

CHANSE.

Please cite this report as:

Vissenberg, J., Puusepp, M., Edisherashvili, N., Tomczyk, L., Opozda-Suder, S., Sepielak, D., Hietajarvi, L., Maksniemi, E., Pedaste, M., & d'Haenens, L. (2023). *Report on the Results of a Systematic Review of the Individual and Social Differentiating Factors and Outcomes of Media Literacy and Digital Skills*. KU Leuven, Leuven: REMEDIS.

Disclaimer

REMEDIS is supported by Research Foundation – Flanders (FWO), Belgium; UK Research and Innovation (UKRI), United Kingdom; Estonian Research Council (ETAg), Estonia; Agencia Estatal de Investigación (AEI), Spain; Academy of Finland (AKA), Finland; and Narodowe Centrum Nauki (NCN), Poland under CHANSE ERA-NET Co-fund programme, which has received funding from the European Union's Horizon 2020 Research and Innovation Programme, under Grant Agreement no 101004509.





Report on the Results of a Systematic Review of the Individual and Social Differentiating Factors and Outcomes of Media Literacy and Digital Skills

Work package 1 – Deliverable 1.1







Table of contents

1. Exe	ecutive summary	5
1.1	The REMEDIS project	7
1.2	Introduction to this report	7
2 Me	thodology	9
1.1	Search protocol	9
1.2	Databases	10
1.3	Search results	11
1.4	Eligibility screening and quality appraisal	13
1.5	Reliability of screening: intercoder reliability	16
2.1	Coding of studies and analysis of results	16
3 Results		
3.1	Theoretical frameworks	
3.2	Outcomes of ML&DS interventions	22
3.2	.1 Outcomes measured in the literature	22
3.2	.2 Effects of ML&DS interventions	23
3	3.2.2.1 Intervention effects	27
3	3.2.2.2 The relationship between sample size and effect size	
3.2	.3 Effect sizes for specific target groups	
3.3	Differentiating factors of ML&DS interventions	40
3.3	.1 Mediation effects in ML&DS interventions	40
3.3	.2 Moderation effects in ML&DS interventions	43
4 Co	nclusions and recommendations	
4.1	Key findings and recommendations	
Acknowledgements		
References		
Appendix		



1. Executive summary

This systematic evidence review aimed to collect and summarise scientific evidence on effective intervention programmes related to Media Literacy and Digital Skills (ML&DS). Through a comprehensive search across major scientific databases and rigorous screening and coding processes, we identified 248 studies investigating ML&DS intervention effectiveness and associated outcomes. In this report, we have presented findings related to the theoretical frameworks guiding these studies, the reported outcomes, and potential influencing factors on intervention effects. Here are the key conclusions drawn from this review:

- 1. **Theoretical Frameworks**: Approximately three-quarters of the studies were informed by theoretical foundations, spanning various fields such as media studies, media psychology, psychological science (e.g., Theory of Planned Behavior), pedagogical science (e.g., TPACK framework), and other related disciplines. The use of diverse theories reflects the multidimensional nature of ML&DS interventions.
- 2. Outcome Categories: Among the subset of 119 studies with rigorous methodologies (experimental or quasi-experimental), media literacy and digital skills-related outcomes were most commonly examined, followed by outcomes related to psychological wellbeing and education/learning. However, there was a notable lack of studies investigating other outcomes like civic/participatory outcomes, physical wellbeing, and socio-cultural wellbeing, highlighting the need for broader outcome measures.
- 3. **Target Groups**: Our analysis identified nine distinct target groups, ranging from children to older adults, including college students, teachers, and parents. Outcomes varied depending on the target group, emphasising the importance of tailoring interventions to specific demographics to maximise effectiveness.
- 4. **Differentiating Factors**: Few studies examined differentiating factors such as mediators or moderators influencing ML&DS intervention effects. Gender was the most commonly considered moderator, with certain target groups showing larger effect sizes. This underscores the need for more research into the nuanced effects of ML&DS interventions on different populations.
- 5. **Methodological Considerations**: The review revealed a limited use of randomised controlled trials and a lack of systematic reporting of effect sizes. Researchers should prioritise robust experimental designs and consistent reporting of effect sizes for more reliable conclusions.

Limitations of this study include the focus on English-language publications, an emphasis on quantitative research, potential omission of relevant studies, and the subjectivity inherent in screening and coding processes. Additionally, the review did not investigate variations in outcome measurement methods across studies.



This systematic evidence review provides valuable insights into the current state of ML&DS intervention research, highlighting the importance of considering target groups, employing rigorous methodologies, and exploring a wider range of outcomes to advance our understanding of ML&DS interventions' impact.



Introduction

1.1 The REMEDIS project

The REMEDIS (Rethinking Media Literacy and Digital Skills) project is funded by the European Union's CHANSE (Collaboration of Humanities and Social Sciences in Europe) programme. The consortium involves 7 academic partners from 6 countries, along with 14 non-academic cooperation partners. REMEDIS seeks to develop evidence-based approaches to develop and evaluate initiatives that foster media literacy and digital skills (ML&DS) to understand what the impacts of ML&DS interventions in different life domains are in terms of positive outcomes.

REMEDIS adopts an innovative research strategy that first aims to identify and quantify the most salient driving factors for ML&DS from a lifelong perspective, and to synthesise the existing evidence concerning the perceived effectiveness of current interventions fostering ML&DS. REMEDIS will pay special attention to target groups, including disadvantaged youths (NEETs or Not in Education or Training), the unemployed, refugees, people with lower SES, carers of NEETs, and (future) teachers.

To achieve its aim, the REMEDIS project has four research objectives.

- 1. To improve existing theoretical knowledge about the actual outcomes of interventions.
- 2. To improve and enhance existing ML&DS intervention strategies based on existing and emerging evidence.
- 3. To adopt advanced methods, and to develop and validate instruments for evaluating intervention strategies.
- 4. To produce evidence-based policy recommendations and develop a user-friendly, customisable evaluation toolkit.

This report contributes to achieving the first objective of REMEDIS by developing an evidence base synthesis using a systematic review of the drivers and outcomes of ML&DS interventions and of characteristics of potentially effective ML&DS intervention programmes that lead to positive outcomes.

1.2 Introduction to this report

REMEDIS employs a methodology that adheres strictly to an evidence-based approach within the framework of its work packages (WPs) and tasks. The initial phase of this process involves the creation of a comprehensive synthesis of existing evidence, which aims to identify the key drivers and characteristics of media literacy and digital skills intervention programmes that have the potential to yield positive outcomes. This systematic review of evidence follows a rigorous set of parameters to ensure that a substantial number of studies meeting the predefined inclusion criteria are thoroughly examined. Multiple searches were conducted on the available body of published literature.

The primary objective of this systematic evidence review is to enhance and consolidate knowledge pertaining to potentially effective intervention programmes. The findings will inform local, regional, national, and European agencies in their decision-making processes, guiding them in selecting initiatives that hold the greatest promises, determining which



....

outcomes to target, and facilitating evidence-based improvements and enhancements to existing programmes. Additionally, the review will offer evidence-based evaluation strategies.

A critical aspect of knowledge exchange involves consolidating information related to both the individual and social factors driving media literacy and digital skills, as well as the outcomes associated with these factors. Furthermore, it seeks to elucidate the key characteristics of intervention programmes that demonstrate potential effectiveness, thus enabling a comprehensive understanding of their impact on specific life outcomes for particular target groups within certain contexts. REMEDIS aims to provide robust evaluation results that support evidence-based policy and practice. Building on these outcomes and collaborating closely with policymakers and practitioners in the six focal countries involved. REMEDIS will implement evidence-based enhancements and improvements to existing interventions. It will also develop evidence-based evaluation strategies and conduct quantitative evaluations of the enhanced interventions.

In practical terms, REMEDIS's approach will yield significant benefits to the research field, policymakers, and practitioners in Europe.

This report presents a comprehensive search protocol used to compile a set of pertinent research articles for further study. The protocol aims to identify and gather scholarly works that explore theoretical frameworks in the areas of media literacy and digital skills. Several key databases were employed to ensure a wide coverage of relevant literature. A combination of keywords was used to refine the search and enhance precision. Inclusion and exclusion criteria were established to ensure the selection of high-quality scholarly articles suitable for further analysis.

Furthermore, the report outlines the theoretical frameworks employed in these studies. Various theoretical perspectives, such as social cognitive theory, cultivation theory, and information processing theory, have been utilised to conceptualise and analyse the complexities of media literacy and digital skills. The report provides a comprehensive overview of these frameworks, their theoretical underpinnings, and their application within the context of media literacy and digital skills research.

This report furthermore explores the outcomes of intervention programmes aimed at improving media literacy and digital skills among different target groups. The report also discusses the potential benefits and limitations of these intervention programmes and identifies areas for future research and improvement. Additionally, it examines the factors influencing media literacy and digital skills, providing a comprehensive overview of the current academic landscape in these domains. By examining these differentiating factors, the report offers insights into the complex interplay between individual, societal, and environmental factors that shape media literacy and digital skills acquisition.

The findings presented in this report contribute to the scholarly discourse surrounding media literacy and digital skills, ultimately informing future academic endeavours and practical interventions in the domain.





2 Methodology

A systematic evidence review was conducted to build an evidence base of the outcomes of ML&DS interventions and of characteristics of potentially effective ML&DS intervention programmes that lead to positive outcomes. A systematic evidence review is a rigorous and comprehensive method to summarise and evaluate existing scientific knowledge and evidence on a particular topic, and it involves a systematic and robust search, appraisal, and synthesis of the research evidence (Grant & Booth, 2009). By compiling and disentangling multiple research findings from quantitative, qualitative, or mixed-methods studies, systematic evidence reviews also allow researchers to clarify empirical evidence and to identify knowledge gaps (Allen, Kim, & Jimerson, 2023). Transparent reporting of systematic evidence review methods, such as the search strategy, eligibility criteria, and exclusions made allows for an objective reporting on the available knowledge about the topic and has the potential for replication (Grant & Booth, 2009).

1.1 Search protocol

The search protocol for this systematic evidence review was developed in November and December 2022. A consultation of the literature on ML&DS interventions together with discussions within the team led to a first version of the search protocol. During a consultation with a research librarian specialising in systematic evidence reviews at KU Leuven, this initial search protocol was further developed. Next, this search protocol underwent multiple rounds of testing and subsequent finetuning: the search query was entered into the selected databases and the first search results were inspected for adequacy for our research purposes. If too many search results were considered irrelevant to the current research, adjustments to the search terms were required. While testing and fine-tuning the search query, attention was paid to the fact that the search query needed to be comprehensive (i.e., capture the literature on ML&DS intervention, and drivers and outcomes of these interventions) and at the same time efficient (i.e., minimising the number of irrelevant search results).

To meet our aim of building an evidence base of the drivers and outcomes of ML&DS interventions and of characteristics of potentially effective ML&DS intervention programmes that lead to positive outcomes, different sets of search terms were needed.

• The first set of search terms needed to identify articles about ML&DS. Based on a previous systematic evidence review on the antecedents and outcomes of gaining digital skills (Haddon et al., 2020), sets of terms capturing the "media" or "digital" dimension on the one hand and the "literacy" or "skills" dimension on the other hand were determined. These "media" or "digital" terms were "media", "digital", "mobile", "internet", "online", "technology", "computer", "ICT", and "web-based". The "literacy" or "skills" dimensions were captured by the terms "skill", "competence", "literacy", "proficiency", and "capability". Next, combinations of each "media" or "digital" terms with each "literacy" or "skills" terms were made to cover the entire research literature and yield as many relevant search results as possible.



- The second set of search terms needed to identify articles about interventions.
- The third set of search terms needed to identify articles using quantitative methods, preferably experimental or quasi-experimental methods, to test the effectiveness of the intervention.
- The final set of search terms was added as a not-term to exclude articles that are not relevant to our research. During the testing of the search terms, many studies related to medical trials or STEM and particularly engineering research came up, which are outside of the scope of the current research. Therefore, it was decided that a NOT-term should be added to the search query to specify the types of research that should be excluded from the search results.

The final search query resulted in four sets of search terms. This search query was entered in exactly the same way in each of the databases that were included in this review.

- Set 1: on media literacy and digital skills: "media skill*" OR "media competen*" OR • "media literac*" OR "media literate" OR "media proficien*" OR "media capab*" OR "digital* skill*" OR "digital* competen*" OR "digital* literac*" OR "digital* literate" OR "digital* proficien*" OR "digital* capab*" OR "mobile skill*" OR "mobile competen*" OR "mobile literac*" OR "mobile literate" OR "mobile proficien*" OR "mobile capab*" OR "internet skill*" OR "internet competen*" OR "internet literac*" OR "internet literate" OR "internet proficien*" OR "internet capab*" OR "online skill*" OR "online competen*" OR "online literac*" OR "online literate" OR "online proficien*" OR "online capab*" OR "technolog* skill*" OR "technolog* competen*" OR "technolog* literac*" OR "technolog* literate" OR "technolog* proficien*" OR "technolog* capab*" OR "comput* skill*" OR "comput* competen*" OR "comput* literac*" OR "comput* literate" OR "comput* proficien*" OR "comput* capab*" OR "ICT skill*" OR "ICT competen*" OR "ICT literac*" OR "ICT literate" OR "ICT proficien*" OR "ICT capab*" OR "web-based skill*" OR "web-based competen*" OR "web-based literac*" OR "web-based literate" OR "web-based proficien*" OR "web-based capab*"
- AND Set 2: on interventions: "intervention*" OR "curricul*" OR "program*" OR "training*" OR "preparation*"
- **AND Set 3: on methodology**: "experiment*" OR "RCT" OR "randomized control* trial" OR "case control" OR "control group" OR "quantitative" OR "evaluat*"
- NOT Set 4: excluding medical and STEM/engineering papers: "medic*" OR "disease*" OR "clinic*" OR "industry*" OR "engineer*" OR "robot*"

In each database, this search string was supplemented with the requirements that the research had to be published in the past ten years (between 2012 and 2022), that the article was published in English, and that the research was peer-reviewed.

1.2 Databases

Drawing on the experience from team members and through consultations with a research librarian specialising in systematic reviews at KU Leuven, a selection of three large database aggregators was made, as these would offer the most sources. The three database aggregators



that were included in this systematic evidence review are Web of Science, Scopus, and ProQuest. In Web of Science, we specifically searched the Social Sciences Citation Index (SSCI), the Conference Proceedings Citation Index – Social Sciences and Humanities (CPCI-SSH), the Book Citation Index – Social Sciences and Humanities (BKCI-SSH), and the Arts & Humanities Citation Index (A&HCI) databases. Through ProQuest, we searched the Education, Psychology, Social Science, Arts & Humanities, and the Sociology databases. Additionally, this was supplemented with two specialised databases: Communication & Mass Media Complete (CMMC) and Education Resources Information Center (ERIC), which were both accessed via EBSCO.

1.3 Search results

The search was performed on December 6th, 2022. The total number of search results across the databases was 5,890. All studies with their bibliographical information were exported from their databases and uploaded into a Zotero library to facilitate the process of screening for duplicates. This screening was done in two steps. First, each individual database export was screened for duplicates. Six duplicates were detected within the Scopus export, resulting in 2,470 instead of 2,476 unique studies exported from Scopus. The four remaining database exports did not contain any duplicates. Second, all studies across databases were combined within one library to be screened for duplicates between the databases. At this point, a notification in Zotero mentioned that three studies in this library had been retracted. After checking each of the retraction notices, these three studies were excluded, resulting in a total of 5,881 exported studies. This set of studies was screened for duplicates one more time. After removing the duplicates (N = 1,003), this resulted in 4,878 unique search results that moved on to the eligibility screening stage. Table 1 contains an overview of the search results.



Database	Database description	Number of search results
Web of Science Core Collection (SSCI, CPCI- SSH, BKCI-SSH, A&HCI)	A large database aggregator providing access to multiple databases that contain peer- reviewed, high-quality publications from scholarly journals, conference proceedings, and books.	1,608
Scopus	A large database aggregator covering a large number of abstracts and citations of peer- reviewed literature from scholarly journals, books, and conference proceedings.	2,476
ProQuest (Education, Psychology, Social Science, Arts & Humanities, Sociology)	A large database aggregator providing access to dissertations, theses, scholarly journal articles and other research outputs from multiple disciplines and from across the world.	498
Communication & Mass Media Complete (CMMC; via EBSCO)	A communication studies database containing research outputs from high-quality communication journals and covering all related disciplines.	105
Education Resources Information Centre (ERIC; via EBSCO)	A comprehensive database containing full-text research outputs and other resources from the field of education.	1,203
Total search results		5,884
Duplicates		1,009
Retracted studies		3
Final search results		4,878



.

1.4 Eligibility screening and quality appraisal

The screening of the final 4,878 search results occurred in two stages. In the first stage, a first set of eligibility criteria were applied to the titles and abstracts of the studies. Next, an extended list of eligibility criteria was used to screen the full text of the studies. In each stage, the eligibility criteria were formulated based on how well the content of the study on the one hand, and its methodology on the other hand, resonated with the goals of the systematic evidence review.

In the first stage of title and abstracts screening, exclusions were made based on the following criteria:

- The study had to be **about media literacy and/or digital skills**: If the study focused solely on topics such as media uses or other skill sets unrelated to digital skills, the study would be excluded from the systematic evidence review. ML&DS could be interpreted as very broad, as a wide range of more general skills, or very specific, such as the ability to evaluate the credibility of online information.
- The study had to be about **ML&DS interventions and their outcomes**. If a study was not about an intervention that aimed to develop or stimulate ML&DS, it had to be excluded from the systematic evidence review. An intervention could be understood as a wide range of activities or initiatives aiming to teach ML&DS, such as a class at school, a workshop, or an educational game.
- The study had to employ **quantitative methods**: an experiment, a quasi-experiment, or a survey (if it tested the outcomes of the intervention). Only quantitative findings allow for robust comparisons between studies, based on quantitative data such as effect size, at a later stage.

For the full-text screening stage, these screening criteria were supplemented with additional, more specific criteria that were not adequate for title and abstract screening due to the limited amount of information in abstracts. Additionally, criteria for the quality appraisal of the studies were added as well, to avoid including low-quality research in the review. These quality appraisal criteria were inspired by the Weight of Evidence (WoE) framework by Gough (2007). As many of Gough's (2007) original proposed criteria were already included in the existing criteria from title and abstract screening, a separate weight of evidence screening was not conducted and instead we opted for adding the remaining quality appraisal criteria to the full-text screening framework.

The final set of screening criteria again consisted of both content-related and methods-related criteria and was composed as follows:

• The study had to be **about ML and/or DS**. Following the WoE framework to evaluate the relevance of the study to the current research, the study needed to contain a clear



.

definition of ML&DS, a clear measure of ML&DS and a clear theoretical base or model of ML&DS for it to be included in the review.

- The study had to be **about ML&DS interventions and their outcomes**. If the study was not about an intervention, it had to be excluded from the review. During full-text screening, special attention was given to whether the description of the intervention was fairly in-depth, and whether the discussion of the effectiveness of the intervention was fairly in-depth.
- The study had to employ **quantitative methods**: an experiment, a quasi-experiment, or a survey (if it tested the outcomes of the intervention).
- The **methodology and the procedures of the research had to be described in some detail**. The following elements had to be described in the methodology section for a study to be included: fair effort to limit selection bias, study includes statistical significance testing, study includes relevant control variables, study has a clear research aim, research questions and/or hypotheses, clear links between methods and findings.
- The study reports on the **main research findings**, and the effect size or at least the statistical data for calculating the effect is present.

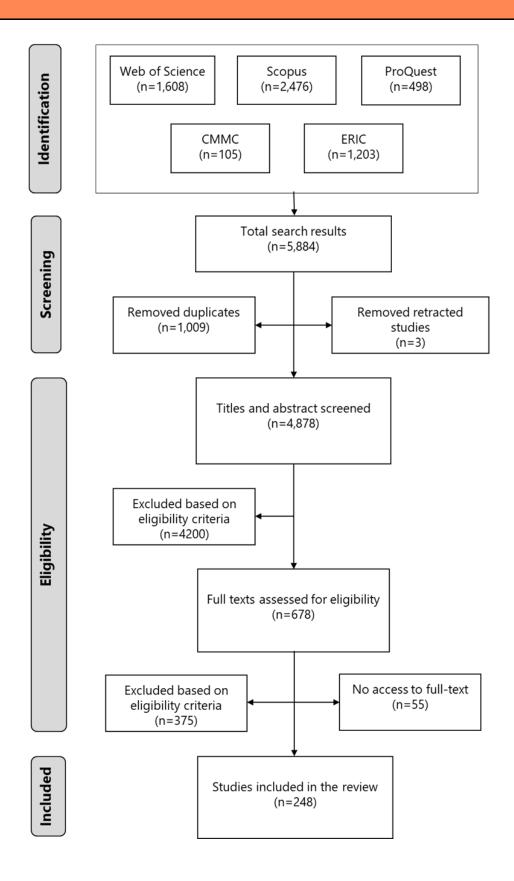
Both in the title and abstract screening and in the full-text screening stages, these criteria were applied in a cascading fashion. Each study was first checked against the first criterion, and could only move on to the second criterion if it passed the first criterion. Studies that did not pass the first criterion were promptly labelled for exclusion, as it was evident that these studies would not be relevant to the current review, without the need to evaluate them against the remaining criteria. During the title and abstract screening stage, if information to make a decision about a criterion was insufficient, the study was retained for full-text screening where more information to judge the study on the criteria would be available in the text.

Throughout the whole screening process, notes were kept about the reasons to include or exclude studies, which would be informative in the next stages of the review. Team members could always mark a study as include, exclude, or unsure. Studies marked as unsure would be further discussed during team meetings to arrive at a final decision to include or exclude the study from the further stages of the review.

After title and abstract screening, 678 studies were retained. We were unable to get access to the full texts of 55 articles. As these articles could not be screened, they were excluded from the research. After full-text screening, a final set of 248 studies was retained for coding and analysis. Figure 1 contains the PRISMA flow diagram of the search and screening process.



Figure 1. PRISMA flow diagram of the search and screening process





1.5 Reliability of screening: intercoder reliability

Intercoder reliability was calculated for both title and abstract level, and full-text level screening inclusion-exclusion decisions. The screening was performed by the six REMEDIS country teams and their respective members for pair-wise decisions, i.e., each abstract or article was screened by two different raters from separate country teams. The abstracts and articles were chosen randomly from the pool of eligible articles. Fleiss' kappa (κ) was calculated with JASP (version 0.17.1) (JASP Team, 2023).

For the title and abstract level, three rounds of screening were completed to reach substantial agreement between coders (Fleiss' $\kappa = 0.63$) according to Landis and Koch's criteria (1977). After each round of screening, the differences were discussed thoroughly, and consensus was reached. For the final round, 451 articles were screened on the title and abstract level, constituting approximately 9% of the total number of screened abstracts (N = 4878). After the third round, all remaining abstracts were screened to decide whether they should be included in the full-text screening.

To calculate intercoder reliability at the full-text level, 72 articles were screened, constituting approximately 11% of the total number of screened articles (N = 678). The intercoder agreement was substantial (Fleiss' κ = 0.79) for the first round of screening. After all differences were thoroughly discussed and consensus was reached, full-text screening was conducted on all remaining studies.

2.1 Coding of studies and analysis of results

The final remaining 248 studies were coded and analysed using a coding framework. This coding framework was developed based on consultations of the literature and on the observations made during full-text screening.

The coding framework consisted of five main sections. The first section concerned the article information, such as the authors, title of the study, the name of the publication, and the quality of the study and publication. Next, the second section was related to the intervention characterisation, where data on the targeted skills, target group of the intervention, procedure of the intervention, and other relevant elements was gathered. The third section aimed to collect information on the methodology that was used to test the outcomes of the interventions, through data such as data collection methods, sample size, and use of experimental conditions. The fourth section was the largest and aimed to capture the outcomes of the interventions that were measured in the studies. For each outcome, the type of effect (within group, between groups, or interaction) was considered along with the statistical information necessary to evaluate the effect size. The last section focused on potential drivers or enablers of the intervention effects through mediators and moderators. The necessary statistical information required for the calculation and evaluation of effect sizes was gathered.

The coding of the articles based on this framework was done using Qualtrics. A questionnaire containing questions to capture the information required in the framework was set up and



.

filled in for each study. A dataset containing the completed coding was exported to SPSS and Excel formats for further analysis.

To compare the effects of the interventions on the outcomes across the studies in this review, it was necessary that the effect sizes of these effects were collected. To arrive at a reliable comparison, only studies employing adequate methodologies for testing the impact of an intervention were considered for this part of the analysis. Therefore, the first step in the calculation of effect sizes consisted of selecting those studies that employed an experimental design in which the participants were divided between at least two conditions (at least one experimental condition and one control condition). In 119 studies out of the 248 total studies in this review, the participants were divided across two or more conditions. Only these 119 studies qualified for further effect size calculations. The size of the effect of the intervention on each outcome was gathered from each article. When no effect sizes but other statistical information (means, standard deviations, and sample size) were reported in the article, this information was used to perform an effect size calculation using an online calculator¹. The calculated effect sizes were Cohen's d, (partial) eta squared, or difference-in-difference. Due to the complexity of experimental designs, the effects studied concerned three types: interaction effects, between-group effects, and within-group effects. For reporting, each effect size was interpreted using the following effect size thresholds:

- Cohen's d: < .2: no effect; .2 .49: small effect; .5 .79: medium effect; .8 > 1: large effect
- Eta squared: < .01: no effect; .01 .059: small effect; .06 .13: medium effect; .14 .2: large effect

¹ We used the Psychometrica calculator for effect size calculations: <u>https://www.psychometrica.de/effect_size.html</u>.



3 Results

3.1 Theoretical frameworks

This subsection presents an overview of the theoretical frameworks used in the articles in this review about interventions that enhance and shape ML&DS. These theories are a key element of these interventions, as they allow for the precise implementation of pedagogical, andragogical, and geragogical experiments. Such theories facilitate the design and implementation of interventions that shape ML&DS in three distinct ways. First, the inclusion of theories in research enables the shaping of conceptual frameworks, including the description of the variables to be measured, as well as the selection of indicators for the interventions. Second, the theories selected often come with research tools and methods that can be readily used in the research process, such as pre-test and post-test measurements. Third, the theories presented in Appendix A provide an opportunity for an in-depth interpretation of intervention results relating to changes in ML&DS levels.

Theories serve as a valuable and informative foundation for researchers to construct and design ML&DS interventions, and this is reflected in the fact that the majority of studies in our review had a clear theoretical basis. One in four of the analysed research reports is embedded in an exploratory research stream without the use of a leading theory. This may be due to the lack of adequate theories defining the main variables, or to the narrowing of interventions to areas that are relatively new types of pedagogical or andragogical activities, not linked to existing theories. Additionally, the lack of theoretical foundations in these articles could be attributed to either a lack of awareness (insufficient exploration of the literature) or a perceived lack of necessity for theory among a specific subset of ML&DS researchers. The non-application of theory results in weaknesses related to the in-depth process of interpreting ML&DS-related phenomena, but in selected situations, it may have provided the basis for the formation of inductive theorisation related to the rapidly changing reality conditioned by media development.

Based on the analysis and breakdown of the theories used, it was noted that 47% of the theoretical frameworks linked directly to disciplines such as media studies, media psychology, media pedagogy, and media sociology. In contrast, 53% were 'auxiliary' theories from the social sciences and humanities. Conducting experiments in the field of ML&DS is a complex activity in which different areas of people's professional, school, and free-time activities intersect. This means that although the main intervention is primarily concerned with ML&DS, related processes require reference to theories beyond the knowledge, skills, and attitudes associated with new and old media. The integration of ML&DS-related theories with humanistic-social theories is an inherent aspect of research within the interdisciplinary analysis strand, where social processes intersect with skills and knowledge related to the use of media-based solutions.

The flexibility in theory usage is also evident in its adaptability, which includes applying a single theory across various age (occupational) groups and in how different aspects of ML&DS are conceptualised. The greatest flexibility in this area was observed for self-regulation under the perspective of social learning theories (Bandura, 1977). This is originally a psychological theory



not directly related to ML&DS, but it is used in explaining the shaping of ML&DS through interactions occurring in formal, non-formal, and informal learning environments. The high popularity and usefulness of Bandura's classical theory may be due to the assumption that ML&DS are firmly embedded in and shaped by a variety of interactions and interpersonal relationships. This relationship therefore provides the background or entry point (boundary condition) for the creation of programmes that enhance the effectiveness of the use of new and old media.

Among those theories that are regularly used in the selected studies, the message interpretation process model - MIP - can also be mentioned (Austin et al., 2006; Austin, 2007; Pinkleton et al., 2001). The MIP model is particularly valuable for understanding not only the messages contained directly in the media, but also the hidden meanings and influences that can have a negative impact on the behaviour of the receivers of these messages. The theory mentioned above is frequently employed as a foundation for interventions. These interventions have a dual purpose: not only to enhance media literacy and digital skills (ML&DS) but also to address health education by promoting content literacy and critical thinking.

Alongside skills like proficiency in one's native language, proficiency in a foreign language, mathematical competence, and others, digital and media competences are often categorised as fundamental competencies. Despite the extensive study of media literacy and digital skills (ML&DS) over the years, there exists a variety of definitions for this central variable. This diversity was evident in the articles reviewed, in which different approaches to ML&DS and its definitional indicators were found (Livingstone, 2004; Chen et al., 2018; Mallia et al., 2020; Lucidi et al., 2017). This richness of theoretical approaches is due to the perspective in which the research is conducted (e.g., the variety of pedagogical approaches based on didactic measurement, or media sociology, highlighting the different processes of the information society). The multifaceted definition of ML&DS is, on the one hand, valuable as it expands the indicators of the theoretical framework, while on the other hand, it can lead to incompatibility between social scientists' understanding and definitions of the key competence under study. The diversity of approaches to ML&DS also arises from the specific focus on particular groups, such as those differentiated by age or occupation. A theoretical framework relating to defining indicators for ML&DS among seniors (Tomczyk, et al., 2023) will differ significantly from the indicators used to define ML&DS among children and adolescents (Helsper et al., 2020). This division, resulting from generational differences, as well as those occurring due to professions, creates a differentiated map of theories to be further differentiated by sociodemographic variables.

Another equally frequently used theory is the theory of planned behaviour (Ajzen, 1991), which is integrated into many aspects of ML&DS interventions, as well as for more narrow dimensions of digital competence (e.g. programming). This theory is one of the more frequently implemented in the field of interpreting risk behaviour mediated by digital media (Tomczyk, 2021). More than 8% of the articles analysed use the assumptions developed by Ajzen, as the authors of the experiments emphasise the centrality of processes such as the intentionality, or lack thereof, of actions mediated by media. The perspective adopted by



Ajzen, despite having been developed in the early 1990s before the emergence of most modern forms of new media, is still of great interest to researchers today.

Another type of theory that frequently appeared in the analysed materials is Technological Pedagogical and Content Knowledge (TPACK). A little under 7% of the articles analysed used this relatively new theory (compared to those previously cited); it is one that is very popular due to the process of the digitalisation of education at various levels (Jiménez Sabino & Cabero Almenara, 2021; Klichowski, 2015). The theory designed by Koehler combines issues relating to didactics while taking into account the technological aspect of modern teaching. The versatility of TPACK in the context of interpretation, as well as the richness of the diagnostic tools, makes the theory very popular among media educators whose main goal is to increase ML&DS among stakeholders focused on educational institutions.

Within the theoretical frameworks akin to TPACK, one notable framework observed in the studies in this review is the Digital Competence Framework proposed by the International Society for Technology in Education (ISTE). The goal of this framework is to break down the various areas where information and communication technology (ICT) is applied in education. This helps in identifying crucial components of knowledge and skills directly related to teachers' digital competences in the context of their teaching activities.

These theories are particularly focused on formal (school) education and are subject to change due to the continuous evolution of e-services and educational technology. Another example is the application of the theoretical framework DigComp, a non-education-based tool which is used a lot in teacher training or by teachers to estimate skills, knowledge and attitudes in different domains (Mattar et al., 2022). Its latest version, which is version 2.2, is a selfassessment instrument for people to assess which skills they lack and which they are more proficient in, it is also a tool for self-learning about different aspects of the digital world.

Among those theories deserving special attention, a group of assumptions should be singled out that consider, similarly to TPACK, pedagogical issues that are not only directly related to ML&DS, but also to methodological aspects of digitally mediated education. Examples of such theories used in the interventions analysed are flipped learning (FL), problem-based learning (PBL), context-based learning (CBL), co-regulated learning (CL), gamification, digital storytelling, team-based learning (TBL), transfer of learning (TL), Pedagogy, Social Interaction and Technology Generic Model, and the unifying theory of the aforementioned solutions, namely constructivism. All these theories have one element in common, which is the abandonment of passive teaching methods in favour of active learning and increasing the effectiveness of teaching activities. Some of the theories mentioned are applicable both in analogue didactics (FL, PBL, CBL, CL, TBL, TL) and in digitally mediated learning and teaching. The aforementioned didactic solutions can provide a basis or methodological-theoretical background for achieving the goal of direct ML&DS growth and the achievement of other didactic goals.

Among the theories that prove particularly useful in the planning of interventions, i.e. a pedagogical, and ragogical or geragogical experiment, three approaches found in the studies



analysed could be distinguished. These are solutions based on the methodology: 5E (Engage, Explore, Explain, Extend (or Elaborate), and Evaluate), AIDA (Applied Instructional Design Academy), or instructional principles for teaching older adults. Each of these theories offers a clearly prepared structured formula to prepare implementation in a standardised manner. Only the areas of ML&DS, which are adapted to the goals and contexts of the intervention, become an object of change. Instructional principles for teaching older adults, on the other hand, is one of a number of approaches that provide a range of methodological guidelines for the effective development of different types of skills and knowledge among people in late adulthood. At the same time, it should be noted that these three theories are not typical theories containing a multi-level view of social processes, but form a set of proven solutions allowing for the preparation of effective educational activities that raise the level of ML&DS.

A separate group of theories are constructs referring to health. These are mostly ancillary theories in which ML&DS form the background or are developed in parallel with other skills and knowledge. Such theories include the Health Belief Model, health/media literacy, body satisfaction, public health literacy, and the tripartite influence model. These theories are applied regardless of the age of the subjects of the interventions. These theories serve to explain the shaping of risky or health-promoting behaviour as mediated by new and old media. This group of theories, as in the case of teacher digital competence, confirms the multidimensionality of activities that shape ML&DS.

Another interesting group of theories are the elaborate models that show the determinants of contemporary human functioning against the attributes of everyday life. This category includes lifestyle theory and youth relational lifestyles. Both theories provided a starting point from which to build research tools related to the measurement of lifestyles mediated by level of ML&DS, as well as allowing for the explanation of phenomena related to functioning in the information society.

In the group of theories related to psychological underpinnings, one theory related to developmental psychology - Bronfenbrenner's ecological systems theory - and the positive psychological framework were also used in the studies in this review. A further type of psychological theory to be distinguished are concepts relating to cognitive processes. An exemplification of the linking of cognitive processes with ML&DS are primarily Critical Thinking, the Habits of Thought Model, and the Signal Detection Theory (SDT) Framework. Above all, these theories have been highly useful in shaping the evaluation of media messages, and individuals' interpretations of behaviours and processes originating or mediated by digital media. These theories also argue for a broader understanding of ML&DS, not only as the ability to use IT software and hardware, but also in terms of activities that assess the quality and veracity of digital information.

Some studies in this review were built on theories that relate to the evaluation of media messages, which is one of the basic components that define ML&DS. To this end, the following theories were used in the studies analysed: lateral reading, reverse image search, information problem solving, abundance economy of information, the information search process model, the cognitive theory of media literacy, news media literacy, media richness theory, media synchronicity theory, and civic online reasoning. The group of theories related to the



evaluation of media messages, as well as related processes, is one of the more populous categories to have been identified during the analysis.

Among the theories supporting the ability to interpret media messages is inoculation theory, which concerns showing the tasks resulting from the protective function against persuasion. Other theories supporting the formation of ML&DS components that were mentioned in the studies in this review include nudge theory, which emphasises the hidden mechanisms behind decision-making and consumer choices, and the transtheoretical model of behaviour change.

Theories that explore how things work when people interact with both new and traditional media have also been valuable in understanding how ML&DS are formed. This group of theories includes concepts like exemplification theory, the theory of change, the funds of knowledge concept, bounded rationality, and realism-skepticism. These theories do not just describe the parts of ML&DS; they delve into how people engage with media and consider the many aspects, nature, and reasons behind the subject of study.

The table in Appendix B presents a synthesis of the theories applied to the interventions analysed in the studies in this review. From the left, the name of the theory, the source that was used by the authors of the intervention, the area of intervention, and the type of target group are listed. The table also counts the frequency of the theories in question and shows the type of theory (whether directly related to ML&DS or ancillary).

3.2 Outcomes of ML&DS interventions

3.2.1 Outcomes measured in the literature

The studies in our review on the effects of ML&DS interventions have tested a wide range of outcomes of these interventions. Such outcomes include, for instance, critical thinking, body appreciation and satisfaction, and perceptions of media realism. On average, the 248 studies included in this review measured between 3 and 4 (M=3.50, SD = 2.86) outcomes of ML&DS interventions. Table 3 presents an overview of the number of outcomes of interventions that were measured in the studies in this review. Over half of the studies (148 out of 248 or 60%) measured three outcomes or less, and still a considerable number of studies (66 out of 248 or 27%) reported the effects of ML&DS interventions on four, five, or six outcomes. Only a small number of studies reported on 7 outcomes or more. It is important to highlight here that many outcome variables concerned composite variables, consisting of several individual measurement items. In the case of such composite variables, the effects of the intervention on these individual measurement items were generally reported, though at times, information regarding the effect of the intervention on the composite variable made up out of these individual items was missing. In cases where information on the composite variable was present, it was counted as a single measured outcome. However, in situations where information about the composite variable was absent, each individual measurement item was counted separately. This might help explain the higher number of studies measuring fewer outcomes (due to the availability of information on composite scales), and the lower number



of studies measuring more outcomes (due to missing information on composite scales and having to consider each individual measurement item as an outcome).

Table 3. Number of outcomes measured				
Number of outcomes	Frequency	Percentage		
1 outcome	66	27		
2 outcomes	42	17		
3 outcomes	40	161		
4 outcomes	31	13		
5 outcomes	17	7		
6 outcomes	18	7		
7 outcomes	4	2		
8 outcomes	7	3		
9 outcomes	5	2		
10 outcomes	5	2		
12+ outcomes	6	2		

3.2.2 Effects of ML&DS interventions

To facilitate the comparison of the effects of the ML&DS interventions under study on the various outcomes, it was necessary to identify studies that used adequate methods that allowed for experimental testing of the intervention and subsequent effect size calculation. In the coding framework, three types of research were distinguished: randomised controlled trials, quasi-experiments, and survey research (where a survey was used to evaluate outcomes



of interventions). Additionally, we included a fourth category labelled "Other" to encompass studies that did not align with any of the three predefined labels. For studies falling under the "Other" category, researchers had the option to specify the nature of the research method in a text field. During the coding process, it was possible to select multiple options if a study used multiple methodologies.

Table 4 presents the types of research that constituted the studies in this review. The majority of the studies in the review concerned quasi-experimental research (158 out of 248 studies, or 64%). About a quarter of the studies (69 out of 248 studies or 28%) concerned survey research, while only 42 studies (17%) were coded as true randomised controlled trials. Among the 22 studies marked as "Other" were mixed-methods designs that next to a quantitative component also included a qualitative component such as interviews or group discussions.

Table 4. Type of research		
	Frequency	Percentage
Randomised controlled trial	42	17
Quasi-experiment	158	64
Survey research	69	28
Other	22	9

Note: It was possible to indicate multiple options.

Only experimental studies that compared at least two conditions (at least a treatment group and a control group) qualified for adequate measurement of the effects of interventions on outcomes. Therefore, only those studies including two or more experimental conditions were included in the effect size calculations that allowed for comparisons of intervention effects across studies. Table 5 contains an overview of the number of conditions included in the studies in this review. In 126 studies, all participants were in the same group and no distinction was made between experimental or control conditions. In 119 studies, the participants were divided across two or more experimental conditions. Only these 119 studies qualified for further effect size calculations.



Table 5. Number of conditions

	Frequency	Percentage
One condition	126	51
Two conditions	88	36
Three conditions	25	10
Four conditions	6	2

In the coding framework, seven types of outcomes were distinguished: Civic/participatory, Economic/employment, Education/learning, Media literacy & digital skills, Physical wellbeing, Psychological wellbeing, and Socio-cultural wellbeing. Additionally, the coding framework contained an "Other" category where a different outcome category could be defined in case the outcome measured did not fit one of the six predefined categories. Following an analysis of the additions made in this "Other" category for this set of 119 studies, two additional categories of outcomes were added: Cognitive outcomes, and Technology acceptance (i.e., how willing and receptive people are to embrace technology and make effective use of it). None of the 119 studies under analysis reported on outcomes in the pre-defined Economic/employment category. Therefore, in what follows, the effects of the ML&DS interventions in this set of 119 studies will be discussed for eight outcome categories: Civic/participatory, Cognitive, Education/learning, Media literacy & digital skills, Physical wellbeing, Psychological wellbeing, Socio-cultural wellbeing, and Technology acceptance. Among civic/participatory outcomes are outcomes such as digital citizenship and awareness of partisanship. Cognitive outcomes include mental capabilities (for instance, in processing information), flow (i.e. a high level of mental engagement), or self-efficacy. Outcomes related to education and learning include variables such as literacy or perceived learning. Media literacy and digital skills outcomes concern factors such as digital literacy, programming skills, and attitudes about online risks. Physical wellbeing outcomes include outcomes such as subjective health and attitudes towards smoking and cigarettes. Psychological wellbeing outcomes consist of factors such as body image, confidence, and social comparison. Finally, socio-cultural wellbeing includes outcomes such as bystander intentions (i.e., the extent to which individuals are inclined to intervene, support or take action in situations where they witness instances of e.g., social discrimination, harassment) and gender role norms.

For each of the eight outcome categories, the number of outcomes for which an effect of ML&DS interventions was reported or calculated, along with the size of these effects, is



displayed in Figure 2. In general, it can be concluded that of the 678 effects of ML&DS interventions found in 119 studies in relation to the eight types of outcomes distinguished, 292 effects (43%) emerged as non-significant; 180 small effects (27%) were found, while 79 effects (12%) emerged as medium-sized. We found 88 large effects (13%) of ML&DS interventions on the eight types of outcomes. For 39 effects (6%), no effect size was reported, and insufficient information was available for the calculation of an effect size.

When examining each of the outcome categories separately, it becomes evident that among the 119 studies focusing on the effects of ML&DS interventions, outcomes associated with media literacy and digital skills were the most frequently tested. Specifically, these studies assessed the effects of ML&DS interventions on 364 outcomes linked to media literacy and digital skills, accounting for 54% of all 678 effects studied.

For 27 reported outcomes (7%), no effect size was reported by the authors in the original article, and insufficient information was present in the article for the researchers to calculate the effect size. For 152 tested outcomes (42%), the effects emerged as non-significant or adverse, and 93 (26%) were considered small. Medium effects of ML&DS interventions on outcomes related to media literacy and digital skills were reported or calculated for 46 outcomes (13%), while an additional 46 outcomes (13%) were found to be strongly affected ML&DS interventions.

Following ML&DS as the primary outcomes, outcomes related to psychological wellbeing were the second most frequently examined. Specifically, the effects of ML&DS interventions on 127 outcomes associated with psychological wellbeing were investigated, making up 19% of all 678 outcomes in the analysis. However, the majority of these psychological wellbeing outcomes (74 out of 127, which is 58%) did not show significant effects. Only 36 outcomes (28%) demonstrated small effects resulting from ML&DS interventions. Additionally, medium and large effects were observed for 11 outcomes (9%) and 6 outcomes (5%), respectively.

Within the 119 studies, outcomes related to education and learning (96 outcomes, 14% of all 678 effects), physical wellbeing (43 outcomes, 6% of all 678 effects), and socio-cultural wellbeing (41 outcomes, 6.0% of all 678 effects) were tested relatively often. However, civic/participatory outcomes (3 outcomes, 0.5% of all 678 effects), cognitive outcomes (3 outcomes, 0.5% of all 678 effects), and technology acceptance outcomes (1 outcome, 0.01% of all 678 effects) have only been considered sporadically in the 119 studies in this analysis.



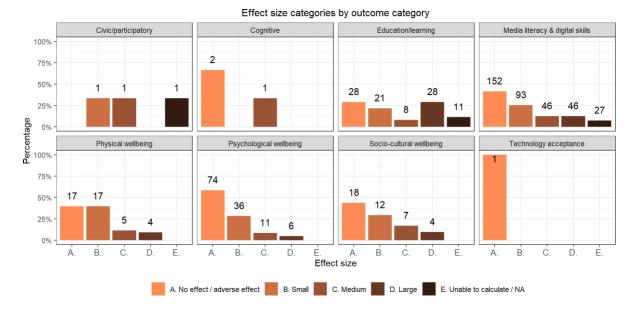


Figure 2. Effect size categories by outcome category. Percentage and number of effect size categories by outcome category in the pool of 678 effects in 119 articles included in the literature review.

3.2.2.1 Intervention effects

119 experiments were included in this analysis. Each experiment contained different situations or conditions that were tested. These experiments looked at the effects of ML&DS on certain outcomes. There are three types of effects that were studied to see how ML&DS interventions influenced these outcomes:

1. Within-Group Effects: This type of effect considers how the results changed over time (from before the intervention to after) and also depending on the specific conditions the participants were in.

2. Between-Group Effects: This type of effect compares the results of participants in different conditions after the ML&DS intervention.

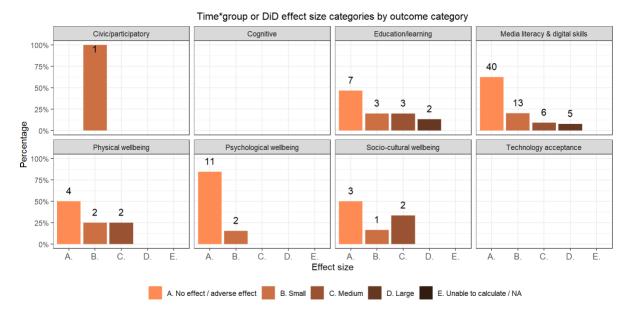
3. Within-Treatment Effects: This effect looks at how the scores of participants within a single treatment group changed from before the intervention to after.

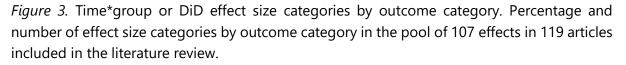
The analysis will discuss how ML&DS interventions impacted outcomes in these 119 studies by looking at each of these types of effects separately.

Figure 3 displays the number of outcomes within each of the eight categories of outcomes for which DiD (Difference-in-Difference) (interaction time*group) were reported or calculated, along with their effect sizes. In total, 107 interaction or DiD effects were tested in the 119 studies in this analysis. The majority of these effects emerged as non-significant (65 effects, 61%); 22 (21%) small interaction or DiD effects of ML&DS interventions on the eight types of outcomes were found, while 13 effects (12.1%) were categorised as medium-sized. Only 7 (7%) interaction or DiD effects were classified as large.



No interaction or DiD effects were found for cognitive outcomes or outcomes relating to technology acceptance, and only one DiD effect of ML&DS interventions was found for civic/participatory outcomes. The highest number of interaction or DiD effects of ML&DS interventions was found for outcomes related to media literacy and digital skills (64 effects), but the majority of these effects emerged as non-significant (40 effects, 63%). Thirteen (20%) DiD effects of ML&DS interventions on outcomes related to media literacy and digital skills were small, while six (9%) effects were medium, and only five (8%) effects were large. Although the number of interaction or DiD effects of ML&DS interventions that was measured for education/learning outcomes, physical wellbeing outcomes, psychological wellbeing outcomes, and socio-cultural wellbeing outcomes was smaller, a similar pattern emerges: About half (or in the case of psychological wellbeing, even more than half) of the interaction or DiD effects emerged as non-significant, with the remaining effects consisting of small or medium effect sizes. Only in the case of education/learning outcomes, two large interaction or DiD effects of ML&DS interventions were found.





The between-group effects of ML&DS interventions comparing the scores of participants in different experimental conditions on the outcome variables at post-test are presented in Figure 4. In total, 322 between-group effects of ML&DS interventions on the eight types of outcomes were reported in or calculated based on the 119 studies in this analysis. Almost half of these effects (150 effects, or 46.6%) emerged as non-significant. In total, 88 small between-group effects (27.3%) were found, and 40 medium-sized effects (12.4%) were reported or calculated; 41 between-group effects (12.7%) emerged as large. For two between-group effects (0.6%), no effect size was reported, and insufficient information was available for the calculation of an effect size.



The largest number of between-group effects of ML&DS were reported or calculated for outcomes relating to media literacy and digital skills (172 effects). However, almost half of these effects (80 effects, 46.5%) emerged as non-significant; 44 (26%) were small, while 26 effects (15%) were categorised as medium. Only 20 effects (12%) of ML&DS interventions on media literacy and digital skills outcomes were large. For two between-group effects on media literacy and digital skills outcomes (1%), no effect size was reported, and insufficient information was available for the calculation of effect size.

A relatively large number of between-group effects were reported or calculated for education/learning outcomes (57 effects, 33%) and psychological wellbeing outcomes (47 effects, 27%). It is worth highlighting the large number of large between-group effects of ML&DS interventions that were reported or calculated for education/learning outcomes: about a third of all the effects measured for education/learning outcomes were categorised as large (18 effects, 31.6%). Smaller numbers of between-group effects were found for outcomes relating to civic participation (1 effect, 0.6%), physical wellbeing (23 effects, 13%), socio-cultural wellbeing (21 effects, 12%), and technology acceptance (1 effect, 0.6%). No between-group effects were reported or calculated for cognitive outcomes.

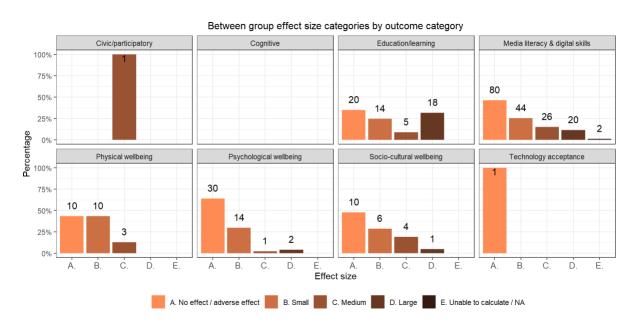


Figure 4. Between-group effect size categories by outcome category. Percentage and number of effect size categories by outcome category in the pool of 322 effects in 119 articles included in the literature review.

Figure 5 displays the within-treatment effects of ML&DS interventions that were reported in or calculated based on the 119 studies in this analysis. In total, 132 within-treatment effects were found. Of these, 49 were non-significant (37.1%), 48 were small (36.4%), 13 were medium-sized effects (9.8%), and 22 were marked as large effects (16.7%).



The largest numbers of within-treatment effects were found for outcomes related to media literacy and digital skills (69 outcomes, 58%), and outcomes related to psychological wellbeing (33 outcomes, 28%). It is noteworthy that the number of small effects (26 effects, 38%) of ML&DS interventions on outcomes related to media literacy and digital skills is larger than the number of non-significant effects (21 effects, 30%). Regarding psychological wellbeing, the majority of effects were not significant (20 effects, 61%) or small (10 effects, 30%), effects of medium or large sizes on psychological wellbeing outcomes were very scarcely reported on in our set of 119 studies. Smaller numbers of within-treatment effects were calculated for outcomes related to education/learning (7 effects, 5%), physical wellbeing (11 effects, 8.3%), and socio-cultural wellbeing (12 effects, 9.1%). No within-treatment effects were reported or calculated for civic/participatory outcomes, civic outcomes, or technology acceptance outcomes.

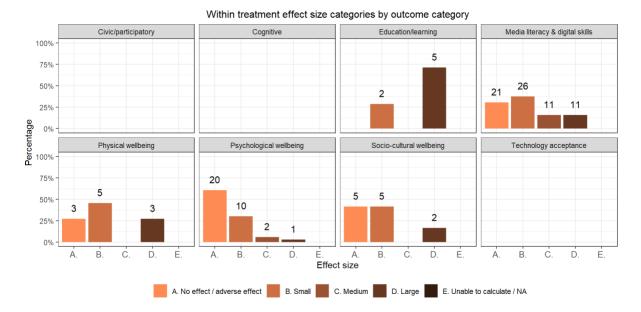


Figure 5. Within-treatment effect size categories by outcome category. Percentage and number of effect size categories by outcome category in the pool of 132 effects in 119 articles included in the literature review.

3.2.2.2 The relationship between sample size and effect size

Figure 6 displays the results concerning the relationship between the sample sizes of the 119 studies analysed in this study and the effect sizes reported or calculated in these studies. The objective was to gain a deeper understanding of whether the selected studies for analysis were underpowered (i.e., studies in which the sample size is too small to reliably detect real effects) or overpowered (i.e. studies in which the sample size is much larger than necessary to detect the effects of interest). In this context, larger effects observed with smaller sample sizes indicated potential underpowered studies, while the opposite suggested overpowered studies. It is worth noting that the studies with the largest sample sizes, which are considered outliers, are not shown on the plot.



Based on Figure 6, it can be concluded that as the effect size increases, sample size decreases. Studies where no significant effects were found on average report higher sample sizes and display more variation in the number of participants than studies where small, medium, or large effects were found. The smallest sample sizes with the least amount of variation in the number of participants were found for studies in which large effects were reported or for which large effect sizes were calculated by the researchers, suggesting underpowered studies.

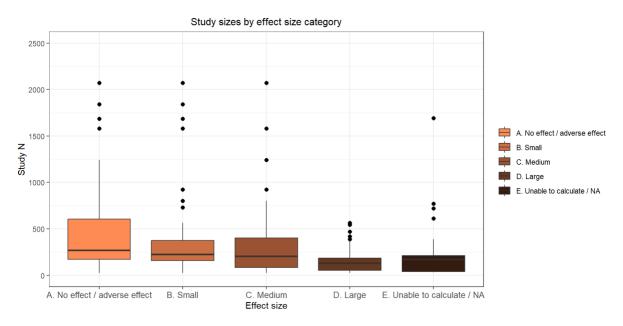


Figure 6. Studies' sample sizes by effect size category.

3.2.3 Effect sizes for specific target groups

The 119 studies investigating the impacts of ML&DS interventions on eight distinct outcome categories have involved a diverse range of participants. These participants have spanned a wide age spectrum, including both children and the elderly. Additionally, some studies have concentrated on more specific subgroups, including college students, teachers, and parents.

Therefore, special attention to the target group of the intervention under study in each article was paid by including an open text field in the coding framework in which this target group could be specified. These open answers were recoded into the following nine categories of target groups: children, youths, college students, (future) teachers, young adults, adults, older adults, parents, and the public in general. In what follows, the effects of the ML&DS interventions analysed in the 119 studies are discussed for each of these target groups. It is conceivable that certain effects were documented for two distinct demographic groups in cases where the study encompassed both children and adolescents. When a narrower, more specific demographic category was applicable alongside a broader one (such as adults being parents), the study opted to use the label of the more precise demographic category. It is worth noting that, except for teachers, none of these groups were the primary focus of our research in the REMEDIS study.



Figure 7 presents the effects of ML&DS interventions on the eight types of outcomes for children. In this analysis, we consider participants to be children when they are younger than 12 years old. In total, 94 effects were measured with child participants across the 119 studies in this analysis. The majority of these effects were measured in the media literacy and digital skills outcome category (44 effects, 47%), and in the education and learning outcome category (21 effects, 22%). It is noteworthy that in both categories, the number of large effects is quite high: 16 large effects on media literacy and digital skills outcomes (36% of all effects on media literacy and 8 large effects on education/learning outcomes (38.1% of all effects on education/learning outcomes).

Fewer effects were measured for children on outcomes relating to physical wellbeing (14 effects, 15%), psychological wellbeing (5 effects, 5%), and socio-cultural wellbeing outcomes (8 effects, 9%). Only one effect was tested for civic/participatory outcomes (1%), and similarly only one effect emerged that related to technology acceptance outcomes (1%). No effects of ML&DS interventions on cognitive outcomes were tested in children.

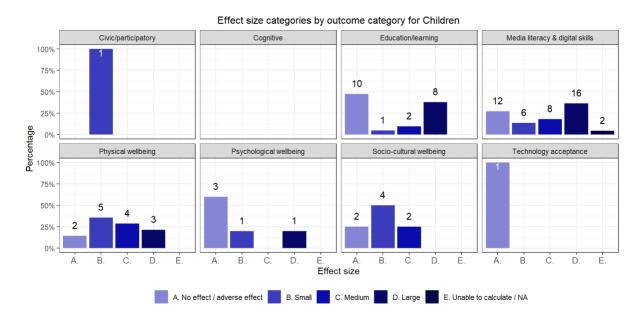


Figure 7. Effect size categories by outcome category for children. Percentage and number of effect size categories by outcome category in the pool of 94 effects in 119 articles included in the literature review.

Figure 8 displays the effects of ML&DS interventions on the eight types of outcomes for youths. In this study, we consider youths to be young people between the ages of 12 and 17, generally those attending secondary education. In total, 290 effects of ML&DS interventions were measured with youth participants across the 119 studies in this analysis. Two outcome categories are tested considerably more than others for effects of ML&DS interventions: media literacy and digital skills outcomes (141 effects, 48.6%), and psychological wellbeing outcomes (66 effects, 22.8%). It is interesting to note that while psychological wellbeing was only



sporadically tested in children, it is higher up the list of outcomes for youths. The effects of ML&DS interventions on education/learning outcomes (33 effects, 11.4%), physical wellbeing outcomes (25 effects, 8.6%), and socio-cultural outcomes are tested to a lesser extent (25 effects, 8.6%). It is, however, interesting, that the largest proportion of large effects can be found for education/learning outcomes (10 effects, 30.3% of all education/learning outcomes): although this type of outcome is not tested as much in youths, it seems to be the most affected by ML&DS interventions. No effects were reported for civic/participatory outcomes, cognitive outcomes, and technology acceptance outcomes.

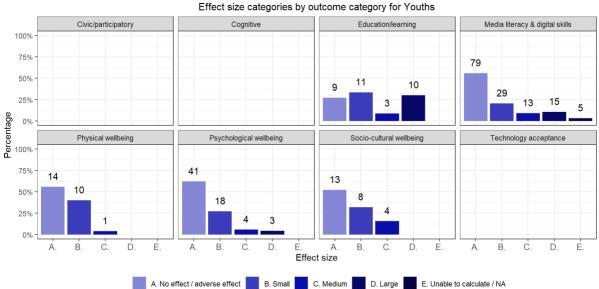


Figure 8. Effect size categories by outcome category for youths. Percentage and number of effect size categories by outcome category in the pool of 290 effects in 119 articles included in the literature review.

Figure 9 presents the effects of ML&DS interventions aimed at college students on the eight types of outcomes. In this study, college students are understood as those who are attending higher education in a college or university. In total, 99 effects of ML&DS interventions aimed at college students were tested in the 119 studies in this analysis. The largest number of effects were tested for outcomes relating to media literacy and digital skills (67 effects, 67.7%). To a lesser extent, the studies in this review considered outcomes relating to education/learning (15 effects, 15.2%), and psychological wellbeing (12 effects, 12.1%). Only sporadically, effects relating to cognitive outcomes (3 effects, 3.0%) or socio-cultural wellbeing outcomes (2 effects, 2.0%) were tested. No effects were tested in the 119 studies in this analysis for civic/participatory outcomes, physical wellbeing outcomes, and technology acceptance outcomes.



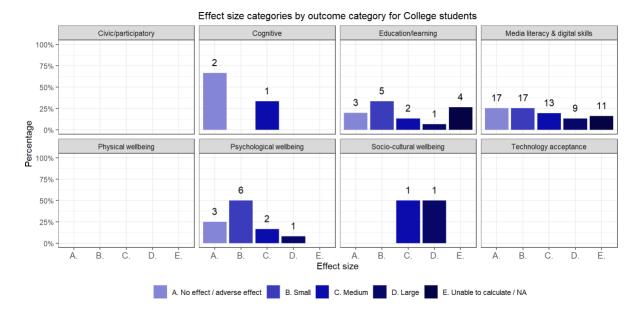


Figure 9. Effect size categories by outcome category for college students. Percentage and number of effect size categories by outcome category in the pool of 99 effects in 119 articles included in the literature review.

The fourth category of target groups that emerged from the analysis of 119 studies are (future) teachers. This group is made up of participants that are already teaching in a school, or those that are in training to become teachers. Figure 10 displays the effects of ML&DS interventions aimed at (future) teachers. It is clear that the numbers of effects tested for teachers are lower and limited to only half of the categories of outcomes in comparison with children, youths, and college students. In total, 36 effects of ML&DS interventions on four out of the eight types of outcomes were measured in the 119 studies in this analysis. The majority of these effects are concentrated within the education/learning outcomes (19 outcomes, 52.8%) and the media literacy and digital skills outcomes (14 outcomes, 38.9%). Only one effect was tested for civic/participatory outcomes (2.8%), and two effects were tested for socio-cultural wellbeing outcomes (5.5%). It is interesting to note that across the outcome categories, the effect sizes generally seem larger: 27.8% of effects are non-significant, 8.3% are small, 8.3% are medium, and 33.3% are large. For college students, the proportion of large effects was only 12.1%, in youths this proportion was 9.6%, and in children this was 29.8%.



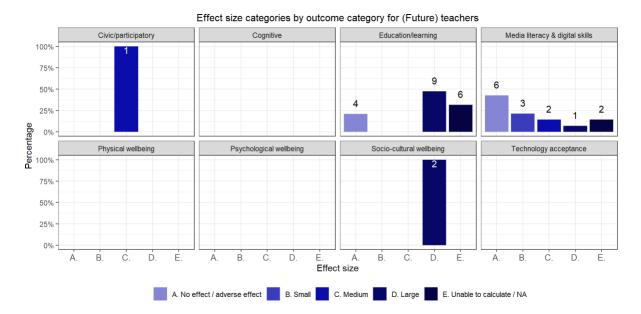


Figure 10. Effect size categories by outcome category for (future) teachers. Percentage and number of effect size categories by outcome category in the pool of 36 effects in 119 articles included in the literature review.

Figure 11 presents the effects of ML&DS interventions aimed at young adults on the eight types of outcomes. Only a small number of effects of interventions aimed at this group were tested, as the total number of effects across the eight types of outcomes is seven. This low number of effects of interventions aimed at young adults may be due to the fact that many young adults are enrolled in higher education and may hence have been included in the college student target group. College students, being readily accessible for research, may have predominantly represented the college student demographic rather than the broader category of young adults. It should be noted that this group of college students did not belong to the group of NEETs, unemployed individuals and refugees the REMEDIS study primarily focuses upon. The seven effects are spread between three categories of outcomes: education/learning (1 effect), media literacy and digital skill (4 effects), and psychological wellbeing (2 effects). It is noteworthy that only one out of these seven effects emerged as non-significant (14%).



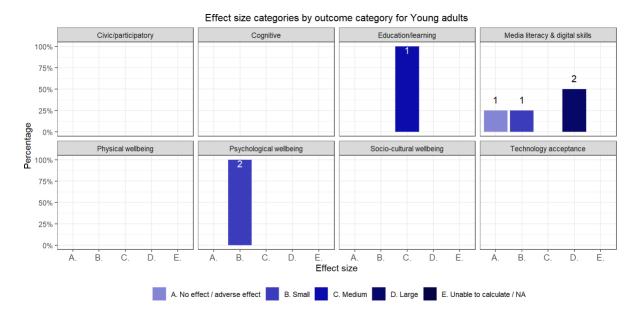


Figure 11. Effect size categories by outcome category for young adults. Percentage and number of effect size categories by outcome category in the pool of 7 effects in 119 articles included in the literature review.

The next target group of ML&DS interventions that was considered in the 119 studies in this analysis were adults. Figure 12 displays the effects of these interventions aimed at adults for the eight types of outcomes that were distinguished. In total, 61 effects of ML&DS interventions aimed at adults were tested across four types of outcomes, with outcomes relating to media literacy and digital skills (62%) and psychological wellbeing (31%) tested the most. Only one effect was tested for civic/participatory outcomes (2%), and 3 effects were tested for socio-cultural wellbeing outcomes (5%). In comparison with the previously discussed target groups, the proportion of larger effect sizes is small, with no large effects and only one medium-sized effect (2%). Instead, for the majority of reported effects, the effect was non-significant (61%) or small (26%).



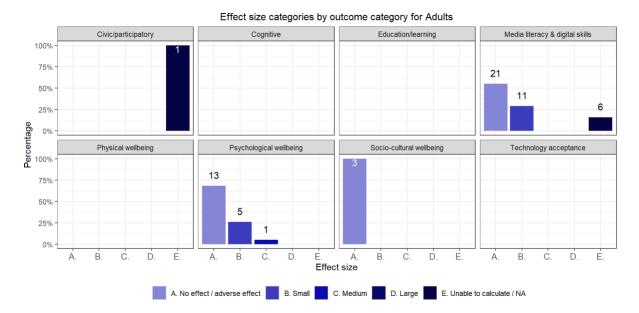


Figure 12. Effect size categories by outcome category for adults. Percentage and number of effect size categories by outcome category in the pool of 61 effects in 119 articles included in the literature review.

Figure 13 presents the effects of ML&DS interventions aimed at the elderly for the eight types of outcomes in the set of 119 studies in this analysis. In total, only 24 effects of interventions aimed at this target group were tested. The majority of these effects were related to media literacy and digital skills outcomes (12 effects, 50%), and psychological wellbeing outcomes (8 effects, 33%). While the effects relating to media literacy and digital skills outcomes are mainly small (4 effects, 33%) or medium-sized (4 effects, 33%), the majority of the effects linked to psychological wellbeing emerged as non-significant (5 effects, 63%). Only one effect was tested for physical wellbeing (4%), and one effect was tested for socio-cultural wellbeing (4%). No effects of ML&DS interventions aimed at older adults were tested for civic/participatory, cognitive, and education/learning.



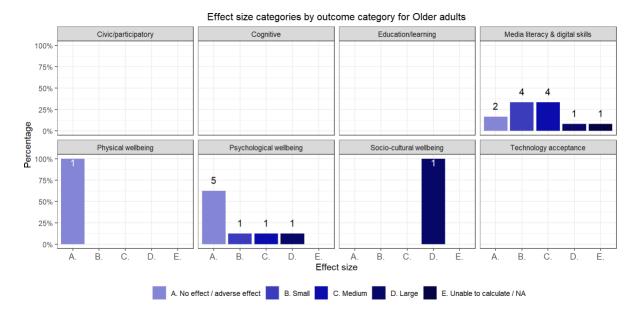


Figure 13. Effect size categories by outcome category for older adults. Percentage and number of effect size categories by outcome category in the pool of 24 effects in 119 articles included in the literature review.

The next target group that was included in the 119 studies testing the effects of ML&DS interventions on the eight types of outcomes using experimental methods with multiple participants assigned to multiple conditions, concerned parents (Figure 14). Within this set of 119 studies, parents are severely underrepresented: only 6 effects of interventions aimed at parents were tested, and these effects were only associated with 2 types of outcomes. More specifically, one effect was found for media literacy and digital skills outcomes (17%), while five effects were found for education/learning outcomes (83%). These effects emerged as either non-significant (3 effects, 50%) or small in size (2 effects, 33%). For one effect, no effect size was reported and adequate information for the calculation of the effect size was lacking from the study. In this set of 119 studies, no outcomes relating to civic participation, cognitive abilities, physical wellbeing, psychological wellbeing, socio-cultural wellbeing, were tested.



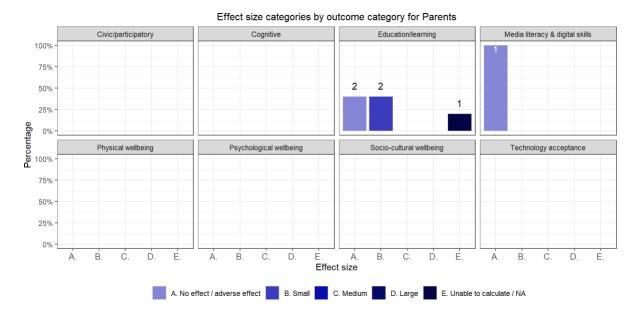


Figure 14. Effect size categories by outcome category for parents. Percentage and number of effect size categories by outcome category in the pool of 6 effects in 119 articles included in the literature review.

The last target group that surfaced from the analysis of the 119 studies pertains to the general public (i.e., no specific target groups). Figure 15 illustrates the impact of ML&DS interventions targeted at the broader public. A total of 18 effects were identified, all of which were associated with outcomes related to media literacy and digital skills. Among these effects, half (9 effects, constituting 50%) were found to be non-significant. Meanwhile, 4 effects were considered small (22%), 4 effects were categorised as medium (22%), and 1 effect was deemed large (6%).

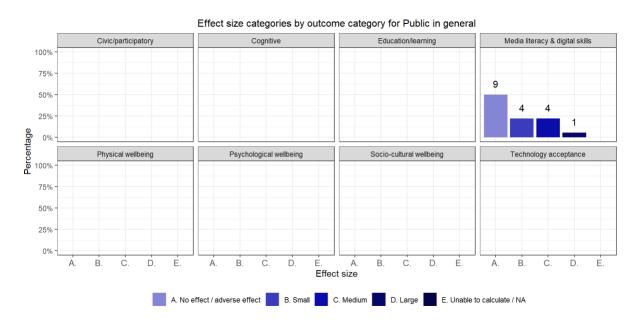


Figure 15. Effect size categories by outcome category for the public in general. Percentage and number of effect size categories by outcome category in the pool of 18 effects in 119 articles included in the literature review.



3.3 Differentiating factors of ML&DS interventions

Most reviewed studies did not include any analysis or discussion of differentiating factors that influence (e.g., moderate, mediate) the effects of the ML&DS interventions. Only 37 of the 248 studies included in the final, full-text literature review (approximately 15%) discussed moderators, mediators, or other unspecified differentiating factors in any form.

Among the 37 studies which reported on differentiating factors, 14 focused on youths (including two that targeted youths with disabilities; one that targeted both parents and youths; and one that targeted youths through their teachers); 6 targeted adults; 5 focused on children; 5 targeted (future) teachers (including one which targeted teachers, but intervention effects were measured on youths); 4 were aimed at young adults (including one study focusing on young women specifically); 3 targeted college students; and parents were only targeted in two studies (including one that also studied youths). None of the studies with differentiating factors covered the target groups of the elderly or the public in general, even though these groups were identified as target audiences in the review of the effect sizes (Chapter **3.2.3**). In general, studies with differentiating factors tended to focus on younger and more educated target groups.

Most of the studies (33) with differentiating factors concerned moderators or variables that could be interpreted as having a moderating effect. Only four studies included mediators or mediation analysis in any form. No studies included both moderation and mediation.

Here, a moderator is considered to be any categorical or continuous variable (e.g., gender, age) that affects the strength or direction of a relationship between two constructs (Hair et al., 2021). However, to discuss the differentiating factors of ML&DS interventions more inclusively, a broad interpretation was adopted: even when moderation analysis was not included in the study (true for most cases) but, group comparisons, etc., allowed to infer the presence of a potential moderating variable, these variables were coded as moderators and included for review.

A mediator, however, should be part of a causal sequence of effect (MacKinnon et al., 2007), i.e., a mediator should be caused by the independent variable. The terms *mediator* and *moderator* were, nevertheless, used rather loosely or not at all in the studied sample of articles. This may have led to mistakes while interpreting and coding the articles. Thus, some variables that were described or coded as mediators were, upon further scrutiny, later recoded as moderators (e.g., gender, past academic performance levels) or excluded from review (e.g., intervention groups, outcomes). In the context of this study, recoding was not considered a major issue because all differentiating factors should be taken into account when designing or revising ML&DS interventions.

3.3.1 Mediation effects in ML&DS interventions

The very small sample size (n = 4) and mistakes in terminology make interpretation of mediation effects difficult. However, all of the studies concerned ML interventions in different



forms (including advertising and greenwashing literacy); DS were not covered in any of these studies. Also, three out of the four articles studied sequential mediation effects. Thus, in the rare instances that mediation effects in ML interventions were studied, thorough analysis with elaborate sequential models and cascading effects may be observed. Nearly all of the mediation effects studied (12 out of 13 effects in total) were significant. It may be assumed that, in general, only empirically supported models of mediation were presented in articles.

All of the mediation studies covered younger target groups: two of the studies targeted young adults (one focused on young women specifically), and youths were also targeted in two papers (one included parents). The affected outcomes were diverse, e.g., ML and its components, behavioural changes in food consumption-related activities, different forms of communication, but also risk behaviour attitude, critical media use, and motivation in learning ML. Although two thirds of the outcomes fell under the category of ML&DS (as defined in Chapter *3.2.2*), Phycological wellbeing, Socio-cultural wellbeing, and Education and learning outcomes were also included.

In the role of mediators were variables such as efficacy, intentions, different forms of communication, wishful identification (i.e., the desire to identify with or be like certain role models or characters), flow (i.e., full engagement in an activity), enjoyment and vividness (of advertisements). Mediators and their effects on the corresponding outcomes are listed in Table 6, where the results are clustered by study (horizontal lines).

Table 6. Mediators		
Mediator	Affected outcome (Category of outcome)	Role of mediator
Sequential mediation: Expectancies for mediation -> Efficacy for dietary changes	Discuss nutrition facts label (ML&DS)	Parents in the intervention group reported higher expectancies for mediation, which led to parents' higher efficacy for dietary changes, and in turn led to more discussion between parents and youths about nutrition fact labels.
Sequential mediation: Negative mediation (parent) -> Perceived desirability of food marketing (youth) ->	Requesting advertised foods (ML&DS)	Parents in the intervention group engaged more in negative mediation, which led to lower levels of perceived media desirability in youths, which led to lower levels of wishful identification, which



Wishful identification (youth)		ultimately led to lower levels of requesting advertised food by youths.
Sequential mediation: Perceived desirability of food marketing -> Wishful identification	Requesting advertised foods (ML&DS)	Youths in the intervention group reported higher levels of perceived desirability of food marketing (contrary to hypothesis), which led to higher levels of wishful identification, and hence higher levels of requesting advertised food.
Wishful identification	Requesting advertised foods (ML&DS)	Youths in the intervention group reported lower levels of wishful identification, which led to lower levels of requesting advertised food.
Collective efficacy	Sharing of message (ML&DS)	For young women in the intervention group, message generation led to higher collective efficacy, which led to more sharing of messages.
Collective efficacy	Interpersonal conversation (Socio-cultural wellbeing)	For young women in the intervention group, message generation led to higher collective efficacy, which led to more interpersonal conversation.
Sequential mediation: Collective efficacy -> Interpersonal communication	Risk behaviour attitude (Psychological wellbeing)	For young women in the intervention group, message generation led to more collective efficacy, which led to more interpersonal conversation, which finally led to less positive attitudes towards risk behaviour.
Sequential mediation: Collective efficacy -> Interpersonal communication	Critical media use (ML&DS)	For young women in the intervention group, message generation led to more collective efficacy, which led to more interpersonal conversation, which finally led to more critical media use.
Sequential mediation: Collective efficacy -> Sharing of message	Risk behaviour attitude (Psychological wellbeing)	For young women in the intervention group, message generation led to more collective efficacy, which led to more sharing of messages, which in



.

•

		turn led to less positive attitudes towards risk behaviour.
Sequential mediation: flow -> enjoyment	Perceived learning (Education and learning)	Enhanced flow among youths in the minigame intervention led to increased enjoyment of the learning experience, which in turn led to increased perceived learning of advertising literacy.
Sequential mediation: Flow -> Enjoyment -> Perceived learning	Adolescents' motivational outcomes (ML&DS)	Perceived learning of advertising literacy led to youths in the minigame intervention being more motivated to reflect critically on advertising and to interact with the learning materials.
Vividness (of advertising messages)	Greenwashing (Advertising) Literacy (ML&DS)	For young adults in the intervention, increased vividness led to increased greenwashing (advertising) literacy outcomes.

3.3.2 Moderation effects in ML&DS interventions

The somewhat larger sample size (n = 33) of studies that include moderators or other differentiating factors, which can be interpreted as having moderating effects, allows for more nuanced discussion than the limited sample with mediation effects. As described earlier, for the purpose of this review, studies that do not have moderation analysis but include variables that affect the outcomes of the interventions were also coded as studies introducing moderators.

The articles in this sample covered both DS and ML interventions, although ML dominated: 17 studies had an ML (including advertising and information literacy) intervention focus, while 12 studies had a DS intervention focus (four studies had a mixed or unrelated focus). The interventions covered all of the target groups described earlier under differentiating factors in general and were also geared toward a younger (and more educated) population: youths (12), adults (6), children (5), (future) teachers (5), college students (3), young adults (2), parents (1).

Altogether, 82 different moderator (differentiating factor) effects on outcomes were studied. In mediation studies, nearly all studied effects were significant, whereas in 33 cases, the moderator (differentiating factor) had no significant effect on the outcome. In the following discussion, we will focus on the 48 significant or partly significant effects from 25 studies.

Gender (15 effects in 8 studies) was the most common moderator to be measured and to have effect. Half of the effects (53%) favoured girls (target groups ranged from children to college students), and no clear pattern emerged in outcome types. A few examples: sexual ML and



body image ML interventions appeared to be more effective for boys; girls improved more on media scepticism, communication and time management. Age (four effects in as many studies) also had a moderating effect: older children/youths improved more than younger ones in different DS. Other personal or social characteristics of the intervention participants that had a moderating effect included, e.g., advertising liking, ethnicity, parent education, and political ideology. In addition to personal characteristics, other moderators (or differentiating variables) that affected the outcomes of interventions were competences, skills, and literacies (e.g., critical thinking level, intellectual civic skills, commercial social media literacy), prior experiences and attitudes (e.g., prior pessimistic outlook, initial perceptions, prior knowledge), and intervention characteristics (e.g., the person delivering the intervention, type of digital device, programme educational value) (Table 7).

Table 7.	Moderators (and other differentiating factors)	
Moderator	Affected outcomes	Outcome category
Pers	onal and social characteristics of intervention pa	rticipants
Active mediation intention	Brand recognition; Attitude toward the brand	Media literacy & digital skills
Age	Digital competencies; Computational thinking; Success score of operating the mouse; Home computer use	Media literacy & digital skills
Cognitive style	Learning effectiveness	Education and learning
Education system	Speed of operating the keyboard; Using the Internet; Using various types of software	Media literacy & digital skills
Ethnicity	Perceptions of technology acquisition	Media literacy & digital skills



General advertising liking	Effectiveness of product placement	Media literacy & digital skills
Gender	Digital competencies; Knowledge of stop-motion films; Social media engagement; Attitudes toward sexual abstinence; Desirability of the sexual messages; Body dissatisfaction; Body image coping strategies; Negative expectancies; Media literacy; Media scepticism; Media ability (communication); Environment structuring; Help seeking from people; Task strategies; Time management	Media literacy & digital skills; Psychological wellbeing; Socio- cultural wellbeing
Parent education	Home computer use; School computer use	Media literacy & digital skills
Political ideology	Host credibility; Program credibility; Program hostility; Fact-checking ability	Media literacy & digital skills
	Prior experiences and attitudes	
Gaming background	Digital competencies	Media literacy & digital skills
Initial perceptions	Perceptions of scientific consensus	Socio-cultural wellbeing
Prior knowledge	Learning effectiveness; Technology acceptance; Information literacy	Education and learning, Technology acceptance, Media
		literacy & digital skills



.

Literacies, skills, and competences

Commercial social media literacy	Body satisfaction	Psychological wellbeing
Critical thinking level	Digital literacy	Media literacy & digital skills
Intellectual civic skills	Information literacy	Media literacy & digital skills
Self-reported grade	Advanced computer activity; Basic computer activity	Media literacy & digital skills
	Characteristics of the intervention	
Advertising literacy training session	Cognitive advertising literacy	Media literacy & digital skills
Online discussion frequency	Attitudes toward algorithms	Media literacy & digital skills
Person delivering the intervention	Information literacy	Media literacy & digital skills
Programme educational value	Brand recognition; Attitude toward the brand	Media literacy & digital skills



. . .

Programme position	Host credibility; Programme credibility; Programme hostility	Media literacy & digital skills
Type of digital device	Attitudes toward algorithms	Media literacy & digital skills

Various outcomes were affected by these moderators (differentiating factors), including body (dis)satisfaction, time management, the effectiveness of product placement, task strategies, attitudes toward sexual abstinence, brand recognition, knowledge of stop motion films, perceptions of scientific consensus, etc (Table 7). The majority of outcomes could, however, be broadly categorised under different forms of ML&DS, but Education and learning, Socio-cultural wellbeing, Psychological wellbeing, and Technology acceptance were also represented. Among the outcome categories described in Chapter *3.2.2*, Civic/participatory, Cognitive, and Physical wellbeing outcomes were missing from intervention studies that included moderating effects.

Six studies (11 effects) indicated that participants with a lower previous knowledge base, less advantaged background, or higher levels of misconceptions/biases benefited more from the ML&DS interventions in different outcomes than those subjects who had a better starting point. This suggests that ML&DS intervention programs are indeed most effective when targeting populations who have more to gain from the interventions. This at least appears to hold true for the limited (generally younger and more educated) target groups under review. The only somewhat opposing study was aimed at a disadvantaged population (youths with disabilities) where in a DS intervention, educationally less privileged youths (from special needs *vs.* mainstream education) received less benefit. Conversely, in the second study focusing on the same target group (youths with disabilities), youths from ethnic minorities received more benefit from the DS intervention than majority ethnic youths. Unfortunately, the complete lack of moderation studies among other vulnerable groups (e.g., older adults, refugees, migrants, low SES groups, unemployed, etc.) does not allow us to draw more definitive, population-wide conclusions.

In all, the literature review highlights the need for more comprehensive research on various mediation and moderation effects within ML&DS interventions. Presently, there is a noticeable absence of DS intervention studies that incorporate mediating effects. Additionally, future studies should aim to include a more diverse range of target groups, with particular attention to underrepresented demographics like the elderly. However, it is worth noting that conducting thorough and robust analyses of both mediation and moderation requires sufficient statistical power, which may pose challenges for interventions focused on more vulnerable target groups due to the need for relatively large sample sizes.



4 Conclusions and recommendations

The aim of this systematic evidence review was to collect and summarise the available scientific evidence relating to potentially effective intervention programmes on ML&DS to gain a better overview of the extent to which different types of outcomes have been studied in this literature on intervention programmes. Using a comprehensive search in large scientific databases and a rigorous screening and coding process, we arrived at a set of 248 studies investigating the effectiveness of intervention programmes aimed at improving ML&DS or an aspect of ML&DS, and the outcomes that are associated with participation in such interventions. In this report, we have presented the findings pertaining to the theoretical frameworks that guided these studies, the outcomes that were reported on these studies, and potential differentiating factors that may strengthen or weaken the effect of an intervention itself. In what follows, we will outline the most important conclusions that can be drawn from this systematic evidence review.

The first section of the results discussed the theoretical frameworks that were used to guide the studies on intervention effectiveness in this systematic evidence review. These theories are a central part of research on the effects of ML&DS interventions, as these insights and conceptual frameworks shape each step in the research process, from the design and implementation of the intervention to the tests of its effectiveness. Approximately threequarters of the studies included in this systematic evidence review were underpinned by a theoretical framework. Among these studies, roughly half were associated with theories originating from fields like media studies and media psychology, while the remaining half drew from theories within other social sciences or humanities domains. What emerged consistently across these studies was a notable flexibility in the application of theory. This adaptability stemmed from the recognition that various facets of people's lives intersected with their engagement in an intervention and the potential impact of that intervention on their lives. The theories employed in these studies exhibited diverse origins, encompassing psychological science (e.g., Theory of Planned Behavior), pedagogical science (e.g., TPACK framework), and various related disciplines. It is worth considering the contextual setting in which these interventions occurred, as the use of specific theories may be influenced by their relevance in educational settings, such as schools or universities.

The second section of the results focused on the outcomes that studies examining the effect of ML&DS interventions reported on. This analysis allowed us to gain an overview of the types of outcomes of ML&DS interventions most commonly tested and the target groups most often focused on in the literature on ML&DS interventions. As such, we were also able to identify less commonly examined outcomes and target groups and hence point towards gaps in the literature on ML&DS interventions and their outcomes.

As outlined in the second section of the results and in the methodology section, to compare the effects of ML&DS interventions on the outcomes measured, we selected a subset of studies that employed adequate methods that allowed for experimental testing of the intervention and subsequent effect size calculation. We only selected those studies that employed experimental or quasi-experimental methodologies and that hence compared at least two



conditions (a treatment group and a control group). This resulted in a subset of 119 studies that qualified for further effect size calculations and comparisons of effect sizes across studies.

Based on our coding framework, we distinguished all six pre-defined types of outcomes and an additional seventh eight outcome in this subset of 119 studies. These categories included civic/participatory outcomes, economic/employment outcomes, education/learning outcomes, media literacy and digital skills outcomes, physical wellbeing outcomes, psychological wellbeing outcomes, socio-cultural wellbeing outcomes, and we added cognitive outcomes to the list. Across the 119 studies, media literacy and digital skills-related outcomes emerged as the most dominantly tested outcomes of ML&DS interventions. In second and third place respectively, outcomes relating to psychological wellbeing and education/learning were examined. These top three outcome categories do not come as a surprise: it is evident that researchers examining an intervention that targets a certain skill want to test whether this skill was actually improved as a result of the intervention. With the increasing concern and subsequent focus of researchers and experts for topics relating to psychological wellbeing and mental health, the attention for this outcome in research on interventions is not surprising. Lastly, the focus on educational and learning outcomes is understandable, as the primary aim of an intervention is often to teach a particular skill or enhance the participants' knowledge on a certain topic: it is evident that researchers, then, aim to test whether any positive learning outcomes were achieved. Lastly, the focus on formal educational and learning outcomes is logical due to the substantial amount of research conducted within formal educational settings, often involving teachers and university students. This is distinct from other outcomes associated with media literacy and digital skills (ML&DS), which also entail learning and knowledge acquisition but may not necessarily be limited to formal education contexts.

The numbers of studies investigating other outcomes such as civic/participatory outcomes, physical wellbeing, and socio-cultural wellbeing, were less numerous. It is important that future research testing the effects of an intervention pays more attention to including a broader set of outcomes that goes beyond the exact expected aims of the project or interventions, to gain a broader view of the different benefits that ML&DS interventions may hold for participants.

Next, in line with the aim of the REMEDIS project to pay special attention to specific target groups, the next part of the findings zoomed in on the outcomes of ML&DS interventions while distinguishing between such target groups. The 119 studies examining the effects of ML&DS interventions have been conducted with a wide variety of participants, not only ranging in age from children to older adults, but also in terms of more specific characteristics such as college students, teachers, and parents. In total, nine specific target groups emerged from our analysis of the 119 studies: children, youths, college students, (future) teachers, young adults, adults, older adults, parents, and the public in general. Based on our analysis of the types of outcomes that are most represented in research differ depending on the target group under study, although outcomes relating to ML&DS continue to dominate. For instance, for children, youths, and college students, more studies reported on outcomes relating to education and learning than for older age groups. Likewise, studies focused on psychological



wellbeing were predominantly conducted with young people and college students. In contrast, this aspect received less attention in research involving older adults and was entirely absent in studies involving teachers or parents. Moreover, it is noteworthy that in certain instances, when specific target groups were the subject of research, the percentage of significant positive effects in the studies increased. For instance, when looking across the set of 119 studies, only 13% of studies reported large effects of the intervention on ML&DS outcomes, while in children specifically, this percentage was 36%. While this pattern of larger effect sizes for specific target groups was not consistent across all outcomes and all target groups, this finding leads us to cautiously suggest that considering and specifying the target group when designing and testing interventions is important in order for the desired positive effects to be stronger.

The final part of the results in this report focuses on the role of differentiating factors on the effects of interventions. Most of the studies in this review did not include any analysis or discussion of differentiating factors, such as mediators or moderators, that have an impact on the effects of ML&DS interventions. Only a few studies in the small set of 37 studies that discussed differentiating factors, analysed mediators. The interventions in those studies focused on media literacy and not on digital skills. In several instances, sequential mediation effects were observed. Most of the studies that did consider differentiating factors were concerned with moderators or variables that may be interpreted to have moderating effects. These moderating variables were very diverse and affected a wide range of different outcomes, which mostly, however, could be categorized under ML&DS outcomes. Gender was the most common variable that was considered as moderating the effect of ML&DS interventions on outcomes. In general, studies that incorporated differentiating factors tended to focus on interventions targeting younger and more educated demographic groups. However, studies assessing the effects of the relatively limited number of ML&DS interventions on older individuals or other vulnerable target groups often lacked the use of more sophisticated models that take these distinguishing factors into account. These findings highlight the clear need for more thorough research on the different mediation and moderation effects of ML&DS interventions. This is especially the case for interventions that focus on digital skills. Additionally, future research should not only diversify the range of interventions tested, but also the target groups of these interventions to gain deeper and more nuanced insights into the value of ML&DS interventions for a wider range of specific target groups.

Our analysis of studies examining the effects of ML&DS interventions on a set of outcomes has revealed that the number of studies that employ adequate methods for testing the effectiveness of an intervention is rather low. Although randomised controlled trials are the preferred method for testing the impact of a manipulation in a random experimental group through comparison with a neutral control group, the majority of studies in this review used quasi-experimental methods where one or more essential ingredients of robust experimental research were missing. Therefore, we advise researchers looking to test the effectiveness of interventions to employ randomised controlled trials, or, if this is not a feasible possibility, to use high-quality experimental designs in which the participants are divided between at least one treatment group and a control group, and in which the participants undergo a pretest and a posttest. In general, our systematic evidence review revealed that researchers examining the



effectiveness of interventions use a wide array of study setup, research methods, and data analysis techniques. Additionally, the lack of a systematic approach or structure to reporting on these studies makes it difficult to provide a systematic overview of this literature. Regarding data analysis, we found that researchers generally did not perform the preferred tests that allow for drawing conclusions about the effects of interventions. While numerous studies rely solely on within-person or between-person effects to draw conclusions, it is ideal to prioritise the calculation of interaction or difference-in-difference effects. These effects involve comparing post-intervention outcomes to pre-intervention outcomes for both the experimental and control groups. Doing so provides a more preferred approach for determining the effectiveness of an intervention. A final conclusion that can be drawn regarding the reporting on intervention effects studies, is that not all studies report the effect sizes or the information that is necessary for the calculation of effect sizes in an adequate way. Quite often in this review, when an effect size was not calculated or reported by the authors of a study, it was not possible for us to calculate the effect size based on the information reported in the article, as this information was often missing or incomplete. Hence, we recommend that future research on the effects of ML&DS interventions places emphasis on conducting the appropriate analysis to ensure more robust conclusions. Additionally, when conducting experimental research, reporting effect sizes should be a key consideration.

This study has several limitations. First, the search was performed in English, so potentially relevant publications on the effects of ML&DS interventions in other languages have not been included in this review. Second, the focus of this systematic evidence review was on quantitative research. Studies examining the impact of interventions for participants in a qualitative way, for instance, through interviews or observations, focusing on the participants' impressions, have not been included in this review. Third, the pool of studies that was included in this review may not include all relevant research on the topic of ML&DS interventions and their outcomes: studies may not have appeared in the databases used, or the research may not have been accessible. Fourth, regarding eligibility screening and coding of the final set of studies, a large team of researchers worked on this systematic review and due to the large pool of studies that emerged from the search, the screening and coding work was divided between different researchers. Although the screening and coding framework were tested on a small set of studies before moving on the full set of studies, regular meetings were organized to discuss the screening and coding and potential doubts or issues that may arise, and intercoder reliability was checked, the screening and coding of studies may be subjected to personal judgement of the researcher and may reflect their positioning and experience in evaluating this type of research. Finally, the measurement of outcome variables of interventions was beyond the scope of this review: we did not examine the ways in which different outcomes were measured in studies and how this may affect the effect of the intervention on this outcome that is reported in the study (e.g. self-report vs. performance test of ML&DS; use of different scales to measure similar concepts across studies).



4.1 Key findings and recommendations

- 1. Objective and Methodology: This systematic evidence review aimed to assess the effectiveness of Media Literacy and Digital Skills (ML&DS) intervention programmes by analysing 248 relevant studies. We conducted a comprehensive search and rigorous screening and coding process.
- 2. Theoretical Frameworks: Approximately three-quarters of the studies incorporated theoretical foundations, which spanned diverse fields, including media studies, media psychology, psychological science, pedagogical science, and other related disciplines. This highlights the flexibility in using theory to shape ML&DS intervention research.
- **3.** Outcome Categories: Among the 119 studies with robust methodologies, media literacy and digital skills-related outcomes were most frequently examined, followed by psychological wellbeing and education/learning outcomes (for children and young people). Diversifying outcome measures beyond these categories is crucial to gain a comprehensive understanding of the benefits of ML&DS interventions.
- 4. Target Groups: Doing research outside of formal education settings would also be desirable. Our analysis identified nine distinct target groups, and only a small number of them could be categorised as economically or socially disadvantaged. However, the outcomes varied depending on the specific group being examined. Customising interventions to suit particular demographics is crucial to maximise their effectiveness. Additionally, conducting research in settings outside of formal education would be advantageous.
- **5.** Differentiating Factors: Few studies explored differentiating factors like mediators or moderators. Gender emerged as the most frequently considered moderator, indicating a need for more research into the nuanced effects of ML&DS interventions.
- 6. Methodological Considerations: The majority of studies did not employ stringent experimental designs. Researchers should prioritise randomised controlled trials or high-quality experimental designs for more reliable results. There also is a need for more consistent reporting of effect sizes.
- **7.** Limitations: This study has limitations, including a focus on English-language publications, quantitative research, potential omission of relevant studies, and subjectivity in screening and coding. Additionally, it did not assess variations in outcome measurement methods.

In conclusion, this systematic evidence review underscores the importance of the use of diverse theoretical frameworks, comprehensive outcome measures, and tailored interventions for specific target groups in ML&DS research going beyond formal education settings. Researchers should employ rigorous methodologies and prioritise randomised controlled trials while consistently reporting effect sizes. Future research should also explore differentiating factors and expand the scope of outcome measurements for different target groups.

Acknowledgements

The authors are most grateful for the generous collaboration of their colleagues in REMEDIS, and for the reviewers' critical suggestions that helped to improve this report.



References

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision* processes, *50*(2), 179-211.

Allen, J.P., Kim, E.K., & Jimerson, S.R. (2023). Meta-analyses and systematic reviews advancing the practice of school psychology: The imperative of bringing science to practice. *School Psychology Review*, *52*(2), 87-94. <u>https://doi-org.kuleuven.e-bronnen.be/10.1080/2372966X.2023.2178769</u>

Alvarez, B. (2011). *Flipping the classroom: homework in class, lessons at home. Learn. First.* http://www.learningfirst.org/flipping-classroom-homework-class-lessons-home (2011).

Archer, M. S. (2012). *The reflexive imperative in late modernity*. Cambridge, England: Cambridge University Press.

Ashley, S., Maksl, A., & Craft, S. (2017). News Media Literacy and Political Engagement: What's the Connection? *Journal of Media Literacy Education*, 9(1), 79–98. <u>https://doi.org/10.23860/jmle-2017-9-1-6</u>

Aufderheide, P. (1993). *Media literacy: A report of the National Leadership Conference on Media Literacy*. Washington, DC: The Aspen Institute

Austin, E. W. (2007). The message interpretation process model. *Encyclopedia of Children, Adolescents, and the Media*, 2, 535-536.

Austin, E. W., Chen, M. J., & Grube, J. W. (2006). How does alcohol advertising influence underage drinking? The role of desirability, identification and skepticism. *Journal of Adolescent Health*, 38(4), 376-384.

Austin, E. W., Pinkleton, B. E., Van de Vord, R., Arganbright, M., & Chen, R. (2006). Channel One and effectiveness of media literacy. *Academic Exchange Quarterly*, 10(3), 115-120.

Austin, EW., Cohen, M., Deen, MK. (2017). *FoodMania! Curriculum Project*. Pullman, WA: Washington State University.

Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education*, 5(6), 66-70.

Bandura, A. (1977). Social learning theory. Oxford, England: Prentice-Hall.

Bandura, A. (1986). Social foundations of thought and action. Englewood Cliffs, NJ, 1986(23-28).

Barron, B., & Darling-Hammond, L. (2008). Teaching for meaningful learning. In D. H. Hammond, B. Barron, P. Pearson, A. Schoenfeld, E. Stage, T. Zimmerman, G. Cervetti, & J. Tilson (Eds.), *Powerful learning: What we know about teaching for understanding* (pp. 2–15). San Francisco, CA: Jossey-Bass.



Barrows, H. S. (1986). A taxonomy of problem-based learning methods. *Medical education*, 20(6), 481-486.

Battig, W. F. (1972). Intratask interference as a source of facilitation in transfer and retention. Topics in learning and performance. Academic Press.

Beck, A. T., & Haigh, E. A. (2014). Advances in cognitive theory and therapy: The generic cognitive model. *Annual Review of Clinical Psychology*, 10, 1-24.

Brand-Gruwel, S., Wopereis, I., & Walraven, A. (2009). A descriptive model of information problem solving while using internet. *Computers & Education*, 53(4), 1207-1217.

Bransford, J. D., & Schwartz, D. L. (1999). Chapter 3: Rethinking transfer: A simple proposal with multiple implications. *Review of Research in Education*, 24(1), 61-100.

Bronfenbrenner, U. 1989. Ecological systems theory. *Annals of Child Development*. Vol. 6, 187-249.

Bush, P. J., & Iannotti, R. J. (1990). A children's health belief model. *Medical Care*, 69-86.

Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). *The BSCS 5E instructional model: Origins and effectiveness*. Colorado Springs, Co: BSCS, 5, 88-98.

Cao, J., Qi, P., Sheng, Q., Yang, T., Guo, J., & Li, J. (2020). Exploring the role of visual content in fake news detection. Disinformation, Misinformation, and Fake News. *Social Media: Emerging Research Challenges and Opportunities*, 141-161.

Chan, C. K. (2012). Co-regulation of learning in computer-supported collaborative learning environments: A discussion. *Metacognition and Learning*, 7, 63-73.

Chen, D. T., Lin, T. B., Li, J. Y., & Lee, L. (2018). Establishing the norm of new media literacy of Singaporean students: Implications to policy and pedagogy. *Computers & Education*, 124, 1–13. doi:https://doi.org/10.1016/j.compedu.2018.04.010

Clark, RE (2001). *Learning from media: arguments, analysis, and evidence*. Charlotte, NC: Information Age Publishing Inc (IAP).

Compton, J. (2013). Inoculation theory. *The SAGE handbook of persuasion: Developments in theory and practice*, 2, 220-237.

Dang, T. T. (2012). Learner autonomy: A synthesis of theory and practice. The Internet Journal of Language, *Culture and Society*, 35(1), 52-67.

Dennis, A. R., & Kinney, S. T. (1998). Testing media richness theory in the new media: The effects of cues, feedback, and task equivocality. *Information Systems Research*, 9(3), 256-274.



Dennis, A. R., & Valacich, J. S. (1999, January). Rethinking media richness: Towards a theory of media synchronicity. In *Proceedings of the 32nd Annual Hawaii International Conference on Systems Sciences*. HICSS-32. Abstracts and CD-ROM of Full Papers (pp. 10-pp). IEEE.

Dicheva, D., Dichev, C., Agre, G., & Angelova, G. (2015). Gamification in education: A systematic mapping study. *Journal of Educational Technology & Society*, 18(3), 75-88.

Escudero, V. G., Gutiérrez, R. C., & Somoza, J. A. G. C. (2019). Análisis de la autopercepción sobre el nivel de competencia digital docente en la formación inicial de maestros/as. *Revista Electrónica Interuniversitaria de Formación del Profesorado*, 22(3), 193-218.

Espinoza, P., Penelo, E., & Raich, R. M. (2013). Prevention programme for eating disturbances in adolescents. Is their effect on body image maintained at 30 months later? *Body Image*, 10(2), 175-181.

Ezeamuzie N. O., Leung J. S. C., Ting F. S. T. (2022b). Unleashing the potential of abstraction from cloud of computational thinking: A systematic review of literature. *Journal of Educational Computing Research*, 60(4), 877–905. https://doi.org/10.1177/07356331211055379

Faggiano, M. P. (2007). *Stile Di Vita E Partecipazione Sociale Giovanile: Il Circolo Virtuoso Teoria-Ricerca-Teoria*. Milano, Italy: FrancoAngeli.

Fisk, A. D., Rogers, W. A., Charness, N., Czaja, S. J., & Sharit, J. (2009). *Designing for older adults: Principles and creative human factors approach* (2nd ed.). Boca Raton, FL: CRC Press.

Freedman, D. A., Bess, K. D., Tucker, H. A., Boyd, D. L., Tuchman, A. M., & Wallston, K. A. (2009). Public health literacy defined., 36(5), 446-451.

Friestad, M., & Wright, P. (1994). The persuasion knowledge model: How people cope with persuasion attempts. *Journal of Consumer Research*, 21(1), 1-31.

Gomez, E. A., Wu, D., & Passerini, K. (2009). Traditional, hybrid and online teamwork: Lessons from the field. *Communications of the Association for Information Systems*, 25, 395–412.

Grant, M.J., & Booth, A. (2009). A typology of reviews: An analysis of 14 review types and associated methodologies. *Health Information & Libraries Journal, 26*,91-108. https://doi.org/10.1111/j.1471-1842.2009.00848.x

Haddon, L., Cino, D., Doyle, M.-A., Livingstone, S., Mascheroni, G., & Stoilova, M. (2020). *Children's and young people's digital skills: A systematic evidence review*. KU Leuven, Leuven: ySKILLS. Retrieved from <u>https://zenodo.org/record/4274654#.YTc-XI4zabh</u>

Hair, J.F., Hult, G.T.M., Ringle, C.M., Sarstedt, M., Danks, N.P., Ray, S. (2021). Moderation Analysis. In: *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R. Classroom Companion: Business*. Springer, Cham. <u>https://doi.org/10.1007/978-3-030-80519-7_8</u>



Helsper, E.J., Schneider, L.S., van Deursen, A.J.A.M., & van Laar, E. (2020). The youth Digital Skills Indicator: *Report on the conceptualisation and development of the ySKILLS digital skills measure*. *KU Leuven*, Leuven: ySKILLS.

Hewitt, J. P. (2020). 22 The Social Construction of Self-Esteem. *The Oxford Handbook of Positive Psychology*, 309.

Hooley, T. (2012). How the internet changed career: framing the relationship between career development and online technologies. Journal of the National Institute for Career Education and Counselling (NICEC).

International Society for Technology in Education. (2007). *National educational technology standards for students*. ISTE.

Irving, L. M., & Berel, S. R. (2001). Comparison of media-literacy programs to strengthen college women's resistance to media images. *Psychology of Women Quarterly*, 25(2), 103-111.

Janz, N. K., & Becker, M. H. (1984). *The health belief model: A decade later*. Health education quarterly, 11(1), 1-47.

JASP (Version 0.17.1) Computer software. JASP Team (2023).

Gough, D. (2007). Weight of Evidence: A framework for the appraisal of the quality and relevance of evidence. *Research Papers in Education*, *22*(2), 213–228. <u>https://doi.org/10.1080/02671520701296189</u>

Jenkins, H., Clinton, K., Purushotma, R., Robison, A. J., & Weigel, M. (2009). *Confronting the challenges of participatory culture: Media education for the 21st century* [White paper]. Retrieved from MacArthur Foundation website: https://www.macfound.org/media/article_pdfs/JENKINS_WHITE_PAPER.PDF

Jiménez Sabino, M. J., & Cabero Almenara, J. (2021). Los conocimientos tecnológicos, pedagógicos y de contenidos del profesorado universitario andaluz sobre las TIC. Análisis desde el modelo TPACK. Innoeduca. *International Journal of Technology and Educational Innovation*, 7(1), 4–18. https://doi.org/10.24310/innoeduca.2021.v7i1.11940

Jones-Jang, S. M., Mortensen, T., & Liu, J. (2021). Does media literacy help identification of fake news? Information literacy helps, but other literacies don't. *American Behavioral Scientist*, 65(2), 371-388.

Jones-Jang, S. M., Mortensen, T., & Liu, J. (2021). Does media literacy help identification of fake news? Information literacy helps, but other literacies don't. *American Behavioral Scientist*, 65(2), 371-388.

Kearsley, G., & Shneiderman, B. (1998). Engagement theory: A framework for technologybased teaching and learning. Educational Technology, 38(5), 20-23.



Klichowski, M. (2015). Model TPACK. O potrzebie technopedagogicznego podejścia do wiedzy i kompetencji nauczycieli. In J. Pyżalski (ed.), *Nauczyciel w ponowoczesnym świecie. Od założeń teore-tycznych do rozwoju kompetencji.* Łódź: theQ studio.

Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *Journal of Education*, 193(3), 13-19.

Kuhlthau, C. C. (2004). *Seeking meaning: A process approach to library and information services* (Vol. 2). Westport, CT: Libraries Unlimited.

Landis, J. R., & Koch, G. G. (1977). The Measurement of Observer Agreement for Categorical Data. *Biometrics*, *33*(1), 159–174. <u>https://doi.org/10.2307/2529310</u>

Lawson, H. A., Claiborne, N., Hardiman, E., Austin, S., & Surko, M. (2007). Deriving theories of change from successful community development partnerships for youths: Implications for school improvement. *American Journal of Education*, 114(1), 1-40.

Lazard, A., & Atkinson, L. (2015). Putting environmental infographics center stage: The role of visuals at the elaboration likelihood model's critical point of persuasion. *Science Communication*, 37, 6-33.

Livingstone, S. (2004). What is media literacy? Intermedia, 32(3), 18-20.

Lucidi, F., Mallia, L., Alivernini, F., Chirico, A., Manganelli, S., Galli, F., ... & Zelli, A. (2017). The effectiveness of a new school-based media literacy intervention on adolescents' doping attitudes and supplements use. *Frontiers in Psychology*, 8, 749.

MacKinnon, D. P, Fairchild, A. J., Fritz, M. S. (2007). Mediation analysis. *Annu Rev Psychol*, 58, 593-614. doi: 10.1146/annurev.psych.58.110405.085542

Mattar, J., Ramos, D. K., & Lucas, M. R. (2022). DigComp-Based Digital competence Assessment Tools: Literature Review and Instrument Analysis. *Education and Information Technologies*, 27(8), 10843–10867. https://doi.org/10.1007/s10639-022-11034-3

Mayer, R. E. (2004). Should there be a three-strikes rule against pure discovery learning? The case for guided methods of instruction. *American Psychologist*, 59(1), 14–19. https://doi.org/10.1037/0003-066X.59.1.14

Mayhorn, C. B., Stronge, A. J., McLaughlin, A., & Rogers, W. A. (2004). Older adults, computer training, and the systems approach: A formula for success. *Educational Gerontology*, 30, 185–203. doi:10.1080/03601270490272124

McGrew, S. (2020). Learning to evaluate: An intervention in civic online reasoning. *Computers & Education*, 145, 103711.



....

McGrew, S., Breakstone, J., Ortega, T., Smith, M., & Wineburg, S. (2018). Can students evaluate online sources? Learning from assessments of civic online reasoning. *Theory and Research in Social Education*, 46, 165–193. https://doi.org/10.1080/00933104.2017.1416320

McGuire, W. J. (1964). Inducing resistance to persuasion: Some contemporary approaches. In Berkowitz, L. (ed.). *Advances in experimental social psychology*. New York: Academic Press.

Michaelsen, L., Fink, D., & Knight, A. (2002). *Team-based learning: A transformative use of small groups in college teaching*. Sterling, VA: Stylus.

Moll, L. C. (1992). *Vygotsky and education: Instructional implications and applications of sociohistorical psychology*. New York, NY: Cambridge.

Nairn, A., & Fine, C. (2008). Who's messing with my mind? The implications of dual-process models for the ethics of advertising to children. *International Journal of Advertising*, 27(3), 447-470.

Norris, P. (2000, April). *The worldwide digital divide*. Paper for the Annual Meeting of the Political Studies Association of the UK, London School of Economics and Political Science (pp. 10-13).

Norris, P. (2001). *Digital divide, civic engagement, information poverty, and the internet worldwide*. Cambridge, UK: Cambridge University Press.

Pedaste, M., Mäeots, M., Siiman, L. A., De Jong, T., Van Riesen, S. A., Kamp, E. T., ... & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review*, 14, 47-61.

Pinkleton, B. E., Weintraub Austin, E., & Fujioka, Y. (2001). The relationship of perceived beer ad and PSA quality to high school students' alcohol-related beliefs and behaviors. *Journal of Broadcasting & Electronic Media*, 45(4), 575-597.

Polk, X. L. (2018). Marketing: The Key to Successful Teaching and Learning. *Journal of Marketing Development, 12*(2), 49-57. https://doi.org/10.33423/jmdc.v12i2.1257

Potter, W. J. (2004). Argument for the need for a cognitive theory of media literacy. *American Behavioral Scientist*, 48(2), 266-272. https://doi.org/10.1177/0002764204267274

Pugacheva, N., Kirillova, T., Kirillova, O., Luchinina, A., Korolyuk, I., & Lunev, A. (2020). Digital paradigm in educational management: The case of construction education based on emerging technologies. *International Journal of Emerging Technologies in Learning* (iJET), 15(13), 96-115.

Reyna, J., & Meier, P. (2018). Using the Learner-Generated Digital Media (LGDM) framework in tertiary science education: A pilot study. *Education Sciences*, 8(3), 106.



Reyna, J., Horgan, F., Ramp, D., & Meier, P. (2017, January). Using learner-generated digital media (LGDM) as an assessment tool in geological sciences. In 11th International Conference on Technology, *Education and Development* (INTED). IATED-INT ASSOC TECHNOLOGY EDUCATION & DEVELOPMENT.

Robin, B. R. (2008). Digital storytelling: A powerful technology tool for the 21st century classroom. Theory Into Practice, 47(3), 220–228. https://doi.org/10.1080/00405840802153916.

Roblyer, M. D. (2006). *Integrating educational technology into teaching*. (4th ed.). Upper Saddle River, NJ: Pearson Education, Merrill.

Rozendaal, E., Lapierre, M. A., Van Reijmersdal, E. A., & Buijzen, M. (2011). Reconsidering advertising literacy as a defense against advertising effects. *Media Psychology*, 14(4), 333-354.

Rozendaal, E., Opree, S. J., & Buijzen, M. (2016). Development and validation of a survey instrument to measure children's advertising literacy. Media Psychology, 19(1), 72-100.

Simon, C., & Tagliabue, M. (2018). Feeding the behavioral revolution: Contributions of behavior analysis to nudging and vice versa. *Journal of Behavioral Economics for Policy*, 2(1), 91-97.

Simon, H. A. (1990). Invariants of human behavior. *Annual Review of Psychology*,41,1–20.https://doi.org/10.1146/annurev.ps.41.020190.000245

Slaby, RG (1997). Psychological mediators of violence in urban youth. In: McCord J, editor. *Violence and Childhood in the Inner City*. New York, NY: Cambridge University Press.

Smith, P. L., & Ragan, T. J. (2005). Instructional design (3rd ed.). Danvers: Wiley.

Swets, J. A. (2014). *Signal detection theory and ROC analysis in psychology and diagnostics: Collected papers*. Psychology Press.

Thompson, J. K., Heinberg, L. J., Altabe, M., & Tantleff-Dunn, S. (1999). *Exacting beauty: Theory, assessment, and treatment of body image disturbance*. American Psychological Association.

Tomczyk, Ł. (2021). Skala i mechanizmy piractwa cyfrowego wśród czeskich i polskich adolescentów w perspektywie paradygmatu ryzyka pedagogiki mediów. Kraków: Wydawnictwo Naukowe Uniwersytetu Pedagogicznego.

Tomczyk, Ł., Mascia, M. L., Gierszewski, D., & Walker, C. (2023). Barriers to digital inclusion among older people: a intergenerational reflection on the need to develop digital competences for the group with the highest level of digital exclusion. *Innoeduca. International Journal of Technology and Educational Innovation*, 9(1), 5–26. https://doi.org/10.24310/innoeduca.2023.v9i1.16433



Touron, J., Martín, D., Navarro, E., Pradas, S., & Inigo, V. (2018). Construct validation of a questionnaire to measure teachers' digital competence (TDC). *Revista española de pedagogía*, 76(269), 25-54.

Tylka, T. L., & Wood-Barcalow, N. L. (2015). What is and what is not positive body image? Conceptual foundations and construct definition. *Body Image*, 14, 118-129.

Van Dijk, J. A. (2013). A theory of the digital divide. In *The digital divide* (pp. 49-72). Routledge.

Velicer, W. F., Prochaska, J. O., Fava, J. L., Norman, G. J., & Redding, C. A. (1998). Detailed overview of the transtheoretical model. *Homeostasis*, 38, 216-33.

Vuorikari, R., Punie, Y., Gomez, S. C., & Van Den Brande, G. (2016). *DigComp 2.0: The digital competence framework for citizens*. Update phase 1: The conceptual reference model (No. JRC101254). Joint Research Centre (Seville site).

Wineburg, S., & McGrew, S. (2019). *Lateral reading and the nature of expertise: Reading less and learning more when evaluating digital information*. Teachers College Record, 121(11), 1-40.

Wolf, S. E., Brush, T., & Saye, J. (2003). Using an information problem-solving model as a metacognitive scaffold for multimedia-supported information-based problems. *Journal of Research on Technology in Education*, 35(3), 321-341.

Yu, K. C., Fan, S. C., & Lin, K. Y. (2015). Enhancing Students' Problem-Solving Skills Through Context-Based Learning. *International Journal of Science and Mathematics Education*, 13, 1377-1401.

Zillmann, D. (1999). Exemplification theory: Judging the whole by some of its parts. *Media Psychology*, 1(1), 69-94.

Zulkifli, H., & Hashim, R. (2020). Philosophy for children (P4C) in improving critical thinking in a secondary moral education class. **International Journal of Learning Teaching and Educational Research**, 19(2), 29–45. doi: https://doi.org/10.26803/ijlter.19.2.3



60

Appendix

Overview of theoretical frameworks

				A	(rea	of in	terve	entio	n			Та	rget	grou	up		Ty o the	of
The ory	Sou rce	D i g i t a l i n c l u s i o n / e x c l u s i o	E x t r e m i s m	H o w m e d i a w o r k	M is/disinformation	O n i n e s a f e t y a n d s e c u r i t y	P r v a c y	S c m s	H e a l t a n d N u t r i c i o n	Teachers MediaLiter acy	O t e r	C h l d r e n	Y o u t h s	A d l t s	O l d e r a d u l t s	F r e q u e n c y	D i r e c t l y r e l a t i n g t o D L & M L	NotdirectlyrelatedtoDL&ML
Message interpretati on process model	Austin, Chen, & Grube, 2006 McGuire, 1986 Austin, 2007 Austin, Chen, Pinkleton, &Johnson, 2006 Pinkleton, & Fujioka,20 01	n		x	x				x		x		x	x		9,72 %	x	
Self- regulation under the perspective of social learning theories	Bandura, 1977	Х		Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	X		9,72 %		х
Media literacy - different approaches	Livingston e, 2004 Chen et al., 2018 Mallia et al., 2020 Lucidi et al., 2017			X	X				X		X		X	X		9,72 %	Х	
The theory of planned behavior	Ajzen, 1991			Х	Х				х		х		х	х		8,33 %		Х
ТРАСК	Koehler et al, 2013									Х				X		6,94 %	Х	
Inoculation theory	McGuire, 1964			Х	Х							Х	Х	Х	Х	6,94 %		Х



..... • • • .

.

.

			Area of intervention											gro	up		C	pe of ory
The ory	Sou rce	Digitalinclusion/exclusion	E x r e m i s m	Howmedi awork	M i s ∕ d i s i n f o r m a t i o n	Onli nesaf etyands ecur ity	P r a c y	S a m s	H e a l t a n d N u t r i c i o n	Teachers MediaLiteracy	O t h e r	Children	Y o u t h s	A d l t s	O l d e r a d u l t s	Frequency	D irectlyrelatin gtoDL&ML	N ot d i r e c t l y r e l a t e d t o D L & M L
	Compton, 2013																	
Flipped classroom (flipped learning)	Alvarez, 2011									Х	Х		Х	Х		4,16 %		Х
Cognitive theory of multimedia learning	Mayer & Moreno 2002 Clark, 2001 Potter, 2004			Х	X								Х			4,16 %	Х	
Problem based learning (PBL)	Barrows, 1986 Barron & Darling- Hammond, 2008	X									X		X	X		4,16 %		X
Nudge theory	Simon, C., & Tagliabue, 2018															2,77 %		х
Self- esteem	Hewitt, 2020			Х	Х				Х				х			2,77 %	Х	
Health Belief Model	Slaby, 1997 Bush & Iannotti, 1990; Janz & Becker, 1984			Х					Х		X		X			2,77 %		Х
Constructiv ist learning theory	Bada & Olusegun, 2015			Х							х			х		2,77 %		Х
Context- based learning (CBL)	Yu et al., 2015										х		х	х		2,77 %		х
The exemplifica tion theory	Zillmann 1999			Х	Х								Х			1,38 %		Х
Advertising literacy dimensions	Friestad & Wright 1994			Х								х				1,38 %	Х	



.

				A	\rea (of in	terve	Та	rget	gro	up		Ty c the	of				
The ory	Sou rce	Digitalinclusion∕exclusion	E x r e m i s m	H o w m e d i a w o r k	M i s ∕ d i s i n f o r m a t i o n	Onli nesafetyandsecur ity	P r v a c y	S c m s	H e a l t a n d N u t r i c i o n	TeachersMediaLiteracy	O t r	Children	Y o u t h s	A d l t s	O l d e r a d u l t s	Frequercy	DirectlyrelatingtoDL&ML	N otdirectlyrelatedtoDL&ML
Learned disliking of advertising	Nairn and Fine 2008; Rozendaal et al. 2011; Rozendaal, Opree, and Buijzen 2015			x								x				1,38 %	x	
Lateral reading	Wineburg & McGrew,				х										х	1,38 %		Х
Reverse image search	2019 Cao, J. et al, 2020				х										х	1,38 %	х	
Health/me dia literacy approaches	Aufderhei de, 1993								Х					х		1,38 %		Х
Theory of change Framework	Lawson et al., 207 Reyna et								х	x			х	x		1,38 % 1,38	x	Х
s to Design LGDM Assignment s	al., 2017; Reyna, et al. 2018															%		
Abstractive -based programmi ng	Ezeamuzie et al. 2022										Х		Х			1,38 %	х	
Co- regulated learning	Chan, 2012										х			х		1,38 %		Х
Gamificatio n	Dicehva 2015						х						Х			1,38 %	Х	
Engagemen t theory	Kearsley & Shneiderm an, 1998									х				х		1,38 %	х	
Digital divide	Norris, 2000 J. V. Dijk, 2013	Х											х			1,38 %	Х	
Processing fluency theory	Lazard and Atkinson, 2015;				Х				х					х		1,38 %	Х	



•••••••

				A	\rea (of in	terve	Ta	rget	gro		C	pe of ory					
The ory	Sou rce	Digitalinclusion/exclusion	E x t e m i s m	Howmedi awork	Mis/disinformation	Onli nesaf etyands ecur ity	P r i v a c y	S c a m s	H e a l t a n d N u t r i c i o n	Teachers MediaLiteracy	O t e r	Children	Y u t h s	A d l t s	O l d e r a d u l t s	Frequency	D i rectlyrelatingtoDL&ML	N ot d i r e c t l y r e l a t e d t o D L & M L
Learner autonomy	Dang, 2012										Х		Х			1,38 %		Х
Lifestyle theory	Faggiano, 2007										Х		Х			1,38 %	Х	
Youth relational lifestyles	Archer, 2012 Faggiano, 2007										Х		Х			1,38 %	Х	
Teacher digital competenc es	Tourón et al., 2018 Giron- Escudero et al, 2019 Pugacheva et al., 2020					Х				Х				Х		1,38 %	Х	
Body satisfaction	Espinoza et al., 2013			Х	Х				Х				Х			1,38 %		Х
Transtheor etical model of behavior change	Velicer et al., 1998				Х	Х	х						Х			1,38 %	Х	
Critical thinking	Zulkifli & Hashim,				Х	х	х				Х					1,38 %		Х
Habits of Thought Model	2020 Slaby, 1997			х							х		х			1,38 %		Х
Informatio n Problem Solving	Brand- Gruwel et al., 2009 Wolf et al., 2003									х				х		1,38 %	Х	
Digital storytelling	Robin, 2008			Х							Х	Х				1,38 %	Х	
Instruction al design	Smith & Ragan, 2005									х	х	х				1,38 %	х	
Participator y culture	Jenkins et al., 2009										х			х		1,38 %		Х
Team- based learning (TBL)	Gomez et al., 2009										х			х		1,38 %		х



				A	vrea (of in	terve	Та	irget	grou		C	pe of ory					
The ory	Sou rce	Digitalinclusion/exclusion	E x r e m i s m	Howmediawork	M i s ∕ d i s i n f o r m a t i o n	Onlines afetyands curity	P r v a c y	S c a m s	H e a l t a n d N u t r i c i o n	Teachers MediaLiteracy	O t e r	Children	Y o u t h s	A d l t s	O l d r a d u l t s	F r e q u e n c y	D i r e c t l y r e l a t i n g t o D L & M L	N o t d i r e c t l y r e l a t e d t o D L & M L
	Michaelse n et al., 2002																	
Co- regulated learning (CRL)	Chan, 2012										Х			Х		1,38 %	Х	
Bronfenbre nner's Ecological Systems theory	Bronfenbr enner, 1989								х			х				1,38 %		Х
Abundance economy of informatio n	Thomas & Brown, 2011				х								Х			1,38 %	Х	
Cognitive theory of media literacy	Potter, 2004				Х						Х					1,38 %	Х	
News media literacy (NML)	Ashley et al., 2017 Jones-Jang et al., 2021			Х	x								х			1,38 %	Х	
DigComp	Vuorikari et al.,2016									Х				Х		1,38 %	Х	
AIDA model	Polk, 2018									х				Х		1,38 %		Х
Media richness theory (MRT)	Dennis et al., 1998			Х							X			X		1,38 %	Х	
Media synchronici ty theory (MST)	Dennis and Valacich, 1999										x			x		1,38 %	X	
Civic online reasoning	Wineburg, S., & McGrew, 2018 McGrew, 2020				x								x			1,38 %	х	
The funds of	Moll, 1992		L	L			L	L	<u> </u>		х			Х		1,38 %		х



			Area of intervention											Target group				pe of ory
The ory	Sou rce	Digitalinclusion/exclusion	E x t e m i s m	Howmediawork	M is/d isinformation	Onlines afety and security	P r v a c y	S c m s	H e a l t a n d N u t r i c i o n	Teachers MediaLiteracy	O t e r	C h l d r e n	Y u t h s	A d l t s	O l d e r a d u l t s	F r e q u e n c y	D ir e c t l y r e l a t in g t c L & M L	N ot d i r e c t l y r e l a t e d t o D L & M L
knowledge concept																		
Transfer of learning	Bransford & Schwartz,1 999			Х							Х		Х			1,38 %		Х
Inquiry- based learning	Pedaste et al., 2015								Х				Х			1,38 %		Х
Public health literacy	Freedman et al., 2009								х				X			1,38 %		X
Bounded rationality	Simon, 1990				х	х							х			1,38 %		Х
Instruction al principals for teaching older adults	Fisk et al., 2009 Mayhorn et al., 2004	X												X		1,38 %		x
Beck's cognitive theory	Beck & Haigh, 2014			х	х	х			х		х		х			1,38 %		Х
Digital career literacy	Hooley, 2012										х		Х			1,38 %		Х
Positive psychologic al framework	Tylka & Wood- Barcalow, 2015			х										х		1,38 %		x
Realism scepticism	Berel & Irving, 1998; Irving & Berel, 2001			X										Х		1,38 %		X
Internation al Standards for Technology in Education (ISTE)	ISTE, 2007	X								X			x	X		1,38 %	x	



. .

	Sou rce	Area of intervention											Target group				Type of theory	
The ory		Digitalinclusion/exclusion	E x t r e m i s m	H o w m e d i a w o r k	M is ∕d is infor mation	Onlines afety ands ecurity	P r v a c y	S c a m s	H e a l t a n d N u t r i c i o n	T e a c h e r s M e d i a L i t e r a c y	O t r r	C h l d r e n	Y o u t h s	A d l t s	O l d e r a d u l t s	F r e q u e n c y	D i r e c t i y r e l a t i n g t o D L & M L	N ot d i r e c t l y r e l a t e d t o D L & M L
Informatio n search process model	Kuhlthau, 2004	n			x								X			1,38 %	Х	
Technology Integration Planning Model	Robyler (2006)									Х				х		1,38 %	Х	
Pedagogy, Social Interaction and Technology Generic Model	Wang, 2008									Х				Х		1,38 %	Х	
Contextual interferenc e in learning	Battig, 1972										Х			Х		1,38 %		Х
5E instruction al model	Bybee et al., 2006				Х								Х			1,38 %		Х
The tripartite influence model	Thompson , Heinberg, Altabe, & Tantleff- Dunn, 1999								Х					Х		1,38 %		X
EnSignal Detection Theory (SDT) framework	Swets, 2014					x		х						x		1,38 %		X



.