

Nomination of Master of IT for Informatics Europe Best Practices in Education Award 2020

Abstract

Master of IT is an educational cooperation between three universities in Denmark, offering a lifelong learning part-time master's degree programme for IT professionals. The purpose of the degree programme is to help closing the digital talent gap, by providing 30 courses, each 15 ECTS. The Master of IT is a part-time degree programme, which allows students to do their full-time work simultaneously. Between 2006 and 2019 more than 1800 IT professionals, from IT businesses, the public sector, the industry, the financial sector, the health sector and the teaching community have attended one or more courses in the degree programme, in the fields of IT teaching, IT development, IT management, IT security and IT implementation.

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The submission for the [Informatics Europe Best Practices in Education Award](#) is on behalf of the coordination committee for [Master of IT](#). Master of IT is a lifelong education on a Master's degree level for IT professionals, offered jointly by eight departments from the three universities: Aalborg University, Aarhus University and The University of Southern Denmark. [It-vest](#), networking universities coordinates the degree programme.

Description of the degree programme and achievements

Development achievements

Master of IT is a lifelong learning part-time degree programme, for practitioners working with ICT, within the fields of IT teaching, IT development, IT management, IT security and IT implementation.

Master of IT provides knowledge on the latest theories and principles behind the development and use of IT. At the same time, it presents the students with methods and techniques that are relevant for the students' current and future work profile.

Master of IT consists of 60 ECTS credits, which is equivalent to one year of full-time study. The level of the part-time Master's degree programme corresponds to a university postgraduate programme. The programme has three different focuses or tracks, being business, interaction design, and software engineering. It consists of three modules (courses) and a Master's thesis. The student is free to put together the optimum combination of modules, however at least two of the modules and the Master's thesis must be from the same track.

SPECIALISED MODULE	SPECIALISED MODULE	OPTIONAL MODULE	MASTER'S THESIS
15 ECTS credits	15 ECTS credits	15 ECTS credits	15 ECTS credits

The Master of IT degree programme offers a buffet with more than 30 courses of 15 ECTS credits, which covers about 80 subjects of 5 ECTS credits and a 15 ECTS credits Master's thesis. Students can create their own degree programme at their own pace or just study the subjects or courses, which they find relevant for their lifelong learning.

The *Master of IT* programme has three tracks:

- [Software Construction](#)
The focus of the track is on principles, theories, methods and techniques. It covers the process of software development: specification, design, construction, analysis, and verification. The student obtains the title Master of IT, Software Construction.
- [Organisation](#)
The focus of the track is on principles, theories, methods, and techniques behind IT development and implementation in organisational and business related change processes – including IT strategy and management. The student obtains the title Master of IT, Organisation.
- [Interaction Design and Multimedia](#)
The focus of the track is on principles, theories, methods, and techniques behind the relations between users and IT systems. The track deals with the development, assessment, and implementation of interactive multimedia and products. The student obtains the title Master of IT, Interaction Design and Multimedia.

Cooperation achievements

Before Master of IT were conceived in the end of the 1990s, there were ten different Master degree programmes within IT at the three universities in [Aalborg](#), [Aarhus](#) and [Southern Denmark](#), offering lifelong learning to people working with IT. The 10 Master's degree programmes were challenged due to few applicants and students and thereby competing for the same students.

Through the It-vest cooperation, the three universities decided to cooperate in the development and implementation of a joint Master of IT degree programme. Master of IT started in 2006, with the purpose of reducing the digital talent gap in all industries.

The governance structure included a coordination committee and a steering committee, both with representatives from the three universities, to ensure quality and relevance of the Master of IT degree programme. The portfolio is dynamic and can be continuously adapted to the needs of the business community, so that the portfolio constantly appears relevant.

The courses are designed with a mixture of theory in form of theoretical lectures and presentations and practice in the form of assignments and discussions that relate theory to the real life experience of the participants. A typical course will conclude with a "research in practice" assignment, where the student constructs new software or a new solution for a technical problem etc. based on challenges from his or her own organisation. To better suit professionals in full-time jobs, most teaching is condensed into a small set of full day seminars that interleaves lectures, exercise solving, and discussions, combined with distance learning and collaboration between seminars.

Often IT professionals do not meet the admission criteria's of Master of IT. For these, a set of bridging courses are offered. This has given about 300 students the possibility of a degree programme in Master of IT.

Competence achievements

From 2006 to 2019 more than 1800 IT professionals, including approximately 17% of the teaching community, has attended one or more courses in the lifelong education of the Master of IT degree programme, in the fields of IT teaching, IT development, IT management, IT security and IT implementation.

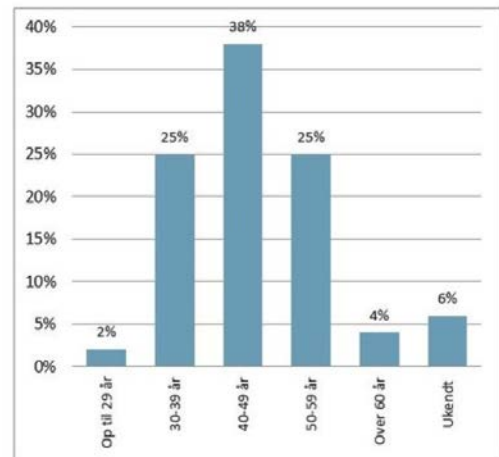
Many of the students study to improve their skills and competences within a specific academic and engineering area, rather than to get a full Master's degree. Some students have passed more than 10 courses. Although the primary product is 15 ECTS courses, more than 340 students has achieved a Master's degree.

61% of the students have a Bachelor's degree when they start studying Master of It, 39% has a Master's degree. On average, they have 16 years of work experience.

The distribution of students on the three Master of It tracks, are 49% on the Organisation track, 31% on the Software Construction track and 21% on the Interaction Design and Multimedia track.

38% of the students have an average age of 40-49, when they begin studying Master of IT (Table 1). 74% of the students are men.

Most of the students are from businesses with more than 250 employees, and from the private sector. Less than 25% of the students are from IT businesses, many students are from the public sector, the industry, the financial sector, the health sector and the teaching community.



Tabel 1. MIT age distribution

Course description

A course at Master of IT is 15 ECTS credits. The Master of IT degree program currently has [31 courses](#), these are:

Software construction	Organisation	Interaction design and Multimedia
Databases for teachers	IT strategy and organisation	Teaching Informatics
Micro services and DevOps	The IT manager	Teaching Interaction design
Datascience and Big Data	IT and business development in SMV	User oriented product design
Secure software development	Qualitative analysis of IT and organisation	Interactive physical products
Database design, development and optimisation	Online management, cooperation and learning	Digital communication technologies
Software architecture in practice	IT project management	User experience design
Network security	Management of enterprise architecture	Information architecture
Business intelligence: Analyses of large databases	Digital Innovation and Digital Transformation	Design thinking and innovative design processes
Real-time embedded software and IoT systems	The change agent – dealing with the human factor	Digital games, game based learning and game design for all
It security and cryptology	IT security in organisations	
	Digital technologies and supply chain innovation	
	Business process management and innovation	

Admission to the Master of IT degree programme

Admission requirements for the Master of IT degree programme is a relevant BA. If a student does not meet the admission requirements, bridging courses are available.

The Master of IT degree programme is developed in cooperation with other IT educational institutions that offer Bachelor's degree programmes in IT, to ensure that the students can study the relevant courses that

grant access to the Master of IT degree programme, and to ensure the possibility of lifelong education for IT professionals.

The situation for lifelong learning and IT specialists in Denmark

In January 2020, the report: "[Analysis of supply of life long higher education](#)" (Rambøll Management on behalf of the Danish Agency for Research and Education) was published. The report shows that lifelong learning in higher education often lives in the shadow of ordinary education, i.e. lifelong education does not have high priority at the universities and there is a lack of commitment from companies to send their employees on lifelong higher education. The report highlights the Master of IT degree programme as a best practice for good sustainable lifelong higher education.

As in other European countries, IT skills in the Danish labour market are in high demand. Lack of necessary competencies and skills, management's challenges in understanding and managing digitalisation and lack of willingness to change in the company, are the biggest barriers to digital ambitions in public Danish organisations ([Rambøll, It i praksis 2018-2019](#)). As another example, the report [Analysis of The labour market for information security in Denmark](#) (Højbjerg Brauer Schultz, commission by the Danish Business Authority, The Digitalisation Agency, The Centre for Cyber Security and The Ministry of Education and Research) shows that the demand for IT security will increase during the next 10 years with more than 10.000 jobs.

Evidence of availability of the outcomes of the initiative to the teaching community

Approximately 17% of the students on the Master of IT degree programme are from the teaching community.

Upper secondary schools

More than 55% of the students on Master of IT from the teaching community teach upper secondary school students level 10-12. Many of them teach topics such as Informatics/Computer Science. The Master of IT programme has contributed by providing upper secondary school teachers with competences in teaching new courses in computer science, such as Basic informatics, Databases and Interaction design. In addition, teachers who teach programming, have taken courses in software development.

University colleges

Approximately 25% of the students on Master of IT from the teaching community are teachers from, what we in Denmark call, university colleges. At these university colleges, the teaching is at Bachelor's level. The students at Master of IT from this teacher's community teach for example future educators at level K-9 and bachelor students in computer science, and they support their colleagues in using IT and teaching computer science.

Universities

Approximately 14% of the students on Master of IT from the teaching community come from universities. These students are both researchers and teachers, and some of them support their colleagues in using IT, developing IT and managing IT.

Evidence of impact

From the [Evaluation of the Master of IT programme completed in 2018](#), we highlight the following from students, teachers and businesses:

Student satisfaction

The students in general are highly satisfied with the Master of IT degree programme. 94% of the respondents recommend the Master of IT degree programme to others and more than 80% of the respondents are satisfied or very satisfied with the Master of IT degree programme. 88% are satisfied or very satisfied with the skills they have gained.

The students experience that they are taught at a high professional level, they express a high degree of satisfaction, and they point out that the Master of IT degree programme has managed to maintain and develop relevant professional courses.

The students find the Master of IT degree programme relevant to their professional work, and to a high degree, they experience that their work experience is included in the study programme. They also find that their acquired competencies meet their expectations.

Student learning outcome

Regarding the students' learning outcome, they are very satisfied compared to the curriculum expectations. The desire for new inspiration, new knowledge that can be used in current jobs, own career aspirations and a desire for academic depth are the factors that are most important to the students as motivation for starting the Master of IT degree programme.

The content of the Master of IT degree programme

The students feel that the courses meet their needs and challenges. The students do not have trouble finding relevant courses. They only sign up for courses or subjects that they, and their business, find relevant. A prerequisite for continuing to be relevant and on the academic front line is that the development of the courses is constantly taking place in an interaction between research and practice.

IT professionals have found the flexible degree programme of Master of IT very attractive. More than half of the participants enrol in the programme without having decided whether they just want one course or they want the full Master's degree programme and a Master's diploma.

The students enrol because they find the courses interesting and relevant to their career and practice. The possibility of ending with a Master's diploma is, however, important to the students, but most of them decide later whether they want to continue in the programme and earn a Master's degree.

Corporate experience

The managers from the companies experience that knowledge, ideas and principles from the education are relevant to the company.

It is not difficult for students to make companies pay for their education. The companies' competence needs are diverse.

The businesses are in high demand for IT specialists who can solve the task rather than project managers. Several point to the fact that they continue to hire computer technicians and bachelors who are in need of

continuing education. They also point out that when we are in a boom in the IT sector, as we are now with a high demand for IT specialists, it is difficult to motivate employees to take further education.

Teacher experience

Teachers experience great satisfaction in seeing that students and their businesses can actually apply what they teach. It can challenge the teachers' own understanding of the theories and techniques they teach, regarding incorporating them into the student and their company's practice. The training provides teachers with insight into challenges in practice, in applicability and the relevance of their research. The students find that they have access to theories that can be applied in practice. Teachers find that students challenge the relevance and usefulness of research, but teaching lifelong students rarely gives teachers input or new ideas for their research, but it gives the teachers great connections to the companies, which the researchers use partly to further develop their courses and partly to establish research collaborations.

Teaching methods

The teaching methods are mostly traditional teaching, which to a high degree is a desire of the students. The teaching methods are widely supported by digital learning materials and flipped learning. A few courses offer on-line teaching. 20% of the students are coming from areas a long way from the universities, which the monthly seminars support. Many of the courses use external researchers or representatives from companies, which with short presentations supplement the teaching.

6. Reference list

The Master of IT degree programme's website: <https://www.master-it-vest.dk/english.html>

It-vest - networking universities' website: <https://www.it-vest.dk/en/it-vest-networking-universities/>

Aalborg University's website: <https://www.en.aau.dk/>

Aarhus University's website: <https://international.au.dk/>

University of Southern Denmark's website: <https://www.sdu.dk/en/>

The Master of IT degree programme's websites for tracks and specialisations:

- Software Construction's website: <https://www.master-it-vest.dk/fagpakker/softwarekonstruktion.html>
- IT security's website: <https://www.master-it-vest.dk/it-sikkerhed.html>
- Organisation's website: <https://www.master-it-vest.dk/fagpakker/organisation.html>
- Interaction Design and Multimedia's website: <https://www.master-it-vest.dk/fagpakker/interaktionsdesign-og-multimedier.html>

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Appendix – Statements from students

The teaching community

Malene Cramer Engebjerg, upper secondary school teacher from [Aalborg upper secondary school](#), has been a student at the course: “Basic informatics”, says, *“Having to teach computer science I am very content with this course, as it has given me a good understanding of the broadness of the course. During the process, we have among other things been around modelling IT systems, usability evaluation, user testing, interaction design, databases, SQL, JavaScript, communication with servers, digital formation and IT security. In addition, the connection between the academic and the academic didactics is very good, and particularly the second part of the course is very useful, where we develop specific upper secondary school courses that can be used in one’s own teaching. The whole course has been very rewarding.”*

[Ib Havn](#), associated professor at the ICT-Engineering education, [VIA University College, Horsens](#), has been a student at the course: “Real-time embedded software and IoT systems” says, *“The teaching about real-time programming and distributed systems was really interesting and instructive to me. That is, questions about how to get small controllers to talk together in a real-time way. One of the main reasons why I chose this particular course is also because embedded software has my personal interest and that I regularly teach students of IT engineering in this field. The academic knowledge has certainly given me a lot compared to my own preparation of teaching. Here I use the theories and the methods to reflect on what it is that I study and teach.”*

[Sebastian Munch Larsen](#), external associated professor at [Aalborg University](#) and education manager at [HF og VUC Nord](#) says, *“As an external associated professor, I draw on both my practical experience and theoretical and methodological tools that the Organisation track at the Master of IT degree programme provides. I guide full-time students who study IT management at Aalborg University. The subjects at Master of IT have definitely strengthened and qualified my starting point as a supervisor. My Master’s degree has given me a solid knowledge of, among other things, IT management, on-line management, agility and yes, how an IT company works from A-Z. All that knowledge lies in the back of my mind. As an educational leader, the Master of IT degree programme has helped equip me, and thus my team, to better accommodate future students at the upper secondary school level. Today’s young people are already digitally formed, so it requires a completely different IT approach and knowledge of the field than it did just 10 years ago.”*

The IT industry

[Else Vindshøj](#), Product Owner at [KMD A/S](#). *“From the first day of teaching, I experienced that I was given concrete tools that I could use right away in my daily work. The subjects at Master of IT are generally of high quality, and compared to the company’s educational budget, I find that you get a lot of value for money compared to, say, a two-day course elsewhere.”*

[Michael Ustrup](#), Senior Systems Engineer at [Systematic](#) says, *“My biggest benefit must be that today I feel really good about working with secure software. Among other things, I have become much stronger in asking the right questions about IT security for a project, and I know how to find the right knowledge if I encounter problems I do not know of.” And, “I dare say that Systematic gained 120 percent from the fact that I took the Secure Software Construction course. I draw on my knowledge from the course every single day, both when working on projects that specifically relate to security components and when it comes to very common projects where security should be part of the general risk analysis for a project. ”*

[Bjørn Therkelsen](#), Cloud Solution Architect at [CGI](#) says *“Being allowed to go deeper with the theories in a professional and academic way made me a much more stable, well-argued and well-founded developer of databases, and I use that extremely much now that I am an architect. My biggest benefit has been that in my*

business we started to look at whether we could optimise the use of temporal data structures in our database and thereby get closer to a real-time data warehousing. In fact, I am right now using this in my thesis. By using some of the technologies that I learned about with the temporal aspect, we were able to keep data in our database in a different way and thereby gain a greater benefit from them - using them operationally. There are quite a few of these elements that I have read about that we are actually starting to use in my business."

[Jes Hvoldal Nielsen](#) is Focus Advisor Security and SAP Leonardo Machine Learning at [SAP Danmark](#), he has a Master's degree in Computer Science. *"The course network security has given me both a deep and broad knowledge of network security. Among other things, we have learned about legal and ethical issues, the use of Machine Learning to analyse network traffic and have been presented with various tools for traffic analysis as well as tools used by hackers. In connection with our hacker discussion, the lectures also included a so-called Hacker Space. Here, in groups, we were given the opportunity to test both defence and attack strategies in practice in a closed environment that the teacher had set up for this purpose. The Hacker Space lectures took place together with day students from Computer Science, and it ended up being a really educational session for all parties."*

[Jesper Lund Klaris](#), Scrum Master at [Bankdata](#). *"I studied the course IT strategy and organisation because strategy and governance are elements that need to be understood in order to act in the financial sector. The biggest benefit was the final project where my colleague and I immersed ourselves in our own business. We looked at how governance is linked to customer satisfaction in Bankdata. In fact, a number of changes subsequently occurred, which were well in line with our conclusions. After taking the course, I was also more able to enter a strategy dialogue, and my opinion got more weight because my views were based on something I had read and not just on a gut feeling."*

Other industries

[Martin Schmidt](#), Software Engineer at [Energinet](#). *"I chose the course software architecture in practice to get more concrete tools and a more theoretical and reflective angle on my work with software architecture - and I certainly did. We worked with the 3 + 1 model, which is based on how to visualise and present its software architecture, and we were on how to document and develop new architecture. In addition, we also worked with quality attributes, ie. what capabilities a software has. The content of the course was useful. In my work at Energinet, I use a lot of what I learned in the course."*

[James Norwood](#), Senior Play Innovation Manager at [LEGO Creative Play Lab](#). *"I continue to draw on my knowledge from the course Interactive Physical Products, because there are many parallels between the type of front-end innovation we work with in our Play Lab and what I learned from the course. Ex. some of the subject's quantitative and qualitative research methods that I use with our user tests of childrens' play. In addition, I also develop on some of the design methods I learned on the course, and particularly the research method "Research-through-design" which was part of the course curriculum. All that knowledge is super useful to me today."*

[Michael Haurum Lægsgaard](#), Consulting manager at [Shareminds](#) *"The course IT change agent consisted of a good mix of theory and practice, and it was clear that the teachers had good knowledge of what is going on outside the university walls. In short, it was a huge advantage that the academical content was directly applicable to practice. The course has given me the ability to become more reflective of both my own and others' management style, and I have certainly become a more confident IT manager myself, because I now have a theoretical foundation to draw on."*

[Sverre Lenbroch](#), Technology & Disruption Manager at [SOS International](#). *"My experience is really positive. The courses were rarely particularly theoretically solemn. Ex. the teachers were good at pulling the theoretical material down to an operational level and asking: "How do we make this work in practice?" In addition, the teaching style was very open to dialogue and filled with concrete examples from the business community, and it worked well. "*

[Margit Sander Granlien](#), IT project manager at [Ilik](#) – a management and IT consulting Agency in Nuuk, Greenland. *"The course Digital communication technologies was at a high professional level, contained a good mix of theory and practice, and then it was well structured. We worked, among other things, to test different communication technologies; it was a lot of learning by doing. I used my knowledge from the course to subsequently analyse the online tools we use on a daily basis and whether they support the workflows, we want to have in the business. In short, I have become much more aware of what to look for with various digital communication technologies and how I can assess their relevance in a concrete context. "*

[Lane Lynggaard Sørensen](#), Department director for eMarket Development Operations at [Jyske Bank](#). *"I chose the course Digital Innovation and digital transformation because we were just about to start at new digital strategy for our capital market area in Jyske Bank. In other words, we were facing a major digital transformation in our trading of shares and bonds, so the course was obvious to me as a supplement to my other education. A great part of the course was the international trip, where we went on business visits and were taught by international researchers in digital innovation and transformation – it was really an eye opener. The course certainly lived up to my current needs and expectations. Specifically, I and my team have used a number of models from the course to present our offer for a new digital strategy for the capital market area, to our management."*