Factors Promoting and Hindering Data-Based Decision Making in Schools. *School*

Effectiveness and School Improvement 28 (2): 242–258. Available at: doi:10.1080/09243453.2016.1256901.

Schildkamp, K., Visscher, A., & Luyten, H. (2009). The effects of the use of a school self-evaluation instrument. *School effectiveness and school improvement, 20(*1), 69-88.

Schildkamp, D. (2019). Data-based decision-making for school improvement: Research insights and gaps. *Educational Research, 61*(3), 257-273.

Scholen op de kaart. (2012). Vind en vergelijk scholen in de buurt. Retrieved from https://scholenopdekaart.nl/.

School Mentor.(2014). *The Norwegian centre for ICT in education.* Available at: https://iktsenteret.no/sites/iktsenteret.no/files/ikt_ministerbrosjyre_eng.pdf

Schratz, M. (1997). *Initiating change through self-evaluation: methodological implications for school development*. Dundee: CIDREE-SCCC.

Schreurs, J. (2007). ICT use in school: vision and performance measures. In M. Auer (Ed.*), E-portfolio and quality in e-learning* (pp. 1-12). Villach: Kassel University Press.

Schumacher, C., & Ifenthaler, D. (2018). Features students really expect from learning analytics. *Computers in Human Behavior, 78*, 397–407. Available at: https://doi.org/10.1016/j.chb.2017.06.030.

Scriven, M.S. (1967). The methodology of evaluation. In R.E. Stake (Ed.), *AERA Monograph series on curriculum evaluation*, 1 (pp. 45-67). Chicago, IL: Rand McNally.

Sebastián López, M. & De Miguel González, R. P. (2017). Educación Geográfica 2020: Iberpix y Collector for ArcGis como recursos didácticos para el aprendizaje del espacio. Didáctica Geográfica, (18), 231-246. Available at: https://zaguan.unizar.es/record/69433

Selwyn, N. (2016). 'There's so much data': Exploring the realities of data-based school governance. *European Educational Research Journal*, *15*(1), 54-68.

Selwyn, N., & Facer, K. (2014). The sociology of education and digital technology: past, present and future. *Oxford Review of Education*, *40*(4), 482-496.

Senge, P. (1990*). The Fifth Discipline: The art and practice of the learning organization*. New York: Doubleday

Senge, P. M., Cambron-McCabe, N., Lucas, T., Smith, B., & Dutton, J. (2012). *Schools that learn (updated and revised): A fifth discipline fieldbook for educators, parents, and everyone who cares about education.* Redfern, Sydney: Currency.

Sergis, S. E., & Sampson, D. G. (2014). From teachers' to schools' ICT competence profiles. In Digital systems for open access to formal and informal learning (pp. 307-327). Cham: Springer.

Sergis, S. (2017). Digital competence-informed educational decision support systems for school organizations and school teachers. Available at: https://dione.lib.unipi.gr/xmlui/handle/unipi/10812

Sergis, S., & Sampson, D. (2014). From teachers' to schools' Digital competence profiles, In: D. Sampson, D. Ifenthaler, J. M. Spector , & P. Isaias (eds.), *Digital Systems for Open Access to Formal and Informal Learning* (pp. 307-327). International Publishing: Springer.

Sestino, A., Prete, M. I., Piper, L., & Guido, G. (2020). Internet of things and big data as enablers for business digitalization strategies. *Technovation, 98*, 102173.Available at: https://doi.org/10.1016/j.technovation.2020.102173.

Shim, J., Lee, Y., Oh, J., & Im, J. (2015). Developing an evaluation system for Korean NHRD. *Review of Integrative Business and Economics Research, 4*(2), 237.

Siemens, G., & Long, P. (2011). Penetrating the fog: Analytics in learning and education. *EDUCAUSE review*, *46*(5), 30.

Siemens, G. (2013). Learning analytics: The emergence of a discipline. *American Behavioral Scientist, 57*(10), 1380–1400.

Slade, S., Prinsloo, P., & Khalil, M. (2019). Learning analytics at the intersections of student trust, disclosure and benefit. In: *Proceedings of the 9th International Conference on Learning Analytics & Knowledge* (pp. 235-244). ACM. Available at: https://doi.org/10.1145/3303772. 3303796.

Slavin, R. E., Cheung, A., Holmes, G., Madden, N. A., & Chamberlain, A. (2013). Effects of a data-driven district reform model on state assessment outcomes. *American Educational Research Journal, 50*(2), 371-396.

Snoek, M., Swennen, A., & Van der Klink, M. (2011). The quality of teacher educators in the European policy debate: actions and measures to improve the professionalism of teacher educators. *Professional development in education, 37*(5), 651-664.

Somekh, B. (2008). Factors affecting teachers' pedagogical adoption of ICT. In *International handbook of information technology in primary and secondary education* (pp. 449-460). Springer US.

Spector, J. M., & Yuen, A. H. (2016). *Educational technology program and project evaluation.* Routledge.

Stake, R.E. (1975*). Evaluating the arts of education: A responsive approach*. Colombus, Ohio: Merril.

Staman, L., Visscher, A. J., & Luyten, H. (2014). The effects of professional development on the attitudes, knowledge and skills for data-driven decision making. *Studies in Educational Evaluation, 42*, 79-90.

Stavropoulou, A., & Stroubouki, T. (2014). Evaluation of educational programmes-the contribution of history to modern evaluation thinking. *Health Science Journal, 8*(2), 193-204.

Stoll, L., & Kools, M. (2017). The school as a learning organization: a review revisiting and extending a timely concept. *Journal of Professional Capital and Community, 2*(1), 2-17. Available at: https://doi.org/10.1108/JPCC-09-2016-0022

Streifer, P. A., & Schumann, J. A. (2005). Using data mining to identify actionable information: Breaking new ground in data-driven decision making. *Journal of Education for Students Placed at Risk, 10*(3), 281-293.

Strier, M., & Katz, H. (2016). Trust and parents' involvement in schools of choice. *Educational Management Administration & Leadership, 44*(3), 363-379.

Stufflebeam, D.L. (1971). The relevance of the CIPP evaluation model for educational accountability. *Journal of Research and Development in Education, 5*, pp. 19-25.

Stufflebeam, D., L.. (2000). The CIPP Model forEvaluation. In: D. L. Stufflebeam, G. F. Madaus, & T. Kellaghan (eds.), *Evaluation Models: Viewpoints on Educational and Human Services Evaluation.* (2nd ed.). (pp. 279–318). Boston, MA: Kluwer Academic.

Stufflebeam, D., L.. (2001). Evaluation checklists: Practical tools for guiding and judging evaluations. *American Journal of Evaluation*, 22, pp. 71-79.

Stufflebeam, D. L.. (2003). The CIPP Model for Evaluation. In: T. Kellaghan, D. L. Stufflebeam, & L. A. Wingate (eds.), *International Handbook of Educational Evaluation* (pp. 31–62). Dordrecht: Kluwer Academic Publisher.

Stufflebeam, D. L. (2007). *CIPP evaluation model checklist.* Western Michigan University. Available at:

https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.401.1277&rep=rep1&type=pdf.

Stufflebeam, D. L., & Zhang, G. (2017). *The CIPP evaluation model: How to evaluate for improvement and accountability*. Guilford Publications.

Susnea, E. (2013). Improving decision making process in universities: A conceptual model of intelligent decision support system. *Procedia-Social and Behavioral Sciences, 76*, 795-800.

Symeonidis, V. (2018). Revisiting the European Teacher Education Area: The transformation of teacher education policies and practices in Europe. *CEPS Journal, 8*(3), 13-34.

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in science education, 48*(6), 1273-1296.

Tan, F. B., & Hunter, M. G. (2002). The repertory grid technique: A method for the study of cognition in information systems. *MIS quarterly, 2002*, 39-57.

Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal, 28(*13*)*, 1319-1350.

Theofilidis, C. (2012). *School leadership and management.From Bureaucracy to transformational leadership.* Athens: Grigoris

Theofilidis, C. (2014). *School Self-evaluation.* Athens: Gregory.

Thompson, K. (ed.). (2006). *Technology, Literacy and Learning: A Multimodal Approach* (Vol. 2). Abingdon-on-Thames: Taylor & Francis.

Tichnor-Wagner, A., Harrison, C., & Cohen-Vogel, L. (2016). Cultures of learning in effective high schools. *Educational Administration Quarterly, 52*(4), 602-642.

Torfing, J., Sørensen, E., & Røiseland, A. (2019). Transforming the public sector into an arena for co-creation: Barriers, drivers, benefits, and ways forward. *Administration & Society, 51*(5), 795-825.

Tripathi, P., & Ranjan, J. (2013). Data flow for competence management and performance assessment systems: educational institution approach. *International Journal of Innovation and Learning, 13*(1), 20–32.

Trochim, W. M., Cabrera, D. A., Milstein, B., Gallagher, R. S., & Leischow, S. J. (2006). Practical challenges of systems thinking and modeling in public health. *American Journal of Public Health, 96*(3), 538– 546. Available at: https://doi.org/10.2105/AJPH.2005.066001

Tsai, Y. S., Mello, R. F., Jovanović, J., & Gašević, D. (2021). Student appreciation of data-driven feedback: A pilot study on OnTask. In: *LAK21: 11th International Learning Analytics and Knowledge Conference* (pp. 511-517).

Tsakanikas, A., Danchev, S., Giotopoulos, I., Korra, E., & Pavlou, G. (2014). *ICT adoption and digital growth in Greece.* Athens: FEIR.

Tsami, E. (2016). Teaching ICT in Greek primary education. *Academia Journal Of Scientific Research, 4*(9), 279-286.

Tsoni, R., Samaras, C., Paxinou, E., Panagiotakopoulos, C., & Verykios, V. S. (2019). From Analytics to Cognition: Expanding the Reach of Data in Learning. *CSEDU, 2,* 458–465.

Tudevdagva, U. (2020). *Structure-Oriented Evaluation*. Springer International Publishing.

Tulowitzki, P. (2016). Educational accountability around the globe: Challenges and possibilities for school leadership. *Educational Accountability*, 249-254.

Tyler, R.W. (1942). General statements on evaluation. *Journal of Educational Research, 35,* pp. 492-501.

Tzotzou, M., Poulou, M., Karalis, T., & Ifanti, A. (2021). Reflecting upon the Greek state-school teacher's changing role in the 21st century: an 'ecosystemic' approach. *Preschool and Primary Education*, *9*(2). https://doi.org/10.12681/ppej.25834

UNESCO (2002). *UNESCO Institute for Education (UIE): annual report, 2002*. Retrieved from: https://unesdoc.unesco.org/ark:/48223/pf0000149311

UNESCO (2008). *The EFA global monitoring report*. *Education for all by 2015. Will we make it?* Paris: UNESCO.

UNESCO (2014). *Toward Universal Learning: Implementing Assessment to Improve Learning*. Available at: https://uis.unesco.org/sites/default/files/documents/toward-universal-learning-implementing-assessment-to-improve-learning-2014-en_0.pdf

UNESCO) (2015b). *Rethinking Education: Towards a global common good?* Retrieved from: http://tinyurl.com/y2a2fpm5 .

UNESCO (2011). *ICT Competency Framework for Teachers*. Retrieved from http://unesdoc.unesco.org/images/0021/002134/213475E.pdf

UNESCO (2016). *Global education monitoring report summary 2016: education for people and planet: creating sustainable futures for all.* Retrieved from: https://unesdoc.unesco.org/ark:/48223/pf0000245745

UNESCO (2017*). Education Transforms Lives.* Retrieved from: http://tinyurl.com/y43teyka

UNESCO. (2018). UNESCO ICT Competency Framework for Teachers. Version 3.0. Retrieved from https://unesdoc.unesco.Org/ark:/48223/pf0000265721.

UNESCO. (2019). *Marco de competencias de los docentes en materia de TIC. Versión 3.* Retrieved from: https://bit.ly/3t0R4vN

UNESCO (2020). Education: From disruption to recovery. Retrieved form https://en.unesco.org/covid19/educationresponse/

Van den Beemt, A., Akkerman, S., Simons, R J. (2011). Considering young people's motives for interactive media use. *Educational Research Review, 6*(1), 55–66. Available at: http://dx.doi.org/10.1016/j.edurev.2010.06.002

Van der Vlies, R. (2020). Digital strategies in education across OECD countries: Exploring education policies on digital technologies. OECD Education Working Papers, No. 226. Paris: OECD Publishing.

Van der Kleij, F. M., Visscher, A. J., Staman, L., & Eggen, T. J. (2017). The role of feedback report characteristics and user professionalisation in using student monitoring systems for data-driven decision making. In *Monitoring the quality of education in schools* (pp. 75-92). Brill.

Van Geel, M., Keuning T., Visscher A. J., & Fox J. P. (2016). Assessing the Effects of a School-Wide Data-Based Decision-Making Intervention on Student Achievement Growth in Primary Schools. *American Educational Research Journal ,53,* (2): 360–394. Available at: doi:10.3102/0002831216637346.

Van Laar, E., Van Deursen, A. J., Van Dijk, J. A., De Haan, J. (2020). Measuring the levels of 21st-century digital skills among professionals working within the creative industries: A performance-based approach. *Poetics, 81*, 101434. Paris, Available at: https://doi.org/10.1787/33dd4c26-en.

Vanderlinde, R., & van Braak, J. (2010). The gap between educational research and practice: Views of teachers, school leaders, intermediaries and researchers. *British educational research journal*, *36*(2), 299-316.

Vars, G. F., Wentworth, J., & Sebberson, D. (2002). Educational connoisseurship, criticism, and the assessment of integrative studies*. Issues in Interdisciplinary Studies.*

Veldkamp, B. P., Schildkamp, K., Keijsers, M., Visscher, A. J., & de Jong, T. (2017). *Verkenning data-gedreven onderwijsonderzoek in Nederland*. Universiteit Twente.

Vianna, H. M. (2000). *Avaliação educacional*. São Paulo: IBRASA, 187-202.

Vigeant, M. A., & Smolleck, L. (2011). Gizmo Festival: K-8 Outreach as a Design/Build for Engineering Students. *ASEE Annual Conference & Exposition*, Vancouver, BC.

Vilanova, R., Vicario, J., Prada, M., Barbu, M., Dominguez, M., Pereira, M. J., M.J. Varanda, M. Podpora , U. Spagnolini , P. Alves Paganoni, A. (2018). SPEET: Software tools for academic data analysis. In: *EDULEARN 2018-International Conference on Education and New Learning Technologies*.

Vo, T. K. A. (2017). Stufflebeam's Context, Input,Process and Product evaluation model: Animprovement, accountability approach for evaluationin education. In: *8th international conference on TESOL*, Hochiminh, SEMEO RETRACT.

Voorberg, W. H., Bekkers, V. J., & Tummers, L. G. (2015). A systematic review of co-creation and co-production: Embarking on the social innovation journey. *Public management review, 17*(9), 1333-1357.

Walker, A., & Maltby, T. (2012). Active ageing: A strategic policy solution to demographic ageing in the European Union. *International journal of social welfare, 21*, S117-S130.

Wang, H., Zhou, X., Lu, C., Wu, J., Deng, X., & Hong, L. (2011). Problematic Internet use in high school students in Guangdong Province, China. *PloS one, 6*(5). Available at: https://doi.org/10.1371/journal.pone.0019660

Warju, W. (2016). Educational program evaluation using CIPP model. *INVOTEC, 12*(1).

Wastiau, P., Blamire, R., Kearney, C., Quittre, V., Van de Gaer, E., & Monseur, C. (2013). The Use of ICT in Education: a survey of schools in Europe. *European*

*journal of education, 48(*1), 11-27.Available at: https://doi.org/10.1111/ejed.12020

Wayman, J. C., Jimerson, J. B., & Cho, V. (2012). Organizational considerations in establishing the data-informed district. *School effectiveness and school improvement*, *23*(2), 159-178. Available at: https://doi:10.1080/09243453.2011.652124.

Wesselink, R., & Wals, A.E.J. (2011). Developing competence profiles for educators in environmental education organizations in the Netherlands, *Environmental Education Research, 17*(1), 69-90, Available at: https://doi:10.1080/13504621003637037.

Williams, K. G. (2014). *A Case Study of Crestwood Primary School: Organizational Routines Implemented for Data-Driven Decision Making* (Doctoral dissertation, Virginia Polytechnic Institute and State University). Available at: http://hdl.handle.net/10919/70845

Williamson, B. (2018). The hidden architecture of higher education: building a big data infrastructure for the 'smarter university'. *International Journal of Educational Technology in Higher Education, 15*(1), 1-26. Available at: https://doi.org/10.1186/s41239-018-0094-1

Xanthopoulou, P., & Kefis, V. (2019). Public Organizations and Public Management in Greece: The Implementation of Private Management Tools in the Public Sector. *International Journal of Sciences, 8*(03), 45-54.

Xanthopoulou, P. & Plimakis, I. (2021). From New Public Management to Public Sector Management Reforms during the pandemic. The effects of Covid-19 on public management reforms and effectiveness. *Technium Social Sciences Journal. 26* (2), 576 – 596. Available at: DOI: 10.47577/tssj.v26i1.5177

Xiao, Y., & Hew, K. F. (2022). The relationships among ICT-related psychological factors, school contextual factors and secondary students' reading performance: A multilevel analysis across 47 economies. *Journal of*

Educational Computing Research, 60(5), 1166-1196. Available at: https://doi.org/10.1177/07356331211070975

Yieng, W. A., & Daud, K. (2018). ICT Competencies among School Teachers: A Review of Literature. *Journal of Education and Learning (EduLearn), 12*(3), 376-381. Available at: DOI: 10.11591/edulearn.v12i3.5579

Young, C., McNamara, G., Brown, M., & O'Hara, J. (2018). Adopting and adapting: School leaders in the age of data-informed decision making. Educational Assessment*, Evaluation and Accountability, 30*(2), 133-158. Available at: https://doi.org/10.1007/s11092-018-9278-4

Yu, S., Qing, Q., Zhang, C., Shehzad, A., Oatley, G., & Xia, F. (2021). Data-driven decision-making in COVID-19 response: A survey. *IEEE Transactions on Computational Social Systems, 8(*4), 1016-1029. Available at: DOI:10.1109/TCSS.2021.3075955

Zala-Mezö, E., Datnow, A., Müller-Kuhn, D., & Häbig, J. (2020). Feeding back research results–Changes in principal and teacher narratives about student participation. *Studies in Educational Evaluation*, *65*, 100848. Available at: https://doi.org/10.1016/j.stueduc.2020.100848

Zangiski, M. A. D. S., de Lima, E. P., & da Costa, S. E. G. (2013). Organizational competence building and development: Contributions to operations management. *International Journal of Production Economics*, *144(*1*),* 76-89. Available at: DOI: 10.1016/j.ijpe.2013.01.021

Zhang, H., & Almeroth, K. (2010). Moodog: Tracking student activity in online course management systems. *Journal of Interactive Learning Research, 21*(3), 407-429.

Zhu, W., Liu, Q., & Hong, X. (2022). Implementation and Challenges of Online Education during the COVID-19 Outbreak: A National Survey of Children and Parents in China. *Early Childhood Research Quarterly*, *61*, 209-219.

Zygouritsas, N., & Agogi, S. S. E. (2020). School Profile and Analytics Framework. Available at: https://reflecting4change.eu/wpcontent/uploads/2021/02/D1.2-

APPENDIX

i) TEACHERS' QUESTIONNAIRE

(Translated from the original version in Greek)

Dear colleges,

I am happy to inform you that I am a PhD candidate in the University of Murcia and this questionnaire is about the research that I make in the frame of my thesis. This research is based on the general frame of the school as a system and on the fields of taking decisions based on data from the school environment which is supported by Information Technology and Communication Systems. The general research problem is focused on the school evaluation based on the digital competence of the school and will try to make recommendations based on data for the improvement of it.

This questionnaire is anonymous and your answers will be used only for the purpose of this survey and they will not be published anywhere else. Your sincere answer and your focus on it, is in great need for this research. Thank you honestly and deeply you for your contribution to this survey.

Best regards

Athanatou Maria

1. Do you think you have adequate knowledge of ICT (Information and Communication Technology)?

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

2. How often do you use ICT at your lesson?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

3. Do you use digital systems from the Ministry of Education whose aim is the administrative and computer support of the schools of the Greek territory?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

4. Do you think that the Greek school is capable enough to support the use of educational programs with the use of new technologies?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

5. How often do you use the interactive whiteboard as an education tool?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

6. Do you use educational programs proposed by the ministry of Education through digital technologies?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

7. Do you cooperate with other schools in your country or abroad with the use of digital technologies?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

8. Do your students interact and solve problems in a web designed environment in the time of class lessons?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

9. Do you consider your students' parents capable of sustaining an internet communication?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

10. Is there communication with students' parents through network?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

11. How easy do students' parents react to a virtual stimulus?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

12. In which grade/ extent do you think that parents should allow their children to make use of digital programs besides the school year time?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

13. Does the school unit where you work organize digital actions regarding traditions/folkways and customs of the local community?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

14. Does the school unit you work at organize actions that have as a goal the sustainable development of the local community?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

15. Do the students of the school have the opportunity to participate on European exchange programs in order to become accustomed to the basic values of the European Community?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

16. Does school leadership set new goals in implementing at innovative programs that are associated with digital community that we live?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

17. Is school leadership concerned about the academic development of the teachers and pushes for that?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

18. Does school leadership appraise often the digital problems that school staff experiences and try to solve them?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

19. Is school leadership supportive enough with parent's concerns and does it communicate then to the teachers through often meetings?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

20. Do you apply innovative programs through new technologies with a goal to improve the educational process?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

21. Do you make sure that to clearly present the aims and goals of the educative routine?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

22. Do you revise your instructional work with the aim of achievement educational targets?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

23. Do you evaluate/assess the educational results using digital programs?

1	2	3	4	5
Not at all	Slightly	Neutral	Very	Extremely

ii) STUDENTS QUESTIONNAIRE

(Translated from the original version in Greek)

My dear students,

Thank you for taking the time to complete the questionnaire. This information will not use your name. Remember that this is not an assessment just a part for a research! Please complete it all and at the end click "Submit". Completing this with great honesty, would help me a lot!

1-not at all, 2-little, 3-enough 4-often 5-always

Yours sincerely

Mrs Maria

To start some personal information:

1. My gender is:

Boy	Girl

2. My age is:

6 years old	7 years old	8 years old	9 years old	10 years old	11 years old	12 years old

3. How many hours do I use digital pc or tablet at home?

1 or 2 hours	3 or 4 hours	4 or 5 hours	Above 5 hours

4. My school has the above digital equipment:

Computer
Laptop
Interactive whiteboard

Projector
Cameras

5. Is there interactive whiteboard in my class?

Yes	No

6. If yes, how often does my teacher use it?

1	2	3	4	5
Not at all	Little	Enough	Often	Always

7.Is there pc or laptop in my class?

Yes	No

8. If yes, how often does my teacher use it?

1	2	3	4	5
Not at all	Little	Enough	Often	Always

9.Is there projector in my class?

Yes	No

10. If yes, how often does my teacher use it?

1	2	3	4	5
Not at all	Little	Enough	Often	Always

11. Do you contact with your teacher through email?

Yes	No

12. If yes, how often do you contact your teacher through email?

1	2	3	4	5
Not at all	Little	Enough	Often	Always

13. Do you contact with your teacher through interactive platforms?

1	2	3	4	5
Not at all	Little	Enough	Often	Always

14. What other internet applications do you use in classroom? (open question)

.....
.....

.....
.....

15. What other digital software do you use in classroom?

.....
.....

.....
.....

16. Does your school use digital applications in order to make activities/actions?

17. How easy is to use digital applications?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely

Yes	No

18. Is there communication through internet with local or schools abroad?

Yes	No

19. Does your school make use of augment reality in lessons?

Yes	No

20. If yes, which augment reality's applications do you use? If no, I do not answer this question.

.....
.....

.....
.....

21. If you answered yes, how easy is to use augment reality's applications?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely

22. Does the use of ICT gives you a motive for learning?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely

23. Do you believe that the use of ICT eliminates the critical thinking?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely

24. Do you believe that the use of ICT has appositive effect in your psychology?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely

25. Do you believe that the use of ICT has a negative effect appositive effect in your education?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely

26. Do you believe that the use of ICT embrace the cooperation with your classmates?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely

27. In my class there are classmates with physical disabilities:

Yes	No

28. In my class there are classmates with learning disabilities:

Yes	No

29. In my class there are classmates with behavioural problems:

Yes	No

30. Does your teacher uses digital software that is aimed at students with difficulties like the above?

Yes	No

31. How much does the confidence of students increased by the use of software for children with special needs?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely

32. How much does the focus of students improved by the use of software for children with special needs?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely

33. How much is their hyperactivity limited by the use of software for children with special needs?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely

34. How much does their eagerness for participating in the course increased by the use of software for children with special needs?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely

35. Do you believe that through the use of ICT social skills are developed?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely

36. How empowering do you find the lesson of ICT use?

1	2	3	4	5
Not at all	Little	Enough	Very	Extremely