

## **Digital education: "education-with" / "education-about" distinction and the teleological definition**

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### **Abstract**

Despite being an object of multi-billion public policies and private sector initiatives, the term "digital education" seems to lack a clear, unambiguous, lexicon-ready definition. A closer analysis reveals that in common parlance, the term is used to denote phenomena related to overlapping but distinct topics like "technology", "media" or "informatics". Such polysemy implies an overall lack of clarity which a public debate about education policies should rather avoid. For this reason, we propose to start sorting things out by defining the term "digital education" in terms of dichotomy of two subordinated concepts, which we label as "education-about-digital" and "education-with-digital". Postulation of this dichotomy combined with analysis of "school's mission" as defined in the legal codices of Land Berlin naturally leads to "teleological definition" which delimits the concept of digital education in terms of its ideal human result.

### **I. Introduction**

#### **a. Rules for definitions**

*"I. Not to undertake to define any of the things so well known of themselves that clearer terms cannot be had to explain them.*

*II. Not to leave any terms that are at all obscure or ambiguous without definition.*

*III. Not to employ in the definition of terms any words but such as are perfectly known or already explained."*

(Pascal, 1658)

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## **b. Of importance of solid definitions**

As already pointed out by Blaise Pascal - one of the very first pioneers of computer science - the use of solid and unambiguous definitions is a *conditio sine qua non* of any successful and perennial scientific enterprise.

But science is not the only domain where definitions play an important role. In fact, sharing of clear and pertinent definitions is a "must" in any activity which involves transfer of information between two or more communicating subjects. If this is not the case - e.g. when different meanings are associated to the term X by speaker A and listener B - confusion and misunderstanding may and shall arise (Peirce, 1878).

It is quite normal if such confusion and misunderstanding arise in an informal debate of two private persons. In such cases, it is the very context of the debate which allows them to gradually align their definitions, resolve ambiguities and finally attain a common goal.

Still, in case of public governance debate addressing multi-cultural and global issues, one cannot simply assume that "all parties involved share the meaning of X" and subsequently issue policies as if it was indeed the case. For the consequence of such approach to policy-making could not be only a provisional confusion, but rather a unmanageable chaos.

## **c. Aim of this proposal**

As far as we know, no publicly available lexicon or encyclopedia contains unambiguous and precise definition of what the term "digital education" (DE-term) means or is meant to mean. This lack of solid base notwithstanding, significant amount of resources is being invested into "digital education" by both private as well as public sector.

For example, in Germany alone, 5 billion euros are expected to be invested into "digital education" in the framework of a so-called "Digitalpakt" (BMBF, 2016). In a reflex-like reaction, the oldest professional society of German mathematicians almost immediately criticized the very same Digitalpakt as only an "apparent solution" which could "miss its target" (GMS, 2016).

Knowing that such frictions are fairly symptomatic for any debate whereby one party speaks about "oranges" while the other speaks about "apples", one can consider a potential reconciliation between all parties involved as a very difficult, if not impossible, enterprise.

The goal of our article is to propose less vague and more useful definitions of the DE-term. This is attained by demonstrating that the DE-term is, in fact, an umbrella term denoting at least two distinct and only partially overlapping regions of the conceptual space (Gärdenfors, 2004).

We shall label these conceptual regions with labels "**education-with**" and "**education-about**".

By pointing out this distinction, we hope to establish a communication channel, a bridge, allowing the proponents of "education-with" approach and "education-about" approach exchange their points of view within a framework of a pragmatic debate based on mutually shared concepts and ideas.

To bring the reason and order in the "digital education governance" debate and allow future generations to become masters and not mere consumers of digital products and services, such is, indeed, the ultimate goal of our proposal.

## II. Current definitions of the term "digital education"

As of 2018, no major authoritative dictionary of English language (i.e. Oxford Dictionary of English, Random House Webster's, Collins English Dictionary, Merriam-Webster dictionary) contains an entry for the term "digital education". Given such a lack of canonic definition, the question "How is the DE-term defined?" can be principally elucidated in following manners:

- syntactic analysis
- semantic / conceptual analysis
- analysis of use in colloquial language
- analysis of use in attested documents

In our quest for a solid definition of the DE-term, all these approaches - as well as their combinations - are to be tested.

### a. Trivial definitions

A most trivial definition of the term "digital education" is the intensional definition following the classical genus-differentia schema of the scholastic tradition:

*Predicative definition* :: **Digital education is education which is digital.**

It may be observed that the statement hereby labeled as "predicative definition" is in fact a pure tautology which does not yield any information about the meaning of the DE-term. The predicative definition does not in any way enrich our representation of what DE-term means.

By performing the syntactical analysis of the DE-term, one obtains a so-called "attributive definition":

*Attributive definition* :: **"Digital education" is a two-word noun phrase wherein the substantive "education" is precised by means of an attributive adjective "digital".**

In this case, we see that the notion of "digital" plays a role of an attribute for the dominant term, which is "education". In terms of phrase grammars, the noun "education" is the head of the phrase while "digital" is its "dependent". (Chomsky, 1957). Purely syntactically speaking, the adjective "digital" plays the same role and function in the DE-term as plays, for example, the adjective "traditional" in the noun phrase "traditional education" or "higher" in "higher education".

### b. Semantic definitions

It is evident that the meaning of the DE-term can be only elucidated with help of meanings of terms "digital" and "education". Without going into detail, let's just precise that all authoritative English-language dictionaries<sup>1</sup> define the term "digital" as something to do with:

1. discrete, very small signals
2. digits, calculation, counting, counting on fingers
3. opposition to continuous (analogue) signal and devices (e.g. the digital/analogue clocks)

When it comes to the term "education", lexicographers of major English-language dictionaries tend to define it, most often, as:

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1. process of receiving (e.g. learning) or giving (e.g. teaching) knowledge, skill or instruction
2. result of such process or that, what has been acquired by it
3. theory, practice and institutional framework of teaching

It may be expected that somewhere in the fuzzy region spanning the spaces of these two concepts, the meaning of the DE-term is to be found.

### c. Folk and "family resemblance" definition

A "folk" definition of the term "digital education" can be articulated as follows:

**Folk definition :: Digital education somehow concerns teaching, learning and digital media or artefacts.**

Intuitively, a region of the conceptual space covered by such "folk definition" can be principally demarcated by presence of combination of two or more among following features:

- feature A = teaching and learning
- feature B = digital media
- feature C = digital artefacts and devices
- feature D = data
- feature E = social networks
- feature F = computer games
- feature G ...

As has already been beautifully demonstrated by Wittgenstein's "Family resemblance" theory of meaning (Wittgenstein, 1953), a diverse palette of very different entities and processes can be subsumed under such "family resemblance" definitions.

Still, it may be observed that considering the folk definition to be "the" definition, can lead to somewhat absurd results. On one hand, putting a chime-looping iPad or a blue-screened Windows computer (feature C) on a teacher's desk (feature A) would validate as a case of "digital education", hence yielding a false positive.

On the other hand, a false negative could also occur: imagine, for example, Alan Turing transferring to children theory of his symbol-manipulating machine by means of the "Computer Science Unplugged" (Bell et al., 2015) method. That is, by means of a method which does not use any digital tools or media at all. Since no digital artefacts or media or data etc. would be employed in such a process, and the only feature from the above-mentioned list is the feature A (e.g. the presence of a teacher), many a proponent of the folk definition would be most probably reluctant to label such knowledge transfer as "*digital education*".

### e. Insular definition

Oxford's Digital Education Strategy precises the DE-term by what it is "*understood to mean*".

**Oxford definition :: "Digital education is understood to mean the employment of technology in the creation and curation of teaching materials in digital form , the design and delivery of teaching, and the engagement and interaction of students with learning through the medium of digital technology."** (OWG, 2016)

This statement indicates that DE, as understood by Oxford's Working Group, is principally about

tools and media employed during the teaching process, it is more about form of the teaching than about the content of what is being taught.

As shall be seen further, Oxford's notion of digital education corresponds to what we subsume under the "education-with-digital" definition. That is, Oxford's Action Plan focuses on teaching how to use digital technologies. On the other hand, it seems to put fairly little focus on what digital technologies really are and what are they intrinsic principles of operation.

This can be further illustrated by collocate term occurring at the right side of the term "*digital*", as presented on Table 1.

<i>Occurences</i>	Collocated Term	Occurences	Collocated Term
34	education	3	skill
20	technolog( ies)	3	method
9	platform	2	resource
5	output	2	research
5	media	2	literacy
4	bodleian	2	learning
4	collection	2	information
		2	humanities

Table 1. Most frequent terms (>1 occurrence) following the term "digital" in Oxford's Commission's Digital Education Strategy (OWG, 2016).

#### f. German definition

Second authoritative document in which we looked for the definition of the DE-term is Education Offensive for Digital Knowledge-based Society published by Ministry of Education and Research of Federal Republic of Germany (BMBF, 2016). In this strategical and normative document, the meaning of the DE-term is elucidated by means of its extension, i.e. by explicit statement of two components which the DE-term involves

*German definition* :: "**According to our understanding, digital education involves both the mediation of digital competence, i.e. the ability to knowledgeable and responsible use of digital media (digital education as content of teaching and learning), as well as learning with digital media (digital education as instrument).**" (BMBF, 2016)

One may observe strong resemblances between the second component - *digital education as instrument* - of BMBF's definition and the Oxford definition.

However, the first component - *digital education as content* - is absent in the insular definition. Another aspect which seems to be missing in the insular definition and to which Germans seem to put particular focus upon are personality- and society- oriented characteristics of the mediation process, this is marked by introduction of adjectives like "knowledgeable" and "responsible".

A comparison between co-occurrence lists from Table 1 and Table 2 points in a similar direction. For Englishmen, "technology" and "platform" and "output" and "media" tend to be of primary importance while aspects of the process dedicated to learning subject himself (e.g. "literacy", "skill", "learning") occur only seldom.

Table 2. Most frequent terms (>2 occurrences) following the term "digital" in Germany's Education Offensive for Digital Knowledge-based Society. (BMBF, 2016).

Occurrences	Collocated Term	Occurrences	Collocated Term
79	Bildung	9	Zeitalter(s)
48	Medien	8	Wandel
27	gestützte(r n)	6	geprägten
20	Wissensgesellschaft	5	Welt <sup>ii</sup>
17	Kompetenz(en)	4	Spaltung
12	Bildungsangebote	3	Technologien
10	Infrastruktur(en)	3	Agenda

### g. European definition

In its "Digital Education Action Plan", European Commission does not explicitly state what DE "is"<sup>iii</sup>. However, in its DE Action Plan, the Commission specifies three priorities which may potentially elucidate the meaning of the DE-term, as understood by the Commission:

*European definition* :: "

- 1. Making better use of digital technology for teaching and learning.**
- 2. Developing relevant digital competences and skills for the digital transformation.**
- 3. Improving education through better data analysis and foresight**

" (EC, 2018)

One can observe the similarity between Commission's first priority, and the notion promoted in Oxford's action plan as well as digital-education-as-instrument notion proposed by BMBF. They are all education-with-digital definitions. However, the second priority of the Commission seems to be more concerned with the content of what is being taught. This is being attained by introducing the term "competence" which, as indicated by Table 3., plays a central role in Commission's vision. In this regards, one can observe salient resemblances between notion of digital education promoted by Bruxelles and the one promoted by Berlin.

Worth of noting is also Commission's third priority, focusing on and around the notion of "data". This seems to be singular: neither Insular nor German definitions consider the notion of data (or related notion of "data analysis") to be central to meaning of the DE-term.

Occurrences	Collocated Term	Occurrences	Collocated Term
24	competences	3	society
20	technology	2	world
18	skill	2	tool
9	transformation	2	revolution
9	single market	2	readiness
6	education		

Table 3. Most frequent terms (>1 occurrence) following the term "digital" in EU Commission's Digital Education Action Plan. (EC, 2018)

### III. Meta-definition of the term "digital education"

It has been indicated that term "digital education" denotes a wide spectrum of phenomena and processes which may or may not have something in common.

More concretely, analysis of three strategic documents related to digital education indicated that the region of conceptual space pointed to by the DE-term is not a compact convex hull with one single centroid (Gärdenfors, 2004), but rather a group of regions, coalesced around multiple semantic prototypes (Rosch, 1999).

Thus, under one interpretation, presence of instrument-related features like "technology, platform, medium" seem to be sufficient and necessary conditions of "digital education". Under a parallel yet still completely valid interpretation, however, more human-oriented features like "competence, expert use, literacy" tend to yield the features which matter.

This indicates a polysemy which, we believe, should be explicitly addressed.

In order to do so, we propose to define the definiendum "digital education" by means of a meta-definition. Id est, by means of a definition whose definiens contains the verbum "define".

*Meta-definition* :: **Digital education is defined as education-with-digital or education-about-digital.**

Note that the conjunction OR in the meta-definition is not an exclusive either-or disjunction, but rather an inclusive one, allowing for both education-with-digital and education-about-digital to be true in the same time.

#### a. Education-with digital

In order to define the "education-with-digital", at least two preliminary "component" definitions are necessary.

*Digital tools* :: **Energy-consuming, discrete signal or information-processing tangible (e.g. hardware) or intangible (e.g. software) artefacts and systems constructed for a specific purpose (e.g. teaching).**

*Digital media* :: **Digital media transmit and process quantized information in order to actualize certain contents within the mind of the human observer (e.g. a student).**

*Education-with-digital* :: **Education-with-digital is concerned with exploitation and integration of digital media and digital tools within the framework of generic teaching, learning, or cognition-enhancing process.**

Having the component terms of "digital tools" and "digital tool" thus defined, we can proceed to one of our main definitions.

#### b. Education-about digital

The education-about aspect of "digital education" is concerned with the content which is being transferred from the teacher to the student, and not with the medium or form of the transfer.

As German Mathematical Society puts it: "Content instead of devices!" (GMS, 2016).

*Education-about-digital* :: **Education-about-digital is concerned with transfer of knowledge and competences related to logics, mathematics, computer science, cybernetics, cognitive science, human-computer interaction, data science, electrical engineering, mechatronics and information theory.**

We define education-about-digital as follows:

It is evident that field which we hereby the label "education-about" strongly overlaps with the field which is sometimes labeled as "computer science education" (CSE). However, additionally to CSE which often tends to focus mainly and uniquely on explanation and transfer of knowledge concerning the main operatory principles of computing machines, education-about-digital tends to integrate also topics like "cognition" or HCI into its curriculum.

That is, topics related to "interface" between the purely artificial and purely human.

#### IV. Conclusion

In section 2.3, we have presented a thought experiment wherein Alan Turing teaching by means of the "Computer Science Unplugged" (Bell et al., 2015) would not satisfy the folk notion of "digital education", while a blue-screened Windows positioned in front of the classroom, would.

A slightly amusing feeling induced by such a thought experiment may, however, fast disappears when one realizes that the world of real educational governance and real - i.e. multi-billion - investment decisions seems to be based on such vague definitions.

Thus, in a country or a continent whose educational governance institutions are misled by use of incorrect definitions, it could easily happen that a merchant of blue-screened "platforms" would get the part of a multi-billion DE-investment cake, while potential Turings would fail to satisfy the conditions of the tender.

##### 4.1. Synthesis

Digital Education is a multi-billion enterprise involving stake-holders spanning all age groups, all sectors of economy (public, private, NGO), all domains of human (family, community, city, region, state, international) and even non-human activity.

However, by being not only "digital" but first and foremost "education", DE is bound to fulfill those conditions which pure education is bound to fulfill as well. For example, the very first article of the School Law of the State Berlin, defines the mission of Berlin's education system as:

*School's mission* :: **"School's mission is to bring all valuable faculties of students to full deployment in order to convey them highest possible amount of force of judgment, in-depth knowledge and skill. The goal must be development of personalities able to ... shape political and social life on the basis of democracy, peace, freedom, human dignity, equality of genders and in harmony with nature and environment."** (SchulG, 2004)

In context of such legal frameworks, education is more than just a sector of economy. And what holds for education should, ex vi termini, hold also for digital education. Therefore, we suggest to stop interpreting "digital education" as a means how Silicon Valley or Shenzhen Economic Zone exploits existing public institutions to obtain access - practically for free - to cognition of cohorts of consumers in the most vulnerable age <sup>iv</sup>.

Rather, we close our proposal with suggest to start considering Digital Education as that domain of human activity, which harnesses the potential of both education-about-digital, and education-with-digital to maximize human potential.

*Teleological definition* :: **The task of digital education is to maximize force of judgment, in-depth knowledge, skillful expertise and personal integrity of voluntarily learning learners by means of well- thought, future-oriented, cognition-enhancing humanist curricula involving education-about-digital or education-with-digital methodologies.**

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Again, the conjunction "or" in the preceding definition is to be interpreted as "inclusive disjunction". This may, hopefully, if not reconcile the education-about and education-with camps, then at least allow posing useful, empirically falsifiable hypotheses. Hence, with help of "lemma terms" of education-about and education-with, education governance decision-makers could potentially start asking some useful questions.

Let's take, as an example, a first practical problem raised by the very existence of education-about / education-with dichotomy.

*The 1st problem of digital education :: **What is the optimal ratio of education-with and education-about in an ideal digital education curriculum ?***

Before pointing out the education-about / education-with distinction, it has not been possible neither to pose such question, nor develop empiric methodologies which would allow us to answer it.

After creating such distinction, however, it's answering is only a question of time. For "if a question can be put at all, then it can also be answered." (Wittgenstein, 1922)

Such, indeed, can be consequences of stringent following of Pascal's guidelines and considering definitions as something worthy of attention.

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i As before, definitions hereby proposed are mostly based on those present in Oxford Dictionary of English, Random House Webster's, Collins English Dictionary and Merriam-Webster dictionary.

ii The notion of a "digital world" is a key notion of "School DigitalPact" issued by the conference of education ministers of German states. In this paper of strategic importance, expression "*digital world*" occurs 17 times while the expression "*digital media*" occurs only twice.

iii The only case where the copular verb "is" occurs besides the DE-term is the sentence: "A key part of digital education is ensuring equity and quality of access and infrastructure.

iv When speaking about digital education of children, one should not lose out of sight a salient fact that a non-negligible segment of a human population tends to use and consume - for the rest of their lives - derivatives of products with which they had been acquainted during their childhood.

v An "ideal curriculum" is defined as a curriculum maximizing the probability of attaining "school's mission".