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Industry Expectations for Transforming IS Education—Discussion on AACSB MaCuDE IS Task Force Finding

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AIS / AACSB MaCuDE IS Curriculum Webinar June 9, 2021

Initial Phase II Findings and Discussion

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- Introduction and welcome; purpose of the meeting (Kalle Lyytinen)
- MaCuDE—specifying a set of challenges that business school IS programs face are forced to deal with (Kalle Lyytinen)
- Presentation of MaCuDE Phase II initial results (Heikki Topi)
- Comments on emergent themes
  - Joe Valacich (University of Arizona)
  - Olivia Sheng (University Utah)
- Discussion and participant feedback (Kalle Lyytinen and Heikki Topi, moderators)
- Key takeaways and next steps (Kalle Lyytinen)

MaCuDE Timeline

MaCuDE Phases and Timeline

Phase I : State of Educational Programs and offerings (1.1.2020-1.1.2021) (delayed due to Covid 19) - Status Report (Forthcoming CAIS in the fall)

Phase II: Industry practice and future needs (2/15/2021- 8/30/2021) - Status Report

Phase III: Recommendations and Guidelines

(9/1/2021-12/31/2021) - ***Final Report***

Advisory Committee

- Jan vom Brocke, University of Lichtenstein, Lichtenstein
- Helmut Krcmar, Technical University of Munich, Germany
- Olivia Sheng, University of Utah, USA
- Bernard Tan, National University of Singapore
- (Mary Tate, University of Wellington, New Zealand)
- Joe Valacich, University of Arizona, USA
- (Ramesh Venkataraman, Indiana University, USA)

Emerging Themes

New Environment

- Data becoming really pervasive
- Growth of data is exponential; 10 times growth experienced by many in a very brief period of time
- Data in tera- and petabytes, involves billions of observations
- Granularity can be very low (every click) to very detailed (thousands of observations per cell, in cancer research)
- Clear difference between ‘big’ data and ‘good quality data’
  - Some dimensions of good: representative, comprehensive, clean
- Increasingly important to engage in real time processing with large scalable data sets (edge computing)
- Offering such data sets and related environment within university programs can be challenging due to cost and time

New Environment

- Some key techniques and approaches have existed for a long time but have recently become more broadly applied and expected
  - E.g., many machine learning techniques have been known for a long time but broader applications have only now become feasible
- In many organizations, it makes sense to outsource the tasks that require the highest specialization of expertise—say, in AI, analytics, or security—and maintain the rest in house, integrated with strong domain expertise
- Increasing need to be able to learn a set of new technologies very quickly
  - Continuing challenge for institutions of higher education: how to combine building the foundational skills that enable long-term learning with the need to satisfy employers' desire to hire graduates that are ready to perform immediately after graduation?

New Big Data Environment

- Distinction of three different types of “big data” use contexts may call for different skills sets and development approaches:
  - Part of the core product/service
  - Way to analyze, monitor, and improve the core product/service
  - Way to analyze, monitor, and improve the business outside the core product/service

Big data and AI are inextricably linked, particularly when capabilities related to big data are built into organizational systems

Broad Categories for New Educational Demands

- Organizational transformation and changes in technological environment
- Key concepts and concerns related to big data and machine learning
- Emerging set of individual competencies required for big data development
- Competency development providers
  - Including the role of colleges and universities

Theme I: Organizational Transformation

- Process improvement and transformation with Big Data
- Process improvement and transformation with AI
- Specific organizational transformation examples (e.g., search, dynamic pricing, real-time decision-making supported, development of treatment therapies, new type of specific health care practices by AI)
- Gaining organizational insights not available and solving organizational problems not solvable without Big Data and AI (transfer or problem domain)
- Creating a learning organization based on learning systems is a key organizational challenge
- Impact of individual competencies on organizational transformation—new competencies needed and currently significant lack of such competencies in the marketplace (for specialists' salary demands currently skyrocketing)

Theme II: Key Concepts and Concerns

- Big Data
  - Volume, Velocity, Variety, and Veracity
  - Constantly changing meaning
  - The size and volume growing still fast; growth has been exponential in the last 5 years (from tera to petabytes; even real time, edge processing can use terabyte level data sets)
- AI and Machine Learning
  - AI: automating big data analytics & modeling
  - Relationship between AI and Machine Learning/Data Science
- Cloud computing as enabler of scalable Big Data and AI

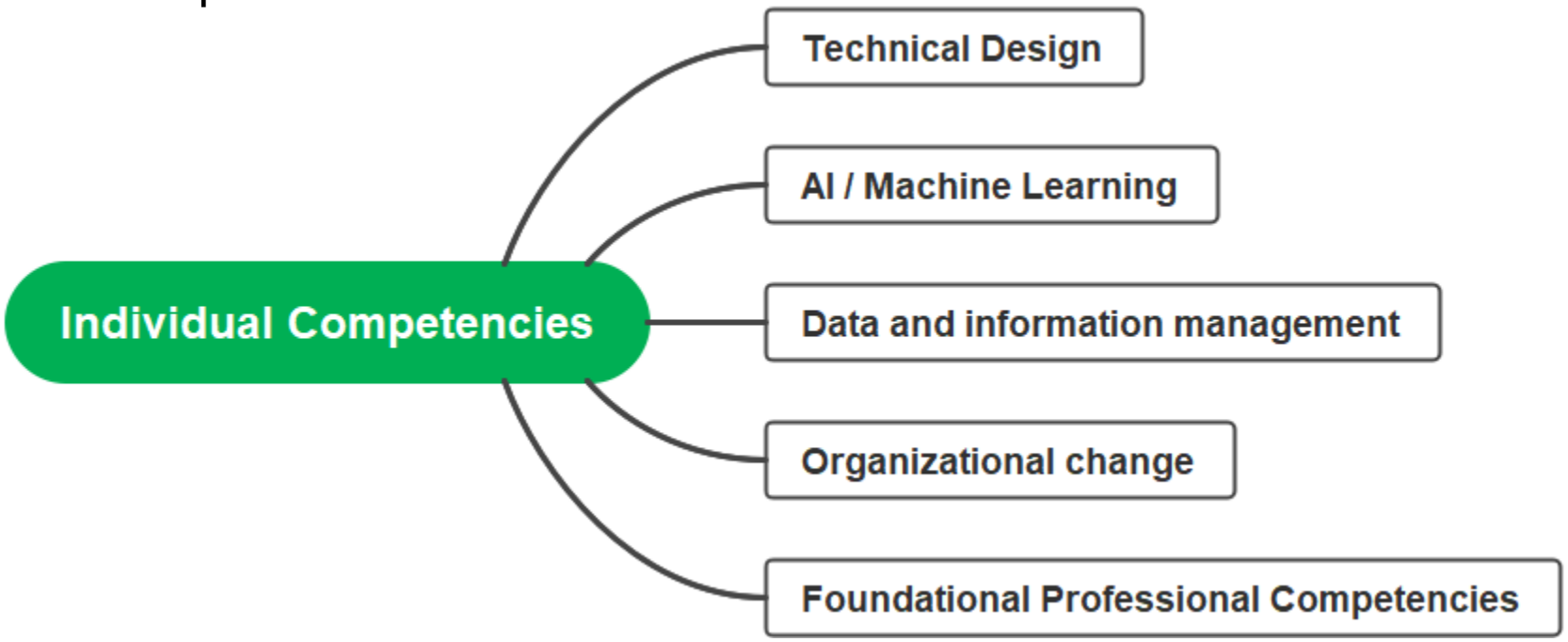
  "…we migrated to the Cloud and now we use things like Bigtable and BigQuery on Google's Cloud product and it allows us to process almost unlimited amounts of data"/ diving into the use of Cloud for AI
- Integration of AI / ML and/or Big Data with large-scale organizational systems

  "big data is mostly around like 'How do we collect the data and store it?"…"Different projects in our company show, the better you can centralize and unify your different master data, the better Big Data analytics, and artificial intelligence will work."
- Big Data and Analytics as a layer built on the foundation of organizational systems
- Data quality and data governance

  "Experience in companies: Quality of data is more of a problem"
  - Some call for 'good data;' instead of big data – understanding what makes a good data becoming critical
- Balance between internal and external resources

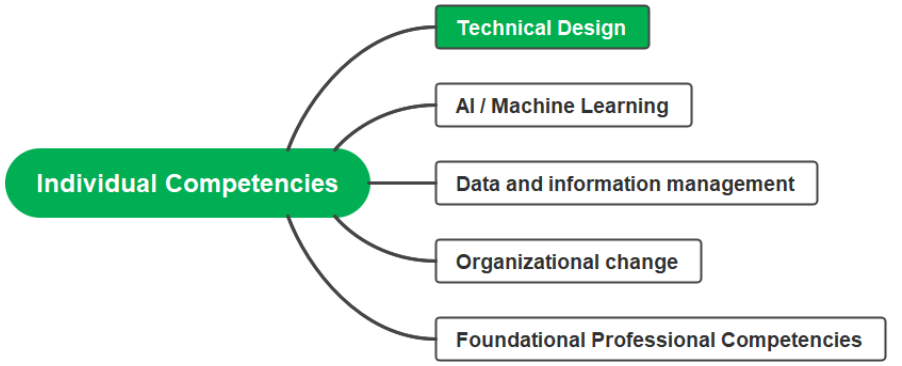
Theme III: Individual Competencies

- Technical Design implementation skills
- AI / Machine Learning
- Data and information management
- Organizational change
- Foundational Professional Competencies



Individual Competencies: Technical Design

- This area is moving **fast** and requires constant learning and attention- however many ‘fundamentals’ have remained relatively stable with new additions for requirements
- Programming
  - “I need someone who is familiar with scripting and programming to work with big data”
- Managing cloud resources
  - “Everything’s in the cloud, and so certainly having people understand the different tracks inside of there”
- Architecting for the cloud
  - “Number two is the infrastructure and the technology itself. Like today, most of the infrastructures for big data live in the Cloud, so choosing the right Cloud platform and the right tools and services in the platform is also another key.”
- Visualization
  - “So understand basic visualization, basic sort of exploration,…, a mental picture, of what this data contains and just sort of the bounds...”
- UI/UX
  - “The other skill that you guys, if you’re not already teaching … is UI/UX [, which] is a big deal. It’s a really, really big deal.”
- Search
- Model and data security
  - “That’s another. So security plays a huge role in this as you’re doing more big data analytics.”



Critical Skills

- The continuingly increasing importance of cloud platforms—ultimately, great majority of computing activities will happen on platforms
  - It is essential to understand how they work, even though (of because) they are very complex
  - Exponential growth in data drives the need for cloud resources in both processing and storage, but availability of advanced capabilities in analytics and AI is an important selection criterion
  - It is often difficult and expensive for departments to provide their students with free access to full capabilities on the current dominant cloud platforms
  - Possible opportunity for AIS: negotiating a deal with, for example, Microsoft to make Azure available to IS depts at a very low cost

Individual Competencies: AI/Machine Learning

- Technical foundations of ML

  "I need someone with sound Machine Learning, Artificial Intelligence understanding so they're correctly applying tools that are available to them. Too many people treat them as a black box and you get a black box answer."

- Various subareas of AI
  - Categorical development and classifiers, predictive analytics, autonomous learning skills

  "making predictions"/ "identify behavioral patterns and thus identify opportunities but also needs."

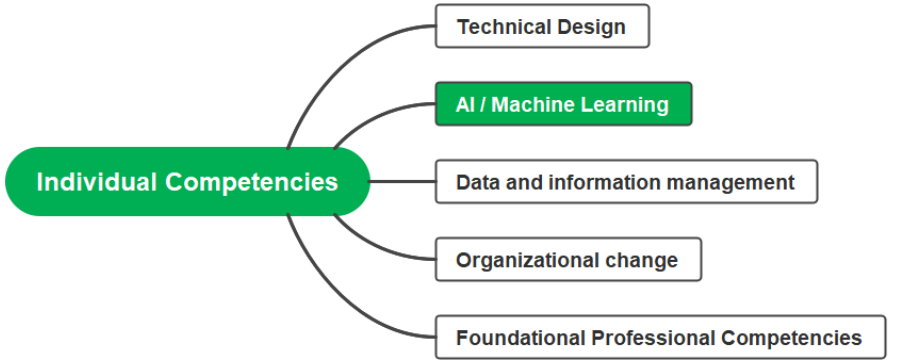
  "and over time, as things got more specialized, ... databases, the application layer, the user interface,… (for students) 'You don't have to do everything from soup to nuts. Figure out what you want to be good at, meaning do you want to be a Data Scientist? (Do you want to be) a Modeler, a Statistician, or a person that creates linking algorithms to be able to link our data more effectively?"

- Building and managing ML models

  "(You gotta) know how to code in Java, and understand statistics and Machine Learning techniques and Deep Learning techniques"/ "but in addition to understanding Python, you also need to understand the universal packages for modeling"

- ML modeling requirements

  "Now the second challenge is (students)... They are never taught how to capture data, collect data, sit back and frame data requirement for model. I haven't seen anybody capable of doing that, and that's a critical requirement in this sector, because before you get to model-building, you need to figure out data requirements and data sufficiency."

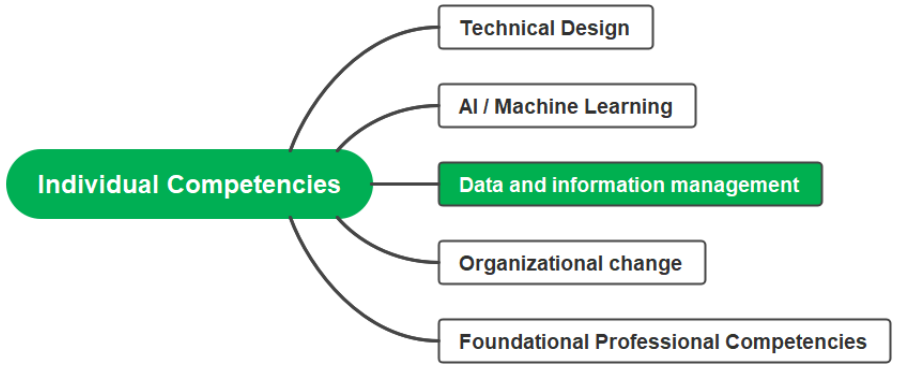


Critical Skills

- The importance of the preparatory stages of the analytics lifecycle (data acquisition, data cleansing) and the activities at a higher level than a single project, such as organization-wide data and model governance
  - These competencies are often undervalued and underappreciated
  - Importance of “raising the baseline level of data competency”

Individual Competencies: Data and Information Management

- SQL
  - “a working knowledge of relational data, its design, and some basic, fundamental SQL skills...you certainly should understand SQL and Schema Design, Relational Databases and, frankly, non-Relational in certain cases, things like that”
- OLAP
  - “We have one employee...He is a professional in using our BI tool “Targit” and in maintaining our data warehouse (OLAP). Competencies are missing in identifying value-creating areas of application of new BI and AI features.”
- Executing and managing the data science life cycle
  - “For someone who’s coming new, often what we have to tell them is ‘Don’t try to be all things in the whole Data Science life cycle,’ meaning there’s this popular definition of a Data Scientist which goes something like ‘You have to understand <09:50> processing systems.”
- ETL
  - “If you’re a Data Scientist or a Machine Learning Engineer or a Technology Support Person, you just have to understand ETL.
- Data structures and algorithms
  - “That requires, of course, some understanding of data structures and some of the stuff from my first point...”
- Data modeling
- Capabilities to model and represent data classes and their relationships
- Data architecture
  - “Understanding data architecture is another skill that most colleges don’t… need to do a better job of...”
- Data governance
  - “Data governance is becoming such this key aspect and a lot of the skills needed for that have been…”



Critical Skills

- Development tools and environments
  - Python and SQL—current core pair of languages particularly for big data/analytics type of work
  - In addition, use of various stacks and frameworks mainstream (such as MEAN, MERN, LAMP stacks and Django, Ruby on Rails, AngularJS, and Vue.js frameworks)
  - Interesting to see what role Spark will have in the future
- Training in statistics is becoming a necessity
- Visualization and other forms of data exploration
  - Tableau as the main environment (“new Excel”), BI

Individual Competencies: Organizational Change

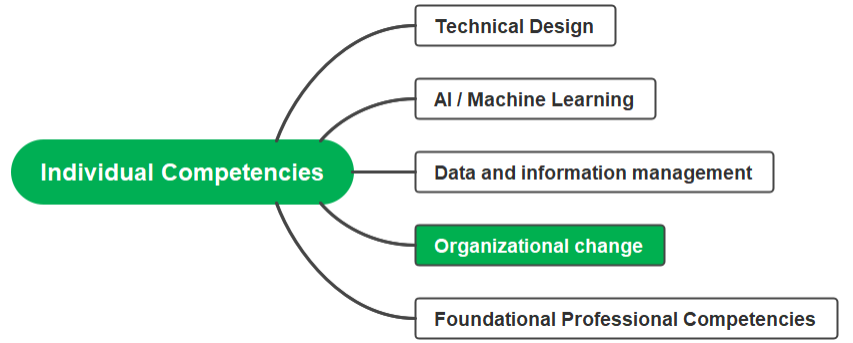
- Understanding the business domain

  "you can build and unsupervised model and to factor out the data into several clusters, but you will not deal with interpreted clusters because you don't understand (how that relates to) customer behavior, product quality or competitive context in that domain. So the first requirement is strong familiarity with the operating domain, or the business domain. So strong business knowledge is required."

- Integrating business and technology competencies to create business value

  "in the creation of these technologies and these capabilities into organizational systems as a whole is an important capability set, so that it's not just one of things, but there are capabilities that are built into system level so that then they all together and collectively work towards bringing/building business value."

- Data domains are also becoming much more diversified
  - Including logistics, health care, finance, public administration, often requiring deep domain knowledge

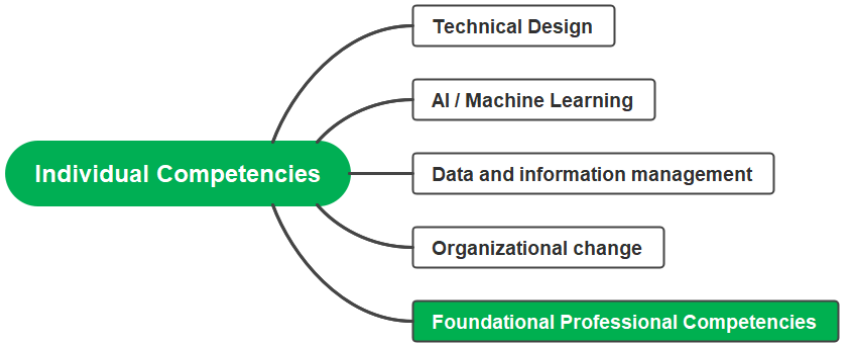


Critical Skills

- Continuing critical need for project management & requirements discovery and specification competencies
  - These are not going to go away
  - Both are taking different forms than they traditionally had
    - E.g., agility in project mgmt; rapidly emerging and changing requirements in big data projects
- Everybody has to have a general understanding of security
  - Includes also increasingly valuable learning models
  - Implementation is often in the hands of those with top-level capabilities

Individual Competencies: Foundational Professional Competencies

- Written communication skills
- Oral communication
  - “(you gotta) be able to create good presentations and talk to Executives.’”
- Teamwork
  - “typically the only way then to educate the workforce is that you would increase or improve the abstracting team skills so they can learn because they have this skills…and integrate things.”
- Negotiation
- Problem solving
  - “A competency is problem-solving, troubleshooting, really cause analysis. I think some of the continuous improvement concepts are actually what I’m gonna say here, too, competencies.
- Critical thinking
  - “Critical thinking for me is one that I often struggle with sometimes with people on my team and making sure…”
- Metalearning
  - Need to have skills to learn new domains, technical skills and
  - Solutions on the fly
- Project management
  - Scoping, execution
  - Big data projects, however, are different from software as they are more open and continuous



Theme IV: Competency Development Providers

- The landscape of competency development and related knowledge sharing more diversified and complex than in the past
  - There are multiple actors and players—universities need to find their niche in the local market
- How to identify high-quality, affordable online learning experiences and integrate them with university curricula?
- Colleges and universities as critical, initial competency development providers

  "University degrees lay the foundation for further training...Mini-degrees offered by software vendors (e.g. Google) might be the future and a challenge to universities"
- Internal training

  "Internal is mostly for domain knowledge, company specifics; commercial for products (and maybe as a gimmick for the employee);"
- Communities of practice

  "Well there's a strong need (demand for training), and what we've done is we've set up a Community of Practice for Data Science."

Competency Development Providers

- Commercial training providers: synchronous online learning
  - “Sometimes we fill in those gaps by falling back on training services from Amazon and from Google and from Facebook because they have Engineers who have these experiences, and these three big organizations I’ve spoken about have spun off ventures or enterprises that focus on providing services to other businesses.
- Commercial training providers: self-paced online learning
  - “Experience shows that self-taught skills are not worth as much as certified skills. Although this often says nothing at all about the actual skills. So doing training with commercial training providers or universities is required to obtain certification for knowledge that sometimes already exists in part.
- Organizational collaboration with universities
  - “but to the extent that we have done a little bit of that, the right answer would be to collaborate with universities to have a naturally intake program where we can influence the curriculum to some extent”
- Formal recognition of learning (certificates, degrees, etc.)
  - “more and more universities provide shorter and more specific seminars or certification training for certain topics. In my opinion, this is the right way for the future.”
  - “from IT perspective, I’ll do things like bringing in a commercial partner to do like an ITIL certification or a Dev Op certification, or like a Cloud Op type certification, things like that, and that’s gone over very well.”
- Integrating training and continuing education with practice
  - “Training is always important. But ‘the music is played in practice’.”
- Research collaboration as a mechanism for competency development
  - “a research project is more exploration. I think having that type of environment, people can learn more about the new tools, without having the commitment that ‘We have to get this done by this date,’”

Commentaries

Commentaries

- Olivia Sheng, University of Utah
- Joe Valacich, University of Arizona

Discussion

Questions

- Are there issues clearly important for industry and relevant to the topic area of interest that are missing?
- Does the analysis include observations that are clearly incorrect?
- From the perspective of IS education, which one(s) of the findings have the highest priority (short-term and long-term)
- What has truly changed compared to our collective understanding of the field of IS?
  - Suggestions:
    - Unprecedented levels of complexity and scale
    - Dealing with inherently uncertain tasks in educational processes
    - Legal, regulatory and ethical justifications for protection of privacy as a key issue
      - New core categories of non-functional requirements?

Questions

- Are there hidden changes reflected in the new meaning of key areas of learning?
  - E.g., data quality, data governance
- Is there new elements of a core that start to emerge from these initial findings?
- Is there room for a generalist program (such as the MSIS)? What are the specialist programs most likely to succeed?
- How much should we focus on data security and privacy?

Next Steps and Conclusion

Next Steps

- Phase II
  - A few additional interviews
  - Formal analysis of interview data
  - Preparation of draft report
  - Collection of advisory board and IS community feedback
  - Preparation of final Phase II report
- Phase III
  - Development of recommendations and final project report

Final Observations

- This webinar is based on initial analysis—detailed coding and analysis will strengthen the analysis and discovery of additional results
- The final recommendations developed in Phase III have potential to have a major impact on the role of IS in the context of business school accreditation processes
- Importance of making sense of the results within the context of collective IS community experience
  - Interpretation and feedback from all of you is essential
- Thank you for your contributions today—please continue to provide feedback!