DigitalWorld 2020 International Expert Panel:

— Discovery and Learning —

From Education to Machine Learning and Deep Learning:

Strengthening Knowledge Through Learning

November 23, 2020, Valencia, Spain

DigitalWorld / The Twelfth International Conference on
Advanced Geographic Information Systems, Applications, and Services
GEOProcessing 2020 / ICDS 2020

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Joint GEOProcessing and ICDS International Expert Panel: From Education to Machine Learning and Deep Learning: Strengthening Knowledge Through Learn

DigitalWorld Expert Panel: . . . Discovery and Learning . . .

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Panelists and Contributors

- *Claus-Peter Rückemann* (Moderator),
  Westfälische Wilhelms-Universität Münster (WWU);
  KiM, DIMF; Leibniz Universität Hannover, Germany

- *Roy Oberhauser,*   [Panelist and Contributor]
  Aalen University, Germany

- *Tsunenori Ishioka,*   [Panelist and Contributor]
  The National Center for University Entrance Examinations, Japan

- *Samia Aitouche,*   [Panelist and Contributor]
  Industrial Engineering Department, University Batna 2, Algeria

- *Martijn Zoet,*   [Panelist and Contributor]
  Zuyd University of Applied Science, The Netherlands

- *Claus-Peter Rückemann,*   [Panelist and Contributor]
  WWU Münster / DIMF / Leibniz Universität Hannover, Germany

DigitalWorld / GEOProcessing 2020 / ICDS: http://www.iaria.org/conferences2020/GEOProcessing20.html
http://www.iaria.org/conferences2020/ICDS20.html

Program: http://www.iaria.org/conferences2020/ProgramGEOProcessing20.html

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Panel foci, statements, topics, and preview:

- We need to increase educational levels and awareness for insight.
  We need to reduce smattering and negligence in context of education.

- We should not underestimate the complexity of human context.

- Learning is and will remain context-dependent.

- Mobile-first teaching; Outsourcing the direct instruction model; The AI as a teacher/instructor and a human coach;

- What can we learn from applying particular 'knowledge', e.g., automated writing scoring.

- Is learning without a teacher or formal education a benefit? Does self-education, distance learning, 'automatic methods' bring new opportunities?

- Are attempts to replace the human in 'digital' education creating paradoxical situations and fallacies?

- Do we need human teacher in the 21st century (and beyond) and why?

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Pre-Discussion-Wrapup:

- **Knowledge:** What kind of knowledge and education are required?
- **Indispensables:** Do we still need humans providing education and education for humans?
- **Focus:** At which place of action can and should knowledge and education be strengthened?
- **Implementation and realisation:** How can tools like machine/deep/. . . learning implemented and applied?
- **Achievement:** What are knowledge, cognition, and learning and what are the core achievements?
- **Case scenarios:** What are 'education and tools' case scenarios and experiences (natural sciences, humanities, applied sciences, . . .)?
- **Analysis:** What are experiences with and from education and learning regarding formalisation and tools?
- **Views:** Are there differences in education/training and academia/industry applications/views?
- **Recommendations:** Which general and special recommendations?
- **Networking:** Discussion! Open Questions? Suggestions for next Expert Panel?

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DigitalWorld Expert Panel: Table of Presentations, Attached

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Panelist Presentations: (presentation order, following pages)

- **Education and Knowledge do Not Deserve Smattering:**
  Allow Solid Information Science Fundaments to Prevail   (*Rückemann*)

- **Tangled Problems, Information/Knowledge Boundaries & their**
  Impact on a Human-Centric Education/Learning Viewpoint (*Oberhauser*)

- **AI-based+ Automated Short-answer Scoring System**   (*Ishioka*)

- **Digital transformation in COVID-19 pandemic era**   (*Aitouche*)

- **Cognitive Overmatch by Single-responsibility Singularity**   (*Zoet*)

DigitalWorld 2020 International Expert Panel

From Education to Machine Learning and Deep Learning: Strengthening Knowledge Through Learning

Education and Knowledge do Not Deserve Smattering:

Allow Solid Information Science Fundaments to Prevail

DigitalWorld / Twelfth International Conference on Advanced Geographic Information Systems, Applications, and Services (GEOProcessing 2020) / ICDS 2020
November 23, 2020, Valencia, Spain

Dr. rer. nat. Claus-Peter Rückemann[1,2,3]

[1] Westfälische Wilhelms-Universität Münster (WWU), Münster, Germany
[2] KiM, DIMF, Germany
[3] Leibniz Universität Hannover, Hannover, Germany

ruckema(at)uni-muenster.de

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Common Information – The Author

Information: CV, lectures, studies, materials, research, and networking

Curriculum Vitae:

    http://www.user.uni-hannover.de/cpr/x/rueckemann/en/

Publications, lectures, and materials:

    http://www.user.uni-hannover.de/cpr/x/rueckemann/en/#Publications

    http://www.user.uni-hannover.de/cpr/x/frodi/en/#Courses

Congresses and venues:

    http://www.user.uni-hannover.de/cpr/x/rwerkr/en/

Research

Dr. Claus-Peter Rückemann
Westfälische Wilhelms-Universität Münster
E-Mail: ruckema(at)uni-muenster.de

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The International Conference on Advanced Geographic Information Systems, Applications, and Services (GEOProcessing);
Director GEXI Consortium; Head of research LX Foundation; Senior Member of Knowledge in Motion long-term project;
Fellow Member of the Int. HPC and Artificial Intelligence Advisory Council; Member of the Indexing Committee Board, IARIA;
Westfälische Wilhelms-Universität Münster (WWU);
Senior Lecturer Information Science, Security, and Computing at Leibniz Univ. Hannover; IARIA Fellow.

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Best Practice: Knowledge and Computing

In 80 Words Around The World.

Knowledge

- "Knowledge is created from a subjective combination of different attainments as there are intuition, experience, information, education, decision, power of persuasion and so on, which are selected, compared and balanced against each other, which are transformed, interpreted, and used in reasoning, also to infer further knowledge.
- Therefore, not all the knowledge can be explicitly formalised.
- Knowledge and content are multi- and inter-disciplinary long-term targets and values.
- In practice, powerful and secure information technology can support knowledge-based works and values."

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Systematical View on Knowledge: FCPM Complements

Complements of Knowledge and Corresponding Sample Implementations:

- **Factual Knowledge** $\Leftrightarrow$ **Numerical data, data** . . .
- **Conceptual Knowledge** $\Leftrightarrow$ **Classification** . . .
- **Procedural Knowledge** $\Leftrightarrow$ **Computing** . . .
- **Metacognitive Knowledge** $\Leftrightarrow$ **Experience** . . .
- . . .

(Source: Aristotle; Anderson & Krathwohl; SACINAS Delegates' Summit 2015–2019)

Joint GEOProcessing and ICDS International Expert Panel: From Education to Machine Learning and Deep Learning: Strengthening Knowledge Through Learn

└─ Status: Fostering Education & Knowledge, Deploying Machines and Tools

Status:

- **Fundaments and background**
  . . . are often neither understood and tought not practically respected.

- **Society and academy**
  are commonly reacting with simplification and training.

- **Smattering and negligence**
  are widely prominent.

- **Omnipresent:**
  Hypes, buzz, neologisms, oxymoronic terminologies, . . .

- **Situation:**
  Rised mentatility tries to gain fast 'success',
  using extenuations, belittlements, and 'simplifications'.

- **Consequences:**
  Education has become training.
  Tools have been raised to 'surrogate' knowledge.

Vision and future:

- **Insight** that knowledge is not the output or result of a tool.

- **Insight** that the fundament of any Turing machine / computer is formalisation (going along with abstraction and reduction).

- **Insight** that tools, in any combination, are not even a surrogate for classical learning.

- **Complements:** Recognition that
  a) education/knowledge and
  b) machines/tools are different leagues.

- **Require education** for solid fundaments, information science.

- **Require training** for tools, appropriate regarding machine 'learning', deep 'learning', augmented 'learning', blended 'learning', artificial 'instruments', . . .

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Conclusions

Conclusions:

- Education is not training. Learning is not tools.

- Educational Taylorism is not an (future-oriented) option.

  a) We should foster solid education, information science,
     multi-disciplinary education.

  b) We should employ tools where holistically appropriate.

- We should increase educational level and awareness
  (e.g., methodologies, systematics, experience, cognition, . . .)
  for insight.

- We should reduce smattering, negligence, . . .

  in context of education (science, management, and service).

Panel 2
Theme: Discovery and Learning
Topic: From Education to Machine Learning and Deep learning: Strengthening Knowledge through Learning

Digital World 2020

Panelist Position

Aalen University

Tangled Problems, Information/Knowledge Boundaries and their Impact on a Human-Centric Education/Learning Viewpoint

Roy Oberhauser
Aalen University
Germany
roy.oberhauser@hs-aalen.de

Background: Some Views on Knowledge/Learning

- Utility/Value view: knowledge/learning only has real value if it can be and when it *utilized* or *applied* and/or propagated
    - *Knowledge value chains*, in contrast to product supply chains, are often not explicit, but essential for a knowledge-centric society
    - How can we readily identify these and augment them?
- Intrinsic view: knowledge/learning have value in and of themselves
    - Knowledge for the sake of knowledge
    - Thinking for the sake of thinking
        - Thinking is based on knowledge
    - Learning for the sake of learning
        - Ongoing learning cycles: humans always implicitly/explicitly learn in their various contexts and knowledge networks due to impulses/reactions in our bodies and the environment in which we exist

Are we Experiencing a Knowledge/Learning Crisis?

- Various factors have converged to create what I will call a *knowledge crisis* and associated *learning crisis*
  - Last person who knew what was knowable at that time is said to be Thomas Young (1773–1829)
- Confronted with an ongoing exponential growth in information and knowledge
  - Articulated by Buckminster Fuller [1] and known as the knowledge-doubling curve. IBM extrapolated that by 2020 knowledge would be doubling in a matter of hours [2].
  - Among the factors fueling this trend: digitalization, data analytics, machine learning, interconnected global access to knowledge, transition from industrial to knowledge- and service-based societies
- Knowledge decay effect or obsolescence process
  - Not all knowledge remains stable, valuable, useful, and accurate for long. Some subset of our knowledge has a "half-life" articulated by Fritz Machlup and this half-life is correspondingly decreasing [3].
  - The effect is exacerbated in rapidly changing high-technology fields and associated education/training/learning
- We need a way to *manage* and *navigate* knowledge in all the various knowledge/learning networks each person participates in and propagate relevant and timely knowledge automatically
- Cognitive limitations imply learning limitations
  - Choices on what and what **NOT** to learn, what knowledge to **ignore** and what knowledge will be applicable/valuable to whom when
  - In this regard, how can we optimally augment human-centric learning, e.g., in mobile learning scenarios?
- Knowledge/learning (network) boundaries/barriers and knowledge propagation affect learning
  - While Machine Learning (ML) and Deep Learning (DL) are cool…
  - All information systems as well as the **human** and organizational knowledge networks they serve are inherently limited in what knowledge they model, contain, learn, and propagate

Theme: Discovery and Learning
Topic: From Education to Machine Learning and Deep Learning: Strengthening Knowledge through Learning

Let us ask just a few ☺ questions (subset) with regard to learning and knowledge:

- What does any individual actually know at a given moment and how can that be (automatically) ascertained?
- What can we know?
- What should we know (e.g., any knowledge missing, considering risk and cognitive, time limitations)?
- Who should all know it (individuals, roles, groups, networks, etc.)?
- When should we know it?
- Why should we know/learn it (**value** view)? Who benefits when (**value chain**)?
- What type of knowledge is it (different handling)?
- What dynamics are associated with this knowledge (e.g., context, time/value decay, group applicability)?
- To what knowledge networks (KNs) is some knowledge applicable?
- How can knowledge be packaged and propagated across KNs?
- How does one learn/acquire this knowledge (**process view**)?
- Before it is learned: How does one become **aware** the knowledge exists, via push or pull?
- How under what circumstances can this knowledge be applied/utilized?
- In what **context** is the knowledge applicable?
- Who should be targeted for active knowledge propagation (push)?
- In what **context** is the person (knowledge -learning-**context** match)?

On "Strengthening Knowledge through Learning": Tangled Problems and Information Boundaries and their Impact on an Individual-Centric Education/Learning Viewpoint

- In the following slides, I elucidate my position by reappropriating points made in the article
  - *"From "Need to Know" to "Need to Share": Tangled Problems, Information Boundaries, and the Building of Public Sector Knowledge Networks* by Dawes, Cresswell, & Pardo (DCP09).
- In particular, I reappropriate various key points from public sector knowledge networks (PSKNs), which the article addressed, to our panel theme and topic for:
  - A human, individual-centric learning/education viewpoint
  - Various Knowledge Networks (KNs) are in view, especially individual (IKNs), group (GKNs), organizational (OKNs) and society (SKNs), not just PSKNs
- Note: in the following slides, areas in blue are my opinions or adaptations of quotes from the article. *Italics* or **bold** for used for emphasis.

On Tangled Problems and Information Boundaries and their Impact on an Individual-Centric Education/Learning Viewpoint

- From (DCP09): "knowledge and boundary challenges help explain why structured IT systems are often *ineffective in transferring knowledge* and information from one organization [or KN] to another. Such systems rely on relatively rigid definitions and rules that are at odds with the dynamic flow and use of information in practice." (my adaptation)

- My position:
  - This is true for all KNs spanning individuals/groups/organizations/society in general
  - Indeed, while ML/DL currently receives much hype and attention, it fails to address individual and organizational KN boundaries and the rigid IT-based KN boundaries at the IT system level.
  - Automated knowledge transfer/propagation across KNs and systems is tricky, and especially with regard to supporting human-based learning and education.

On Tangled Problems and Information Boundaries and their Impact on an Individual-Centric Education/Learning Viewpoint

- **Lesson 1 from (DCP09): "The elusive nature of knowledge can cause considerable difficulty for [KNs] - it is dangerous to assume that meanings are clear, *context* is understood, and quality is acceptable to all participants." (my adaptation)**
  - "Knowledge management studies also show that *what is information to some is knowledge to others*. Information forms the basis for knowledge development, on the one hand, and knowledge often is required to assimilate and interpret information, on the other (Davenport, DeLong, and Beers 1998)."
  - "Important aspects of knowledge sharing go beyond simple information or data exchange to focus on knowledge as *knowing*, implying the ability to **use knowledge to accomplish some task** or reach some level of performance (Brown and Duguid 2001)."

- With regard to **learning** and knowledge utilization: we lack mechanisms for automatically ascertaining the **context** a person is and task they are doing, and the **context** with which some knowledge is associated (e.g., acquired) or under what context it is needed or can be used, e.g., for active knowledge propagation (push) across KN boundaries.

On Tangled Problems and Information Boundaries and their Impact on an Individual-Centric Education/Learning Viewpoint

- (Continued) **Lesson 1 from (DCP09): "The elusive nature of knowledge can cause considerable difficulty for [KNs] - it is dangerous to assume that meanings are clear, context is understood, and quality is acceptable to all participants."** (my adaptation)
  - "The ease of knowledge sharing or the best ways to **propagate** it through a [KN] will depend on the nature of the knowledge itself. Some elements of knowledge are explicit, formal, and embodied in easily accessible media or artifacts, such as written policies, procedures, standards, and databases. This kind of knowledge is readily conveyed to others by language, images, or structured data and information systems. Other elements of knowledge are likely to be more tacit, **embedded in** social **context** and practices, and conveyed through "learning by doing" rather than through explicit means (Cohen and Bacdayan 1994; Wenger 1998). Knowledge also may be viewed as an organization-level phenomenon, embedded in organizational forms, expertise, and historical, social, material, and cultural **contexts** (Gherardi and Nicolini 2000)."

- Learning/education typically involves **propagating** knowledge:
  - Knowledge acquisition, propagation, and utilization is highly **context-dependent** – because context is so multifarious and ambivalent – significant work is still needed on supporting and standardizing practical context modeling and exchange to support context-aware knowledge systems

On Tangled Problems and Information Boundaries and their Impact on an Individual-Centric Education/Learning Viewpoint

- **Lesson 2 from (DCP09): "As a potentially sharable resource, knowledge varies in several essential respects— codifiability, embeddedness, and dynamics—and each variation demands substantially different treatment within a [KN]."** (my adaptation)

  - "Variations in the nature of information and knowledge resources can be summarized in terms of three dimensions. One is codifiability—the ease with which knowledge is expressed in language, numbers, formal procedures, and explicit techniques. A second is practice embeddedness—the degree to which knowledge is situated in or generated by ongoing practice and learning by doing (Cohen and Bacdayan 1994). **Information and knowledge are also very much embedded in changing temporal, physical, and programmatic contexts that need to be conveyed along with the information if someone working in a different context is to understand it**. The third dimension is **dynamics**—the degree to which knowledge is constantly being recreated and transformed by use, including the development of new knowledge.

- We lack mechanisms for automatically ascertaining the **context** a person is and task they are doing, and the **context** with which some knowledge is associated (e.g., acquired) or under what context it is needed or can be used, e.g., for active knowledge propagation (push) across KN boundaries.

On Tangled Problems and Information Boundaries and their Impact on an Individual-Centric Education/Learning Viewpoint

- **Lesson 3: "[KNs]** ~~organizations, jurisdictions, and sectors~~ **are a form of cross-boundary exchange. The boundaries of [KNs] present the most obvious challenges, but more subtle boundaries related to ideology,** ~~professional~~ **norms, and** ~~institutional~~ **divisions, [preferences, expectations, culture, experience, etc.], can be equally problematic."** (my adaptation)

  - "Crossing boundaries also means interaction with "alien" business [, personal, group, organizational, educational, or society] **processes** and practices. As with information systems, the logic and full interpretation of a **process** may be poorly documented, causing, at best, a fragmented understanding of the complete **process**. The *knowledge necessary to interpret many kinds of information is also intricately linked to the business [or other] processes from which it arises and in which it is used. Thus, effective data sharing and integration across boundaries often requires cross-boundary examination and understanding of diverse business [or other related] processes and practices.*"

  - "Organizational and professional cultures pose other kinds of boundaries. Knowledge often is embedded in these cultures and thus is not easily extracted or transferred (DeLong and Fahey 2000)…**For information systems, the knowledge wrapper that holds the logic of data structures, definitions, collection methods, processes, and interpretive schemes is unique to the organizational setting in which it was created. This knowledge may be poorly documented and distributed in ways that make it difficult to aggregate and share**. Without sharing this knowledge, however, the transfer of data across organizations [or the range of KNs] is unlikely to produce meaningful results."

- **Processes** are a key ingredient to **context** as well as knowledge transfer and learning. Without knowledge transfer, learning and the associated **knowledge value chains** and **learning value chains** are inhibited

On Tangled Problems and Information Boundaries and their Impact on an Individual-Centric Education/Learning Viewpoint

- **Lesson 4 from (DCP09): "Trust, like knowledge, comes in different forms that work best under different conditions. Lack of sufficient trust—and lack of the right kind of trust—can be powerful inhibitors to [KNs]."** (my adaptation)
  - "Trust influences how culture, values, and personal and organizational relations influence the processes and outcomes of knowledge sharing (Cresswell et al. 2006). Trust is necessary in the face of the dynamic risks and interdependence inherent in knowledge sharing (Rousseau et al. 1998). When trust is low, transaction costs rise as a result of efforts to implement management and oversight controls that prevent exploitation (Jones, Hesterly, and Borgatti 1997)."
  - "different kinds of interactions demand different sorts of trust, and the lack of trust, as well as active distrust (Lewicki, McAllister, and Bies 1998), sharply limits what can be attempted and achieved."

- Determining an initial level of trust (automated or manual investigation) and developing and readjusting trust between KNs is an ongoing and demanding aspect that can inhibit knowledge sharing and inter-KN learning

On Tangled Problems and Information Boundaries and their Impact on an Individual-Centric Education/Learning Viewpoint

- **Lesson 5 from (DCP09): "Risk is inevitable in [KNs], and it is perceived and handled differently by different players."** (my adaptation)
    - "Substantial risks inherent in knowledge sharing and collaboration can greatly interfere with effective KNs. Parties may not share the same understanding of risk and thus disagree over what may or may not be shared (Pardo et al. 2006). Common areas of disagreement include privacy, confidentiality, and security concerns; ambiguity about statutory authority to collect, share, or release information; and different degrees of openness to ~~public~~ access."
    - "Knowledge also may constitute highly valued organizational or personal assets. Loss of exclusive control of that knowledge can inhibit open dialogue and collaboration."
    - "If the benefits of sharing are not clear, or if the exchange appears too one sided, barriers go up." Therefore, explicit strategies to address these perceptions of risk are critical to the success of knowledge-based collaboration"
- To address risk assessment, transparency about knowledge propagation, transfer, ownership, authority, protection, security, etc. are essential to supporting the various learning processes across the range of KNs from people to society

On Tangled Problems and Information Boundaries and their Impact on an Individual-Centric Education/Learning Viewpoint

- **Lesson 12 from (DCP09): "Learning and adaptation are essential to [KN] development and survival."** (my adaptation)
  - "***Knowledge networks** are inherently **learning organizations***. They exist in a *dynamic* environment in which changing ~~economic~~ conditions, ~~political~~ priorities, and social trends have a strong effect on their status and operation. These conditions require not only **learning** but also ongoing **adaptation**. The *interactions* among individuals, organizations, and communities are the *channels* by which *knowledge is exchanged, examined, and integrated*."
- Applying automated dynamic **adaptive approaches** to human-centric learning and education processes across the KN spectrum are essential.
  - New forms of intelligent process-aware information systems could help support this.

On Tangled Problems and Information Boundaries and their Impact on an Individual-Centric Education/Learning Viewpoint

- **Lesson 13 from (DCP09): "Technology is necessary but not sufficient for success."**
  - "…appropriate technology is a necessary but insufficient ingredient in the development, nurturing, and sustaining of [KNs]... in order for IT tools to be appropriate, they must be suited and scaled to the network structure and goals and be usable by all of the participants at reasonable cost and effort. However, participants often believe that having appropriate technology is the key to success. Their mistake comes in thinking that making different systems "talk" to each other is readily doable, and that once this is done, the knowledge-sharing problem will be solved." (my adaptation)
  - "no information system—no matter how powerful, sophisticated, or intuitive—can solve political, organizational, or managerial problems, or problems associated with conflicting or competing goals or professional practices…information technology should be part of the effort to deal with these kinds of problems, but … certainly no unexamined IT "solution" will untangle them."
- While much technology-centric progress has been attained in the realm of acquiring ML/DL based knowledge, the larger and more tangled issues for transferring knowledge beyond information system boundaries and viably augmenting human knowledge and learning across the span of KNs from individuals to society lingers.

Summary

- Tangled problems and information boundaries impede knowledge propagation and thus learning
- Structured IT systems are rigid and often ineffective in transferring knowledge and information across KNs
- The elusive nature of knowledge can cause considerable difficulty
- Knowledge acquisition, propagation, and utilization is **context-dependent** – thus systems must detect or be aware of the context (automatically or manually) regarding learning/education situation (**context-aware**)
- Standardize practical context modeling and exchange mechanisms to support **context-aware knowledge systems**
- **Processes** are a key ingredient to **context** as well as knowledge transfer and learning. Without knowledge transfer, learning and the associated **knowledge value chains** and **learning value chains** are inhibited
- **(Automating) trust** between KNs remains is an ongoing challenge for knowledge sharing and inter-KN learning
- To address risk assessment, **transparency** about knowledge propagation and governance are essential to supporting the various learning processes across the spectrum of KNs from people to society
- **Automated dynamically adaptive approaches** to human-centric learning and education processes across the KN spectrum are essential. New forms of **intelligent process-aware information systems** could help support this.

The larger and more tangled issues for transferring knowledge beyond information system boundaries and viably augmenting human knowledge and learning across the span of KNs from individuals to society lingers.

Conclusion

- We underestimate/oversimplify the complexity of the human context for knowledge and learning and associated tangles and boundaries between the spectrum of heterogenous KNs that span from the individual and groups to society.
- Learning is and will remain context-dependent and thus knowledge must be treated that way
  - Context and motivation: .e.g., utility and intrinsic (curiosity) motivation for knowledge acquisition and learning can play a role
  - Augmenting human-centric learning more comprehensive and challenging than ML or DL which work within a defined scope.
- Inter-KN knowledge propagation and learning inhibited by lack of viable context domain models and knowledge and learning exchange standards for business, knowledge, and learning processes
  - Top-down approaches (e.g., Semantic Web) have remained academic
  - Bottom-up approaches (e.g., JSON-LD) that might support individual-centric context are too diverse for realistically crossing IT system and other boundaries to be applicable to an individual learning context in any practical and economic way
  - Context modeling languages are few, domain-specific, and lack adoption

Future Outlook

- We wait for a Silver Bullet:
  - A Dead Technology returning from the Trough of Disillusionment (in reference to Gartner Hype Cycle) in a different form…
  - Or some New Technology that promises to address the various Tangles and Boundaries that impede knowledge propagation across KN boundaries, context-awareness, cross-KN learning, and human-centric learning and education processes
- In the meantime, intelligent and adaptive process-aware and context-aware information systems and mobile learning approaches can be combined with ML/DL-based knowledge management systems to support an interim constrained and limited solutions to augment human learning and deliver context-relevant and timely knowledge

Related Research Supporting (Mobile) Context-Aware (Learning) Adaptable Process-Aware Information Systems

On supporting **Mobile-Centric Human Learning Processes**:

- "DEKXTROSE: An Education 4.0 Mobile Learning Approach and Object-Aware App Based on a Knowledge Nexus" by Roy Oberhauser. eLmL 2020. IARIA, 2020.
  - **Context-based object recognition** via the smart device camera used to trigger learning paths; **Knowledge** nexus-based multimedia approach aligned with Higher **Education** 4.0 for creating learning apps on mobile devices; Support multiple didactic models, intrinsic curiosity, gamification, digital collaboration; Diverse didactic method workflow-like learning flows/processes support group-based learning

On **Context-Aware and Intelligent Process-Aware Information Systems**: e.g.,

- *Advances in Intelligent Process-Aware Information Systems: Concepts, Methods, and Technologies*. Grambow, Gregor, Oberhauser, Roy, Reichert, Manfred (Eds.). Springer, 2017. ISBN 978-3-319-52181-7.

- "Context-Aware and Process-Centric Knowledge Provisioning: An Example from the Software Development Domain" by Gregor Grambow, Roy Oberhauser, and Manfred Reichert. In: Innovations in Knowledge Management - The Impact of Social Media, Semantic Web and Cloud Computing. Intelligent Systems Reference Library 95, Springer, 2016. pp. 179-209. ISBN: 978-3-662-47826-4.

Thank you

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Panel 2
Theme: Discovery and Learning
Topic: From Education to Machine Learning and Deep learning: Strengthening Knowledge through Learning
(patterns, deep learning, recursive learning, mobile learning, knowledge transfer, surface and deep web, etc.)

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Panellist Position

AI-based+ Automated Short-answer Scoring System

Tsunenori Ishioka, Professor, Nat. Ctr. for Univ. Entrance Examinations, Japan tunenori@rd.dnc,ac.jp

- Three Types of Writing Test

- Current Status of Short-answer Written Test

- AI methods for automated scoring

- Combined use of Training wheels for understanding

- Words specification is also helpful

AI-based+ Automated Short-answer Scoring System

Tsunenori Ishioka*

E-mail: tunenori@rd.dnc.ac.jp

* The National Center for University Entrance Examinations, Japan

Nov. 21-25, 2018
DegitalWorld2000, Spain

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Three Types of Writing test

1. Math → difficult
   - ■ Formula recognition is difficult.
   - ■ Standard Correction procedure?
   - ■ There are many more formats that show the same formula.

Formula input panel

Correction

Three Types of Writing test

2. Essays → practical
   - ■ No correct answer
   - ■ Rhetoric, logics, contents
   - ■ Practical application: e-rater, Intellimetric, and Jess (for Japanese)

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3. Short-answers → In progress
   - ■ Model answer(s)
   - ■ Semantic identity / Recognizing textual entailment
   - ■ Technical difficulty
   - ■ Not applied for high-stakes test(s)

Short Answers Writing Test

☐ Understanding meaning using deep learning

☐ LSTM＋Attention；ELMO; BERT, XLNet, ALBERT

   ■ A large amount of digitized data and pre-scoring data are required

  → Suitable for large-scale testing

☐ Classrooms?

4

Question Answering on SQuAD2.0

- ☐ Reading comprehension dataset
  - ■ 100K questions and 50K+ unanswerable questions
  - ■ Human Performance

    EM: 86.831, F1: 89.452
- ☐ Now (Oct.30, 2020)
  - ■ Rank1:SA-Net on Albert

    EM: 90.724, F1: 93.011

Reasonable Solutions for short-answer scoring

1. Training wheels for understanding
   - Generally not true
   - Context-sensitive synonyms

   Father's feeling = **Compassion**

   - Combined use of scoring rubric
   - Synonym, mandatory words, volume …

2. Specification of words or phrases
   - TOEIC Writing Test

An Example of Scoring rubric

tab   tab

syno   jizya   jizyah   synonym

syno   Muslim Islam

syno   "Indigenous people" "Different ethnic groups"

gold 5 "Even when indigenous people in a place of conquest were Muslim, they were exempted from Jizya. Even when an Arab had land in a place of conquest, kharaj was imposed." model answer

part1 2 "Even when indigenous people in a place of conquest were Muslim, they were exempted from Jizya."   partial points

lack1 -1 "had land"   mandatory words; When missing, reduce the points

lack2 -2 jizya

vol -5 60-40   volume max [- min]

Write a sentence based on a picture

Writing Test

You will write ONE sentence that is based on a picture. With each picture, you will be given TWO words or phrases that you must use in your sentence.

Airport terminal / so

(Type your response here.)

8

Conclusion

☐ Recognizing textual entailment is still difficult technically.

☐ **Proposed Solutions** are realistic and effective

■ AI solution + Training wheels for understanding

■ Use of words specification

IARIA

Panel 2
Theme: Discovery and Learning
Topic: From Education to Machine Learning and Deep learning: Strengthening Knowledge through Learning
(patterns, deep learning, recursive learning, mobile learning, knowledge transfer, surface and deep web, etc.)

Digital World 2020

Senior Lecturer researcher

Digital Transformation in Education in Covid-19 Era

Samia Aitouche,

Laboratory of Automation and Manufacturing

industrial Engineering department

University Batna 2, Batna, Algeria

s.aitouche@univ-batna2.dz

Introduction

COVID-19 has Shaked all the calculations and plannings of the humanity during the 2020 and continuing situation in 2021. We are in the second vague of it. We lost members of our families and our friends. This is in the social side, in economic side, all goverments and businesses were touched by the closing and decrease of their turnover without finding a final solution to the degrading situation.

As a lecturer in the university, our courses were stopped suddenly and then resumed.

We were forced (we do not have any choice) to continue lessons on line. We lost the opportunity of face to face lessons , which was very benefic to assimilation.

Now, what are the advantages and inconvenients of on line education?

How COVID-19 pandemic transformed the basic education of the young generation and why information management research should care?

In this study, authors examine the digital transformation initiated by the COVID-19 pandemic in the basic education of the young generation. They argue that information management research should better acknowledge children, their digitalized everyday life and their basic education as significant areas of concern. The responsibles and parents should understand them as well as allow them to shape the education offered to them in the context of higher education. but we should also aim at influencing the basic education of the young generation – for the purpose of equipping them with important skills and competencies for their digital futures but also for the purpose of arousing their interest in this important field, maybe even as a career option [2].

In other study: Covid 19-A major cause of digital transformation in education or just an evaluation test

Another finding argue that Young people nowadays belong to the so called digital generation, so we expected that students are actually happier with eLearning rather than the traditional onsite learning [4].
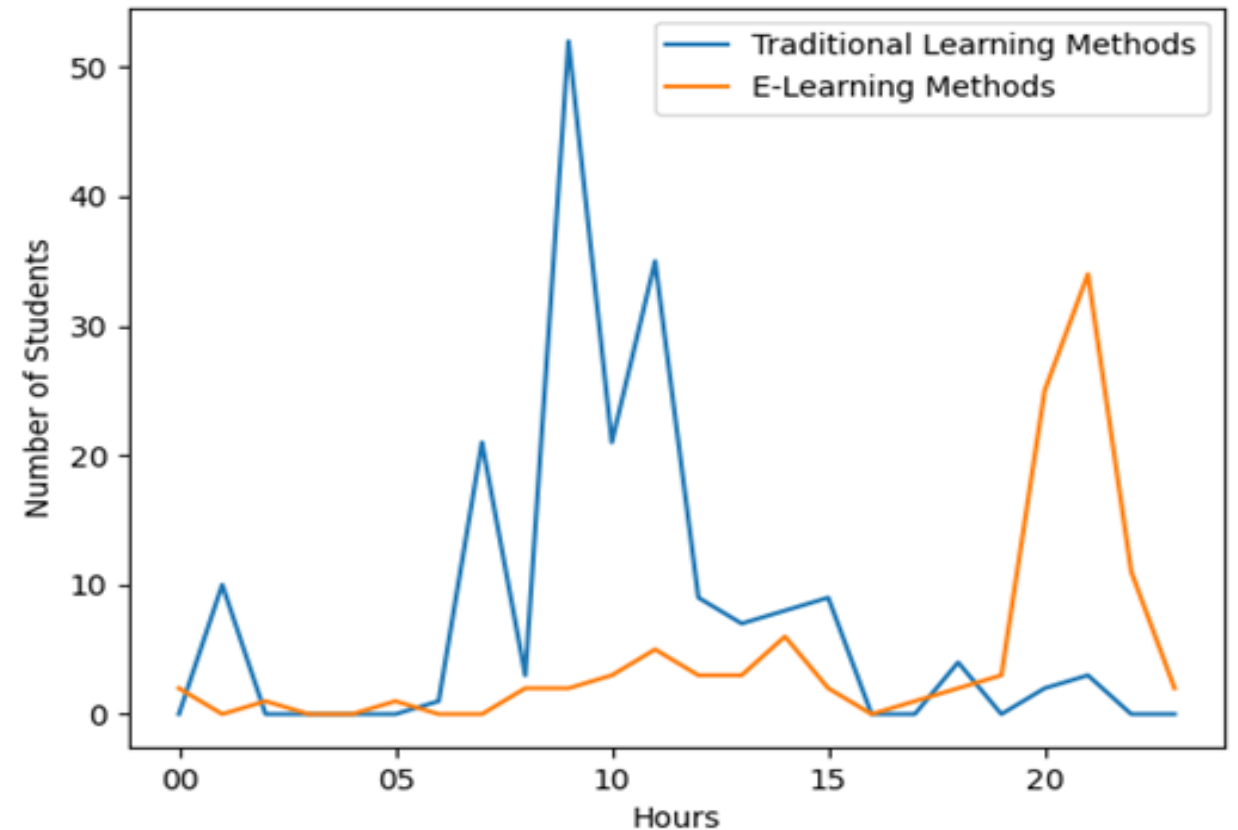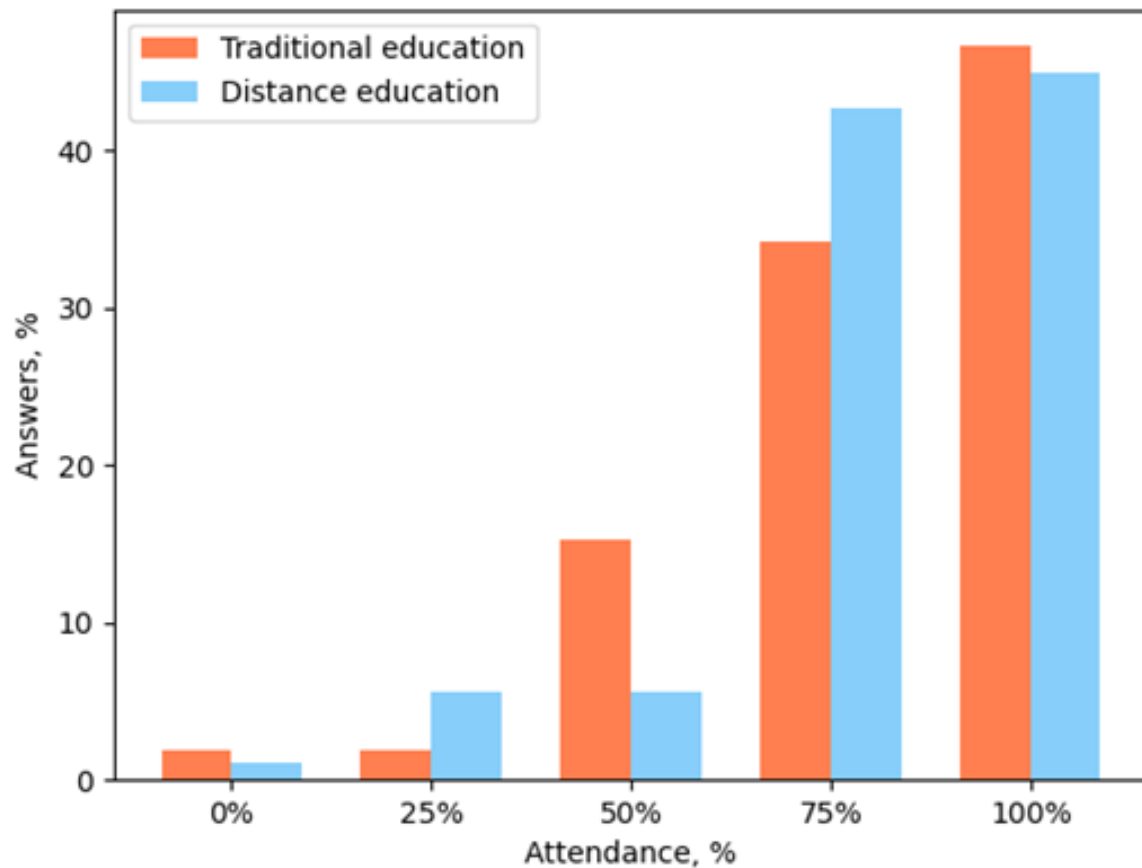
Higher education and research in Latin America: Transition to the use of digital technologies by Covid-19

The results determine that the information on the academic programs is accessed through digital environments, in terms of research, little projection prevails over the advances in times of pandemic, generating uncertainty in the face of the revitalization of the science-technology-humanities trilogy, in Latin America. It is concluded that the scope of technologies to overcome student desertion is weakly spread. In research, the visibility of strategies that guarantee their continuity is omitted, generating paralysis or delay, influencing scientific-technical progress. It is necessary to go beyond the exclusive use of technologies for teaching, and promote the dissemination of accessibility, visibility and interoperability of technological platforms that respond to the requirements of an educational environment violated by COVID-19.

COVID-19 and the digital transformation of education: What are we learning on 4ir (South Africa)?

In South Africa, during the lockdown, a variety of 4IR tools were unleashed from primary education to higher and tertiary education where educational activities switched to remote (online) learning. These observations reflect that South Africa generally has some pockets of excellence to drive the education sector into the 4IR, which has the potential to increase access. Access to education, particularly at a higher education level, has always been a challenge due to a limited number of spaces available. Much as this pandemic has brought with it massive human suffering across the globe, it has presented an opportunity to assess successes and failures of deployed technologies, costs associated with them, and scaling these technologies to improve access [6].

Education in Algeria in COVID-19 Era

All institutes and departments, including the Industrial Engineering department, of university Batna2, Algeria started using the e-learning Moodle platform to publish courses for all degrees of study and establish online sessions, especially for Ph.D. students [1]. Some courses were accomplished via Zoom platform. The problem was that certain rural zones are not connected to internet and other students do not have their own room to follow courses at home. The operation was not very successful as expected.

A COVID-19 panacea in digital technologies? Challenges for democracy and higher education (Canada)

Universities have transitioned to online education in order to slow the spread of COVID-19. This transition mobilizes the technological utopian imaginary that digital technologies can rescue populations from the disease. It also raises the risk of deepening neoliberal educational reforms and, by extension, poses a threat to democracy itself. This commentary explores this risk and suggests ways to resist the resulting neoliberalization of education that it could entail [7].

COVID-19 and the promotion of digital competences in education (Europe)

European Reference Framework for Digitally-Competent Educational Organizations exists but there are lacks and insufficiencies in application discovered in COVID-19 situation. There is a resistance of teachers in all levels to the on line teaching.
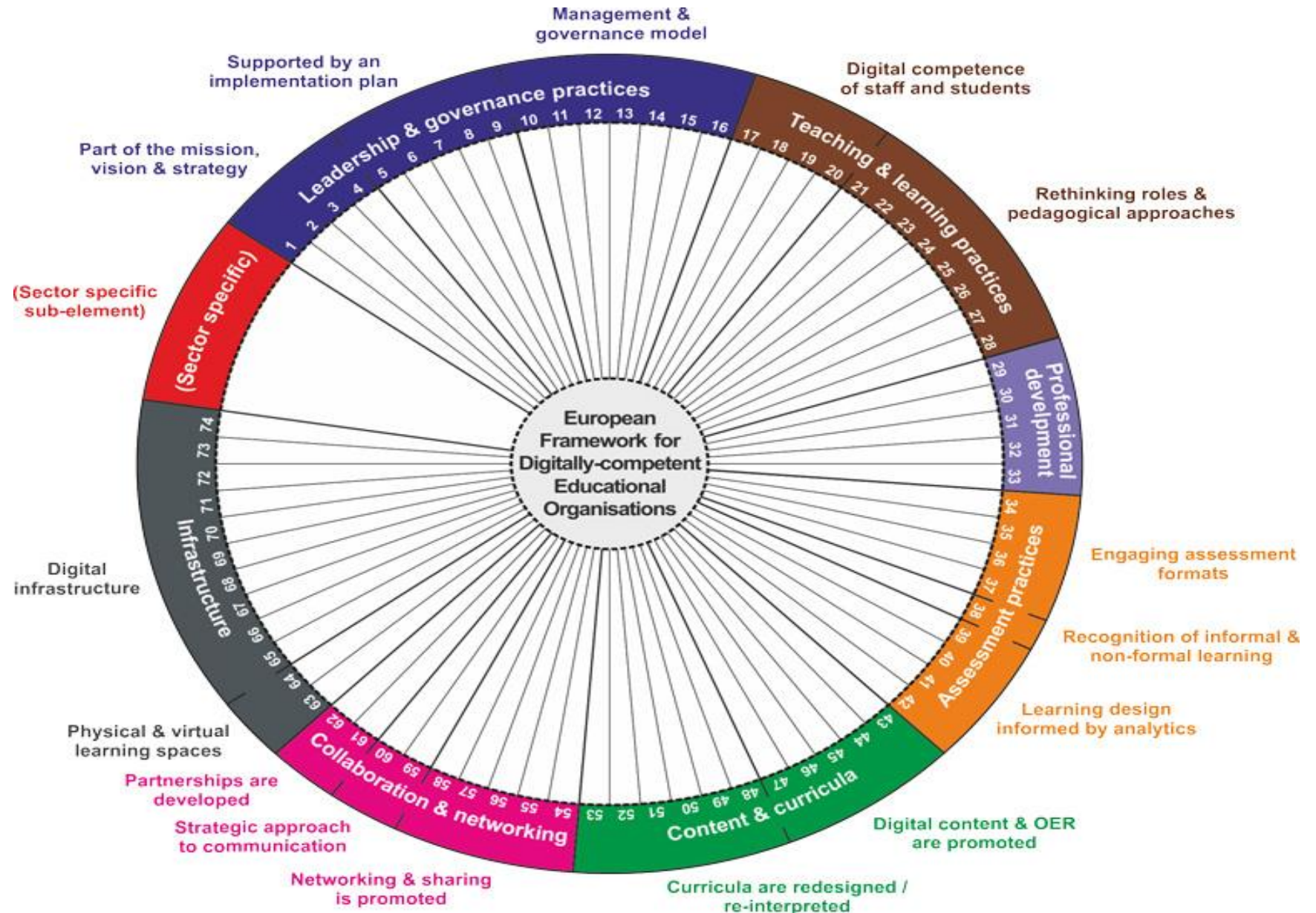
COVID-19 and the promotion of digital competences in education (suggestions)

1	The government should further promote the construction of the educational information superhighway, and test its functions, as well as assess whether it can meet the demand for online teaching in times of emergency.
2	To equip teachers with standardized home-based teaching equipment across the country, especially with standardized electronic devices to meet the needs of online teaching and individual tutoring in the home environment. Students' need for basic learning equipment should also be considered.
3	To provide systematic training for teachers. Arguably the use of online platforms for high-quality teaching is an inevitable trend in the Internet era.
4	To support and call for research into online education, at a national level, to enlighten approaches to effective online education. In addition, to encourage and support social organizations and schools to play their roles fully is also of paramount importance.
5	One of the most pressing current tasks is to conduct in-depth investigations into online education, especially concerning student support.

Suggestions from [3]

Digital instructional practices to promote pedagogical content knowledge during COVID-19

Through qualitative methods that included reflection, observation notes, and systematic discussion, four themes emerged of promising digital practices that model effective teaching and promote pedagogical content knowledge. These practices include the use of breakout groups, an interactive whiteboard, an interactive agenda, and community-building activities. The authors hope to support teacher educators globally by illustrating specific practices that facilitate student engagement and model pedagogical practices for pre-service teachers [8].

Conclusion

THE HUMANITY IS NOT READY IN TECHNOLOGICAL SIDE TO FACE COVID-19 SITUATION

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Panel 2
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Digital World 2020

Panellist Position

Cognitive overmatch by single-responsibility singularity

Martijn Zoet, Zuyd University of Applied Science, martijn.zoet@zuyd.nl

- Proactive longitudinal data collection

- Single-responsibility Machine Learning

- Singularity and Single-responsibility Machine Learning

- Selective Cognitive Overmatch

- Cooperation Human and Machine

→ The 'only' race is the race for cognitive overmatch

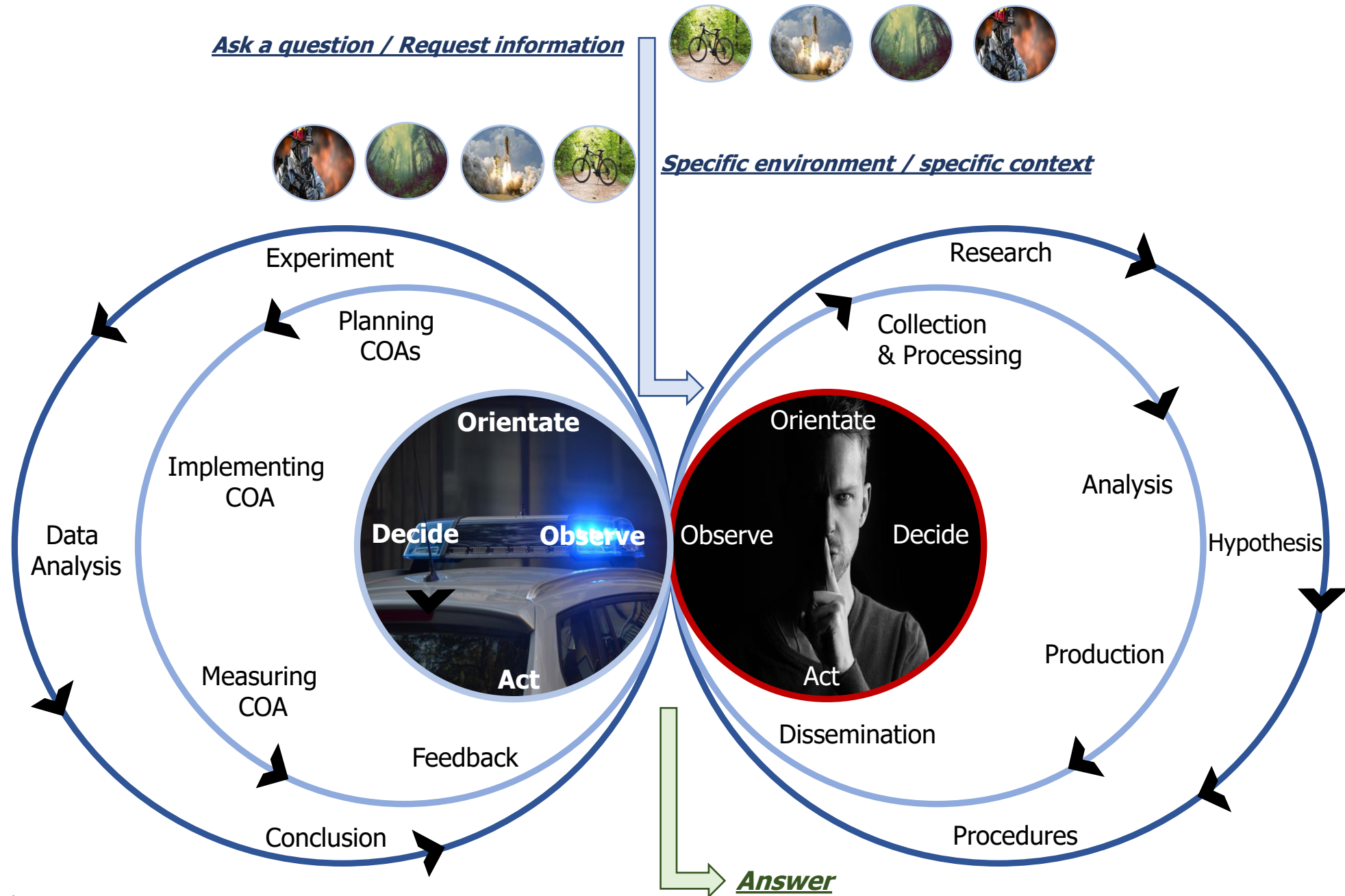→ Forget 'marathon' singularity and focus on winning the 'sprints'
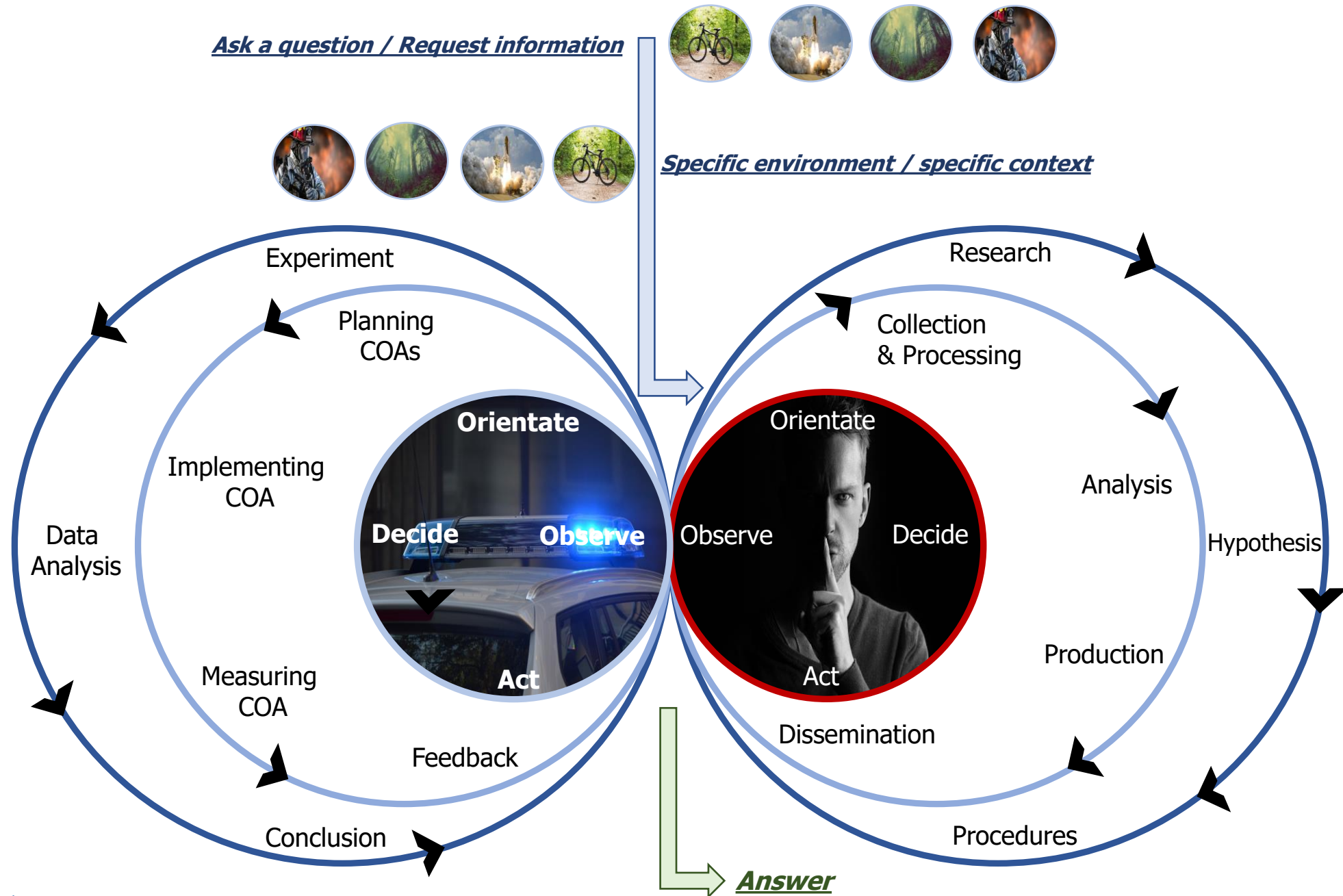
→ Neurons, Neurons and Neurons
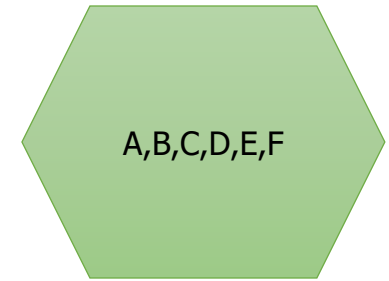
Cognitive overmatch by single-responsibility singularity

Intelligence

Ask a question / Request information
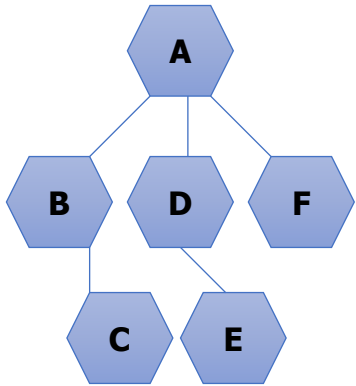
Specific environment / specific context

Left cycle (outer): Experiment · Planning COAs · Implementing COA · Measuring COA · Feedback · Conclusion · Data Analysis

Left cycle (inner): Orientate · Observe · Act · Decide

Right cycle (outer): Research · Collection & Processing · Analysis · Hypothesis · Production · Procedures · Dissemination

Right cycle (inner): Orientate · Observe · Decide · Act

Answer

EDM-Competence Centre

What does cognitive overmatch mean?

Single-responsibility Machine Learning

Selective Cognitive Overmatch

Human / Machine Cooperation