

DO (JUNIOR) SOFTWARE ENGINEERS NEED INTERCULTURAL COMMUNICATION COMPETENCIES?

What intercultural communication competencies should be taught to SE students?



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M3S Research unit (Empirical Software Engineering
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Information Processing Science

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Business Information Systems

ICT and Communication

Oulu University of Applied Sciences (Oamk) 2003-

LECTURER HISTORY

mathematics, research methods, programming,
information systems, English for IS students,
intercultural communication, academic writing,
scientific thinking, ...

Tutoring both domestic and international students
teaching in English 2004 –
Master and Bachelor level education

DEGREES

- M.Sc. Mathematics, subject teacher, 2000
THESIS: On Characters and Gaussian and Jacobian Sums (2000)
- Major (Laudatur) Studies in Information Processing Science, 2000
THESIS: The Use of Biometric Features in Smart Card Identification: An Example of Verification Using the Keystroke Method (2000)
- M.Sc. English Philology, 2019
THESIS: English-medium instruction in a Finnish higher education institution: attitudes and experiences of IS students and lecturers (2019)
- Ph.D. Information Processing Science, 2021 –
TOPIC: Intercultural Communication in SE

PUBLICATIONS

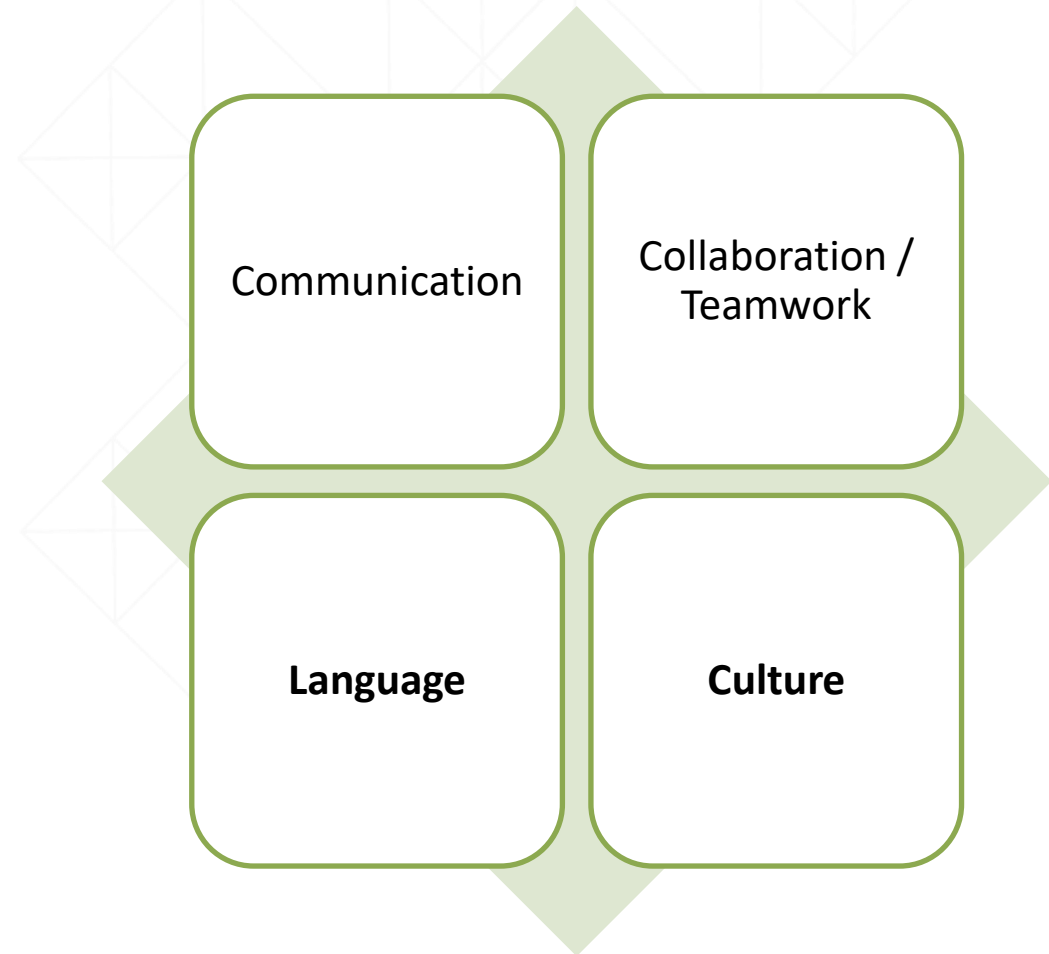
- Niva, A. & Markkula, J., 2022, Communication Skills Requirements of Junior Software Engineers : Analysis of Job Ads. in Product-Focused Software Process Improvement, D. Taibi, M. Kuhrmann, T. Mikkonen, J. Klünder, and P. Abrahamsson, Eds., Cham: Springer International Publishing, 2022, pp. 201–216. [Online]. Available: https://doi.org/10.1007/978-3-031-21388-5_14
- Niva, A., Markkula, J., Annanperä, E., 2023. Junior Software Engineers' International Communication and Collaboration Competences. IEEE Access 11, 139039–139068. <https://doi.org/10.1109/ACCESS.2023.3340409>
- Niva, A., Markkula, J., Annanperä, E., 2025. Software Engineering Competency Models and Intercultural Communication Competencies: A Systematic Literature Review. Journal of Systems and Software. 112662. <https://doi.org/10.1016/j.jss.2025.112662>

ONGOING

- Niva, A., Markkula, J., Annanperä, E., 20XX. Exploring Intercultural and English Competencies for Junior Recruitment in International Software Engineering Organizations: A Qualitative Interview Study

TOPIC: Intercultural Communication in SE

- Main Research Questions
 - What intercultural communication competencies are necessary for software engineers?
 - What intercultural communication competencies should be taught to SE students?
- Focus Areas
 - **International** SE context
 - **International** workplaces
 - where people from different nationalities and cultural and linguistic backgrounds collaborate
 - collaboration takes place within an organization's internal working environments and through external international and global operations
 - **Junior** perspective



Software Engineering (SE)

- Definition of SE:
 - The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software. (IEEE Standard Glossary of SE Terminology)
- Agile manifesto, paradigm, and principles
 - emphasizes collaboration and communication, individuals and interactions, customer collaboration
- Software Productivity
 - Shaped by social and cultural factors, communication, collaboration
- SE Guides and Frameworks
 - SWEBOK, Software Engineering Body of Knowledge v4.0 (2024)
 - CC2020, Computing Curricula 2020 (2020)
 - SE2014, Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering (2014)
 - SWECOM, the Software Engineering Competency Model (2014)
 - e-CF, the European e-Competence Framework for ICT professionals
 - ESCO, European Skills, Competences, Qualifications, and Occupations

Software Engineering Body of Knowledge (SWEBOK V4.0)

SWEBOK Knowledge Areas

Software Requirements
Software Architecture
Software Design
Software Construction
Software Testing
Software Engineering Operations
Software Maintenance
Software Configuration Management
Software Engineering Management
Software Engineering Process
Software Engineering Models and Methods
Software Quality
Software Security
Software Engineering Professional Practice
- Professionalism, Group Dynamics and Psychology, Communication Skills
Software Engineering Economics
Computing Foundations
Mathematical Foundations
Engineering Foundations

Related Disciplines

Business Analysis
Computer Engineering
Computer Science
Cybersecurity
Data Science
General Management
Information Systems and Technology
Mathematics
Project Management
Quality Management
Systems Engineering

- **communication** and **teamwork** skills are vital because software engineers **communicate** with various stakeholders, customers, coworkers, and suppliers
- work is often conducted in **teams**, multidisciplinary environments, and varied application domains
- retaining open and productive **communication** with all parties is vital.
- software engineers need to receive **communication** from stakeholders at all stages, consult stakeholders, make decisions, generate plans, and **communicate** clearly, directly to each other or in documents and written products
- well-functioning **teams** share responsibilities, rewards, and workload as, at best, **team members** complement each other and build on each other's knowledge and creativity
- software engineers need to **communicate** well, both **orally** and in **reading** and **writing** as their work seeks abilities to investigate, comprehend, and summarize information, provide training and documentation, read for skill improvement and information gathering necessary for the project goals, write to correspond to customer requests or produce documents required by the process, give presentations, and enter face-to-face interaction
- **multicultural** environment and geographically separated teams, possibly in different time zones
- projects, divided into pieces across national and **cultural borders**, and **teams**, consisting of people from **diverse cultural backgrounds**, demand tolerance and acknowledgement of societal norms
- international outsourcing and global shipment of software components.
- more frequent **communication** is seen to mitigate geographical and **cultural** divisions, promote cohesiveness, and raise productivity
- software products and services should be delivered efficiently, effectively, and to the benefit of stakeholders
- requires SE management activities such as planning, coordinating, monitoring, controlling, and reporting
- working requires functioning project, personnel, communication, and stakeholder management
- "career success is affected by the ability to consistently provide oral and written communication effectively and on time."

Job ad study

FINDINGS

Method

- **166 online job ads applicable to junior software engineers**
 - TE Offices' Vacancies job seeking service [**mol.fi**] maintained by Public Employment and Business Service in Finland during **27.1.-11.3.2022**
- Inclusion criteria
 - Software engineer or related title in Finnish or in English
 - back-end / front-end / full stack / software / web developer / designer
 - permanent job (trainee, summer job, job overseas positions excluded)
 - junior software engineers, i.e., jobseekers with less than three years of work experience
- **Content and thematic analysis, skill count – skill identification method**
 - NVivo, MS Excel, and IBM SPSS Statistics.
 - Objectives: 1) find competency requirements, and 2) describe working environment*
- Literature review
- Synthesis

* job ads contain descriptions of the working environment without being interpreted as competence requirements

Findings

- 60 % of the job ads were written in Finnish and 40 % in English (n=166)
- 36 % of the ads written in Finnish have an English job title (n=99)

FIGURE. Competency Requirements in job Ads

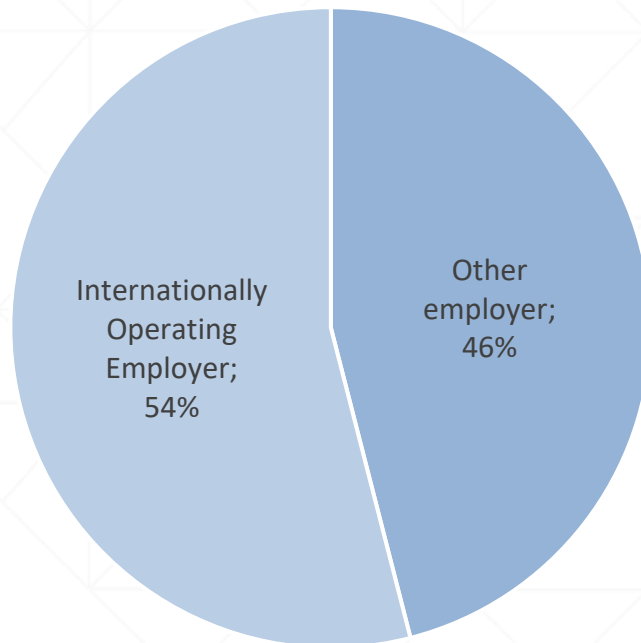
Competency Area	Job Ads (n=166) %
English	59
Finnish	42
Other languages*	4
Communication	24 / 41**
Intercultural	2
Collaboration / teamwork	42 / 60**

* n=4 Swedish, n=2 German, and n=1 multilingualism

** 'pure' requirements / all related requirements

Results – Internationality Aspects

FIGURE. Operational Environment of the Employer based on Job Ads (n=166)



- 54 % of the job ads convey international aspects
- Internationality appears in ...
 - operational descriptions
 - International or global actor such as 'truly international company,' several locations, different nationalities
 - products and services
 - Sold globally, foreign customers, deliver systems all around the world
 - opportunities for working in an international or global company or with international actors
 - Global and international teams, international partners, networks, travelling, working abroad
 - internationalization skills
 - Contribute to the company's growth
 - instructions given to foreign jobseekers
 - Residence permit, relocation, citizenship

Results - Comparison 2 by Employer Type

TABLE. (All related) Competency Requirements in job Ads

Competency	All Employers % (n=166)	Internationally Operating Employer % (n=90)	Other Employer % (n=76)
English	59	73	42
Finnish	42	37	47
Other languages	4	7	1
Intercultural	2	4	-
Communication	41	46	36
Collaboration	60	63	55

Communication 24 %
Social / Interaction 13 %
Written 11 %
Oral 2 %

Collaboration / Teamwork 42 %
Independent 22 %
Self-driven, Proactive 22 %
Agile 17 %

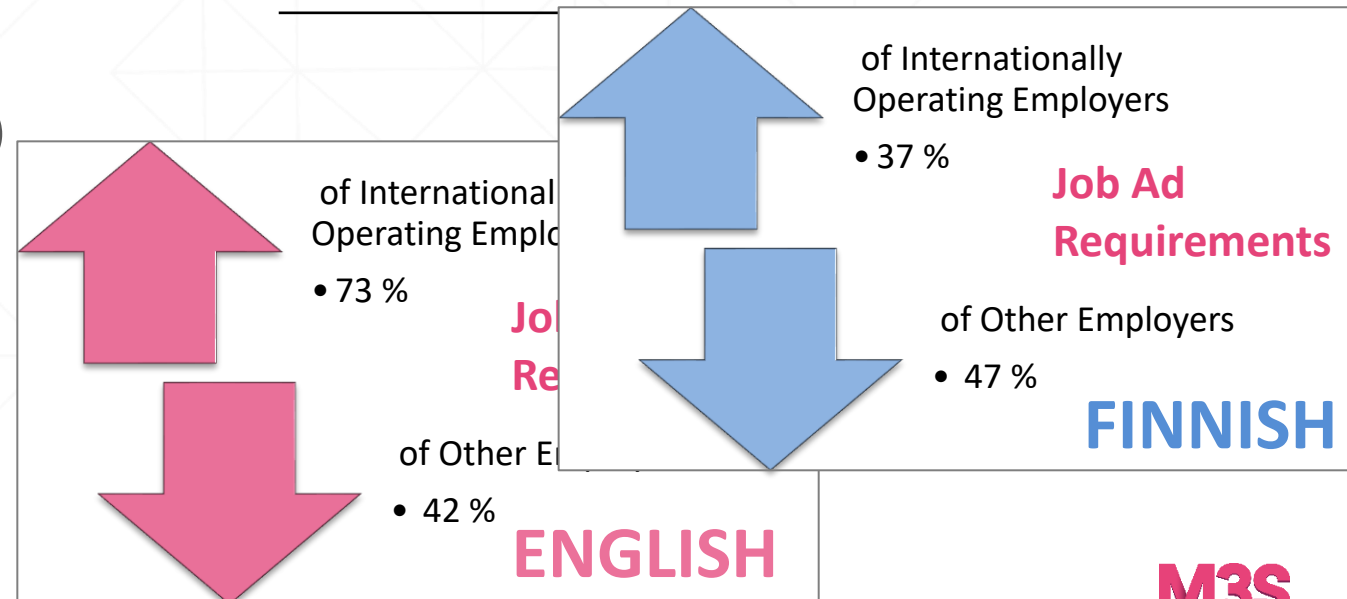
Working environment descriptions:
Collaboration with customers, stakeholders, and team members 82 %
Mutual Support 56 %

Results – Language Skills

- 69 % of the job ads required at least one language
- Internationally Operating Employers
 - 82 % required at least one language
 - presented demands mostly for only English (43 %) or both English and Finnish (26 %).
- Other Employers
 - 53 % required at least one language
 - Presented no demands for languages (47 %) or both English and Finnish (36 %)
- 23 % of the ads demanding Finnish skills described that Finnish skills are seen as a nice bonus or advantage, not mandatory for the job

TABLE. Language Requirements in job Ads (n=166)

Skill	%
Both English and Finnish	30
Only English	26
Only Finnish	8
English, Finnish, and other	3
Only other language or multilingualism	1
No language requirements	31
Total	100

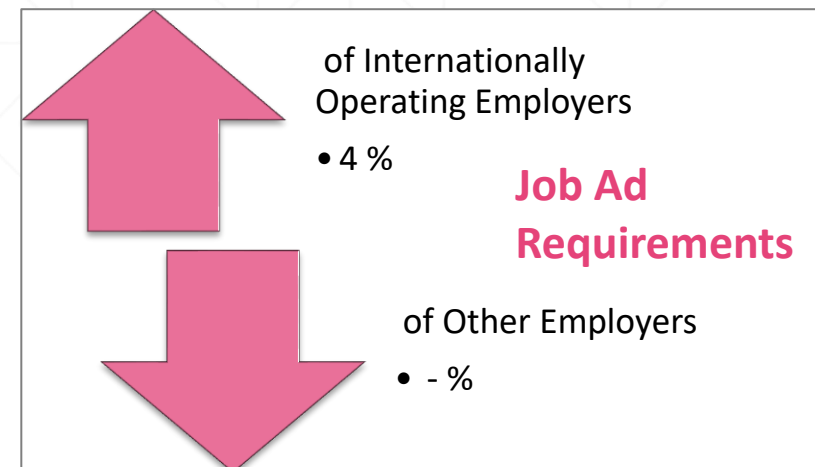


Results – Intercultural Competence

- Requirements
 - “ability to work in Finnish and international networks”
 - “well-suited for an international work environment”
 - “we expect you to be a professional with good team spirit and who is comfortable in communicating with different people with different backgrounds and cultures.”
 - No one required knowledge of different cultures.
- working environment descriptions
 - organization descriptions, value descriptions (diversity, equality, discrimination, inclusion etc.), and references to working culture
 - Finnish working culture
 - diverse communities and customers

TABLE. Requirements in job Ads (n=166)

Competence	All Employers %	Additional Information
Intercultural	2	



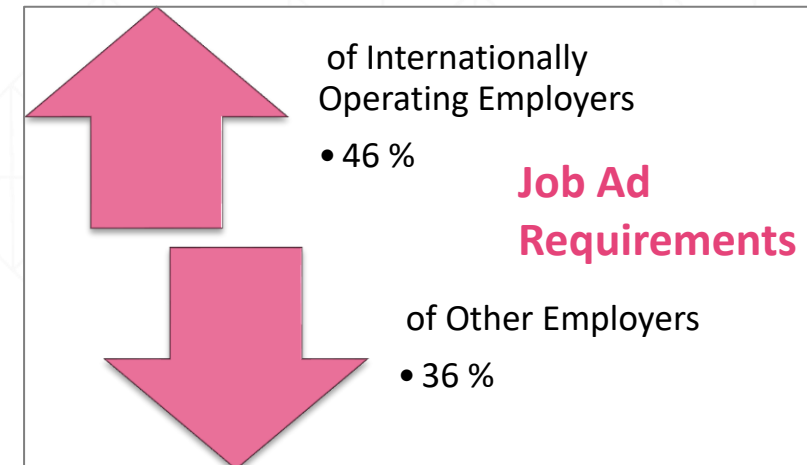
Moreover, most of the other cultural issues were presented by internationally operating employers

Results – Communication Competence

- Requirements
 - ‘pure’ communication skills
 - often combined with other, especially with language and collaboration,
 - social and interaction skills, socialness, outgoingness, outspokenness
 - written and oral, documentation, reporting, communicate with customers and other partners, bring up own viewpoints, receive feedback from experts, give guidance in system deployment, courage to ask for help, brainstorming, confidence in communication; communication with project management, end users, and non-technical people.
- Communicative situations in working environment descriptions
 - fundamental communication skills: informing and explaining, questioning, listening, negotiation, decision-making, instructing
 - discuss professionally and interactively within a team and with other stakeholders
 - express their opinions, ask, question
 - problems are handled openly in the workplace
 - Workplace values open and direct talk
 - Feedback, listening skills
 - influence their own work, work tasks, company culture, work practices, and developed products and services
 - participate actively in decision-making
 - innovate, brainstorm, create ideas and stories
 - end user guidance, training, customer service, and requirements engineering
 - office, remote, and hybrid ways of working
 - face-to-face and online communication and collaboration

TABLE. Requirements in job Ads (n=166)

Competence	All Employers %	Additional Information
Communication	41	Communication skills 24 % Social and Interaction Skills 13 % Written Skills 11 % Oral communication skills 2 %



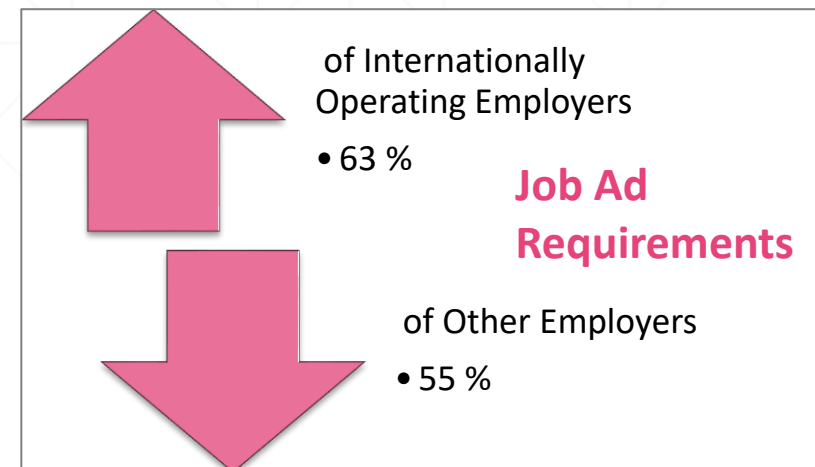
Moreover, the job ads written by internationally operating employers described more communication and collaboration situations than other employers

Results – Collaboration (teamwork) Competence

TABLE. Requirements in job Ads (n=166)

Competence	All Employers %	Additional Information
Collaboration	60	Collaboration or teamwork skills 42 % Independent skills 22 % Self-driven, pro-active attitude 22 % Knowledge of Agile 17 %
WORKING ENVIRONMENT DESCRIPTIONS: collaboration with customers, stakeholders, and team members 82 % mutual support 56 %		

- Requirements
 - excellent, dedicated, accurate, flexible, fearless, good, or collaborative team players, who have excellent, strong, or great collaboration skills, who enjoy teamwork, are easy to collaborate with, a true team player mindset, ability to collaborate and work in teams and groups
 - often joined with the ability to work independently or act on their own initiative
 - willingness, enjoyment, and motivation for collaboration and independent work
 - experience or familiarity with agile development, methods, or projects, such as Scrum
- working environment descriptions
 - work involves collaboration with customers, stakeholders, and team members
 - within a team; with a product owner, Scrum master, team lead, other developers, and other technical experts
 - together with
 - various engineers, analysts, designers, testers, leads, and architects whose expertise covers various technical aspects such as system, application, DevOps, hardware, UI, UX, security, network, or graphics
 - product management, product and service managers, quality assurance, company founders, and other experts
 - business operations, R&D, production, sales, marketing, and content creators
 - with customers and end-users, other industrial leaders, manufacturers, technology and business partners, subcontractors, suppliers, and authorities
 - customer collaboration, customer-oriented approach, and customer service skills
 - mutual support given by colleagues, leaders, and the entire work community
 - offer help and guidance to each other
 - workplace supports the newcomer, to develop skills relevant to the role occupied in the team but also to get into work by means of work orientation, boarding, a nominated mentor, learning from skilled colleagues
 - work distribution, backup behavior, the adjustment of the work tasks, adaptability.
 - kind and caring colleagues and work community, team and company spirit, cohesion, a sense of togetherness



Moreover, the job ads written by internationally operating employers described more communication and collaboration situations than other employers

Final Conclusions

- A junior software engineer should demonstrate a tolerant and adaptable attitude, cooperativeness, independence, openness, courage to influence, oral and written social interaction skills, fluent professional English and local language communication skills as well as field-specific and general collaboration methods.

[No intercultural competencies]

- A junior software engineer [is expected to have] extensive competence in collaboration, high competence in English, and considerable competence in a local language and communication
 - intercultural competences and foreign languages other than English are hardly required

THANK YOU!



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