iTeach Workshop

iTεach

Lifelong Learning Programme

Programme

8:30 Project outline (Prof Glassey, Newcastle Uni)

8:40 Chemical engineering education today – Are we teaching the right things? (Prof Glassey, Newcastle Uni)

9:15 Open forum discussion

9:45 Can we measure effectiveness of teaching? (Prof Schaer, Uni Lorraine)

10:15 Open forum discussion

10:30 Coffee

11:00 Application of framework to reaction engineering courses (Prof Madeira, FEUP)

11:30 Open forum discussion

iTeach Project outline

Prof Jarka Glassey
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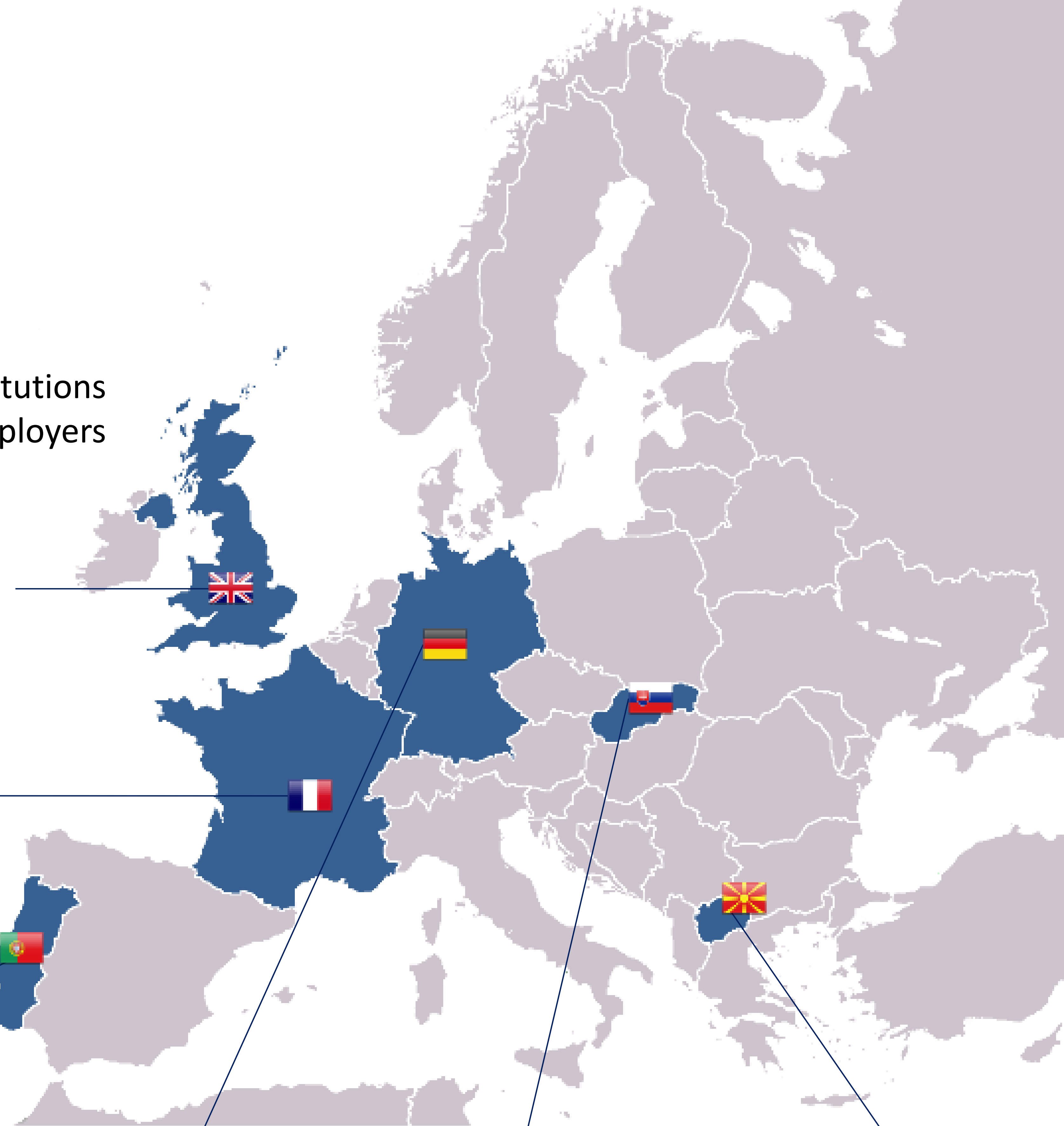
Newcastle University

Consortium partners

+ 16 Higher Education Institutions, Professional Institutions and Employers



Newcastle University

Jarka Glassey
(project coordinator)

UNIVERSITÉ DE LORRAINE

Eric Schaer

U.PORTO

Luis Miguel Madeira

technische universität dortmund

Norbert Kockmann

STU
SLOVENSKÁ TECHNICKÁ UNIVERZITA V BRATISLAVE

Milan Polakovic

INTERNATIONAL BALKAN UNIVERSITY

Aleksandra Porjazoska

#	Name of organisation	Type of institution	Country
1	Czech Society of Chemical Engineering	Professional membership association	Czech Republic
2	Institution of Chemical Engineers (IChemE)	Global Professional membership organisation	United Kingdom
3	Portuguese Engineers's Association	Professional membership association	Portugal
4	Slovak Society of Chemical Engineering	Professional membership association	Slovakia
5	Société Française de Génie des Procédés	Professional membership association	France
6	DECHEMA; ProcessNet	Professional membership association Association of chem.eng. industry and profession	Deutschland
7	Industrial Advisory Board, CEAM/Chemistry	Independent Industrial advisory board	United Kingdom
8	ThyssenKrupp Uhde, GmbH	Private – chemical engineering company	Deutschland
9	Portuguese Society for Engineering Education	Higher Education Association	Portugal
10	Budapest University of Technology and Economics	Higher Education Institution	Hungary
11	Danish Technical University, Lyngby	Higher Education Institution	Denmark
12	Martin-Luther-University Halle-Wittenberg	Higher Education Institution	Deutschland
13	Technical University Eindhoven	Higher Education Institution	Netherlands
14	University of Belgrade	Higher Education Institution	Serbia
15	University of Chemical Technology and Metallurgy	Higher Education Institution	Bulgaria
16	University of Istanbul, Faculty of Engineering	Higher Education Institution	Turkey

Project motivation

- How do we ensure continuing relevance of CE degrees with changing industrial landscape and societal challenges?
- How do we ensur for the increasing student numbers?
- Lab provision, tut visi
- Not just doing the s tir

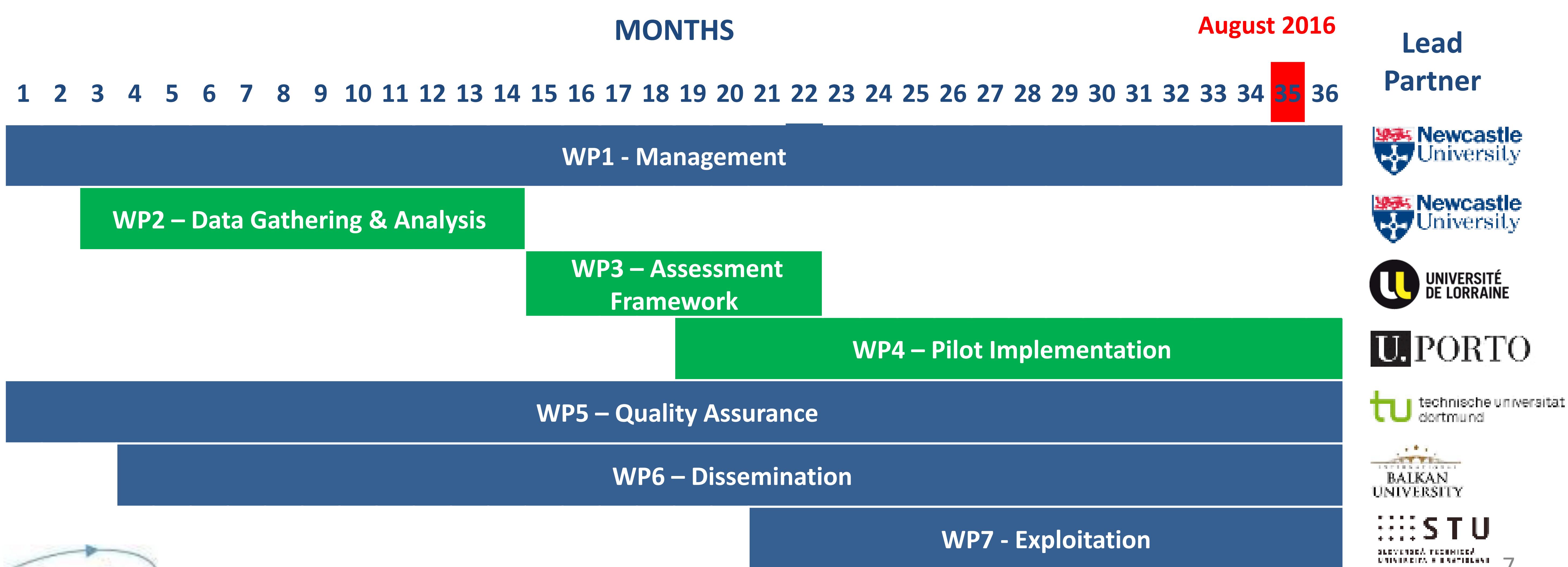
ctations, educ

Project Aim

Develop a framework to **assess the teaching effectiveness** in delivering core **chemical engineering knowledge** and **employability competencies**.

www.iteach-chemeng.eu

Workplan (Oct. 2013 – Sept. 2016)



Objectives

1. Review the learning outcomes of a chemical engineering education formation in consultation with industrial and academic partners (WP2);

2. Promote closer involvement of employer organizations in chemical engineering curriculum formation - focus groups, questionnaires to identify the skill gaps and requirements (WP2);

3. Establish state-of-the art in assessing the effectiveness of teaching (core) Chem. Eng. knowledge and on the development of professional skills and competencies required to increase the employability of the graduates (WP2);

Objectives

4. Define various indicators of the effectiveness of teaching in chemical engineering higher education (WP3);

5. Investigate in more depth methods of effectively acquiring employability competencies, using psychometric approaches amongst others (WP3);

6. Use decision making technology and multi-objective optimisation to identify the most appropriate evaluation methods and develop a robust framework (WP3);

7. Test the framework at partner institutions focusing on various pedagogic methodologies in each geographical area to enable the investigation of dependencies between educational systems and the effectiveness of pedagogic methodologies (WP4);

Chemical engineering education today – Are we teaching the right things?

Work Package 2
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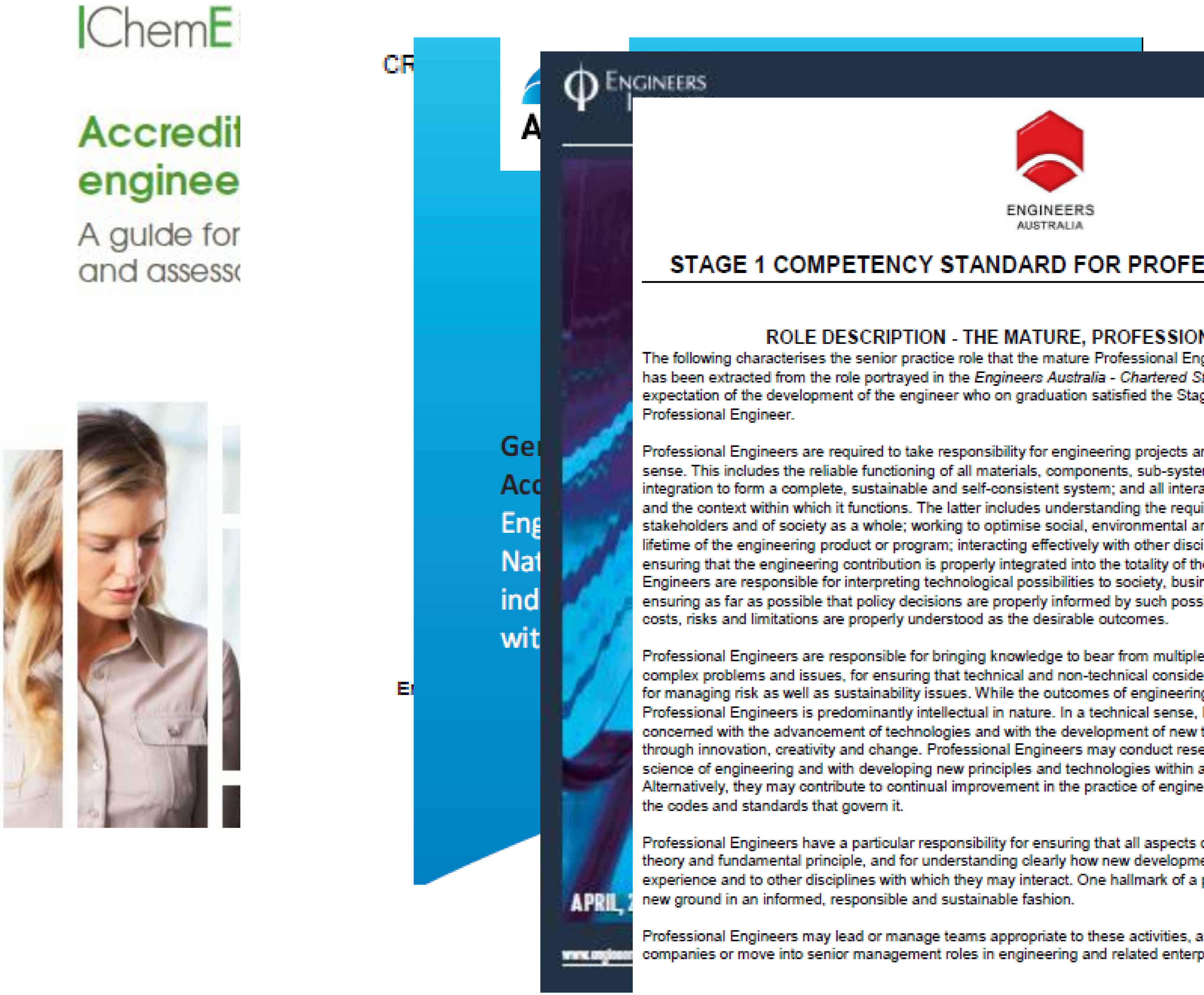
WP2 Process overview – Establishing baseline in effectiveness

- Review of various (inter)national CE accreditation requirements
- List of learning outcomes (LO) collated
- Survey sent to academics, industrialists and graduates on the importance of knowledge, skill and competency areas (> 260 valid responses)
- Statistical analysis of the quantitative data responses to identify any trends and their significance
- Analysis of qualitative responses through Nvivo theme identification and correlation to the trends in the quantitative data
- National focus groups with all stakeholders to explore emerging themes

Review of accreditation requirements



STAGE 1 COMPETENCY STANDARD FOR PROFESSIONAL ENGINEER

ROLE DESCRIPTION - THE MATURE, PROFESSIONAL ENGINEER

The following characterises the senior practice role that the mature Professional Engineer may be expected to fulfil and has been extracted from the role portrayed in the *Engineers Australia - Chartered Status Handbook*. This is the expectation of the development of the engineer who on graduation satisfied the Stage 1 Competency Standard for Professional Engineer.

Professional Engineers are required to take responsibility for engineering projects and programs in the most far-reaching sense. This includes the reliable functioning of all materials, components, sub-systems and technologies used; their integration to form a complete, sustainable and self-consistent system; and all interactions between the technical system and the context within which it functions. The latter includes understanding the requirements of clients, wide ranging stakeholders and of society as a whole; working to optimise social, environmental and economic outcomes over the full lifetime of the engineering product or program; interacting effectively with other disciplines, professions and people; and ensuring that the engineering contribution is properly integrated into the totality of the undertaking. Professional Engineers are responsible for interpreting technological possibilities to society, business and government; and for ensuring as far as possible that policy decisions are properly informed by such possibilities and consequences, and that costs, risks and limitations are properly understood as the desirable outcomes.

Professional Engineers are responsible for bringing knowledge to bear from multiple sources to develop solutions to complex problems and issues, for ensuring that technical and non-technical considerations are properly integrated, and for managing risk as well as sustainability issues. While the outcomes of engineering have physical forms, the work of Professional Engineers is predominantly intellectual in nature. In a technical sense, Professional Engineers are primarily concerned with the advancement of technologies and with the development of new technologies and their applications through innovation, creativity and change. Professional Engineers may conduct research concerned with advancing the science of engineering and with developing new principles and technologies within a broad engineering discipline. Alternatively, they may contribute to continual improvement in the practice of engineering, and in devising and updating the codes and standards that govern it.

Professional Engineers have a particular responsibility for ensuring that all aspects of a project are soundly based in theory and fundamental principle, and for understanding clearly how new developments relate to established practice and experience and to other disciplines with which they may interact. One hallmark of a professional is the capacity to break new ground in an informed, responsible and sustainable fashion.

Professional Engineers may lead or manage teams appropriate to these activities, and may establish their own companies or move into senior management roles in engineering and related enterprises.

Example learning outcomes

2 Core Chemical Engineering

2.1 Fundamentals

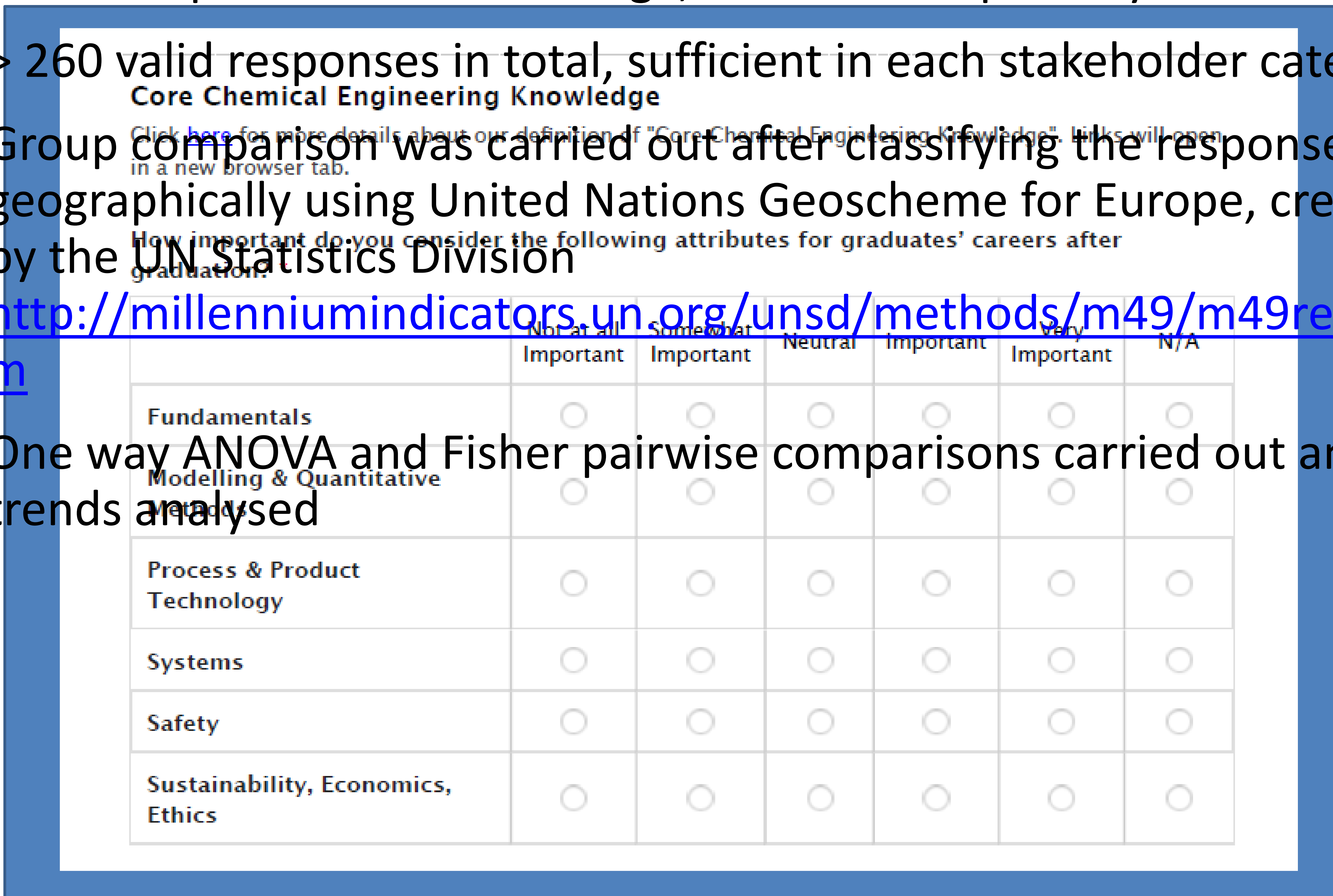
- Understand the principles of mass and energy balances.
- Understand the thermodynamic and transport properties of fluids, solids and multiphase systems.
- Understand the principles of momentum, heat and mass transfer, and be able to apply them to problems involving flowing fluids and multiple phases.
- Be able to apply thermodynamic analysis to processes with heat and work transfer.
- Understand the principles of equilibrium and chemical thermodynamics, and be able to apply them to phase behaviour, and to systems with chemical reaction.
- Understand the principles of chemical reaction engineering

2.2 Mathematical Modelling and Quantitative Methods

2.3 Process and Product Technology

Questionnaires

- Survey sent electronically to academics, industrialists and graduates on the importance of knowledge, skill and competency areas
- > 260 valid responses in total, sufficient in each stakeholder category
- Group comparison was carried out after classifying the responses geographically using United Nations Geoscheme for Europe, created by the UN Statistics Division http://millenniumindicators.un.org/unsd/methods/m49/m49regin.htm
- One way ANOVA and Fisher pairwise comparisons carried out and trends analysed



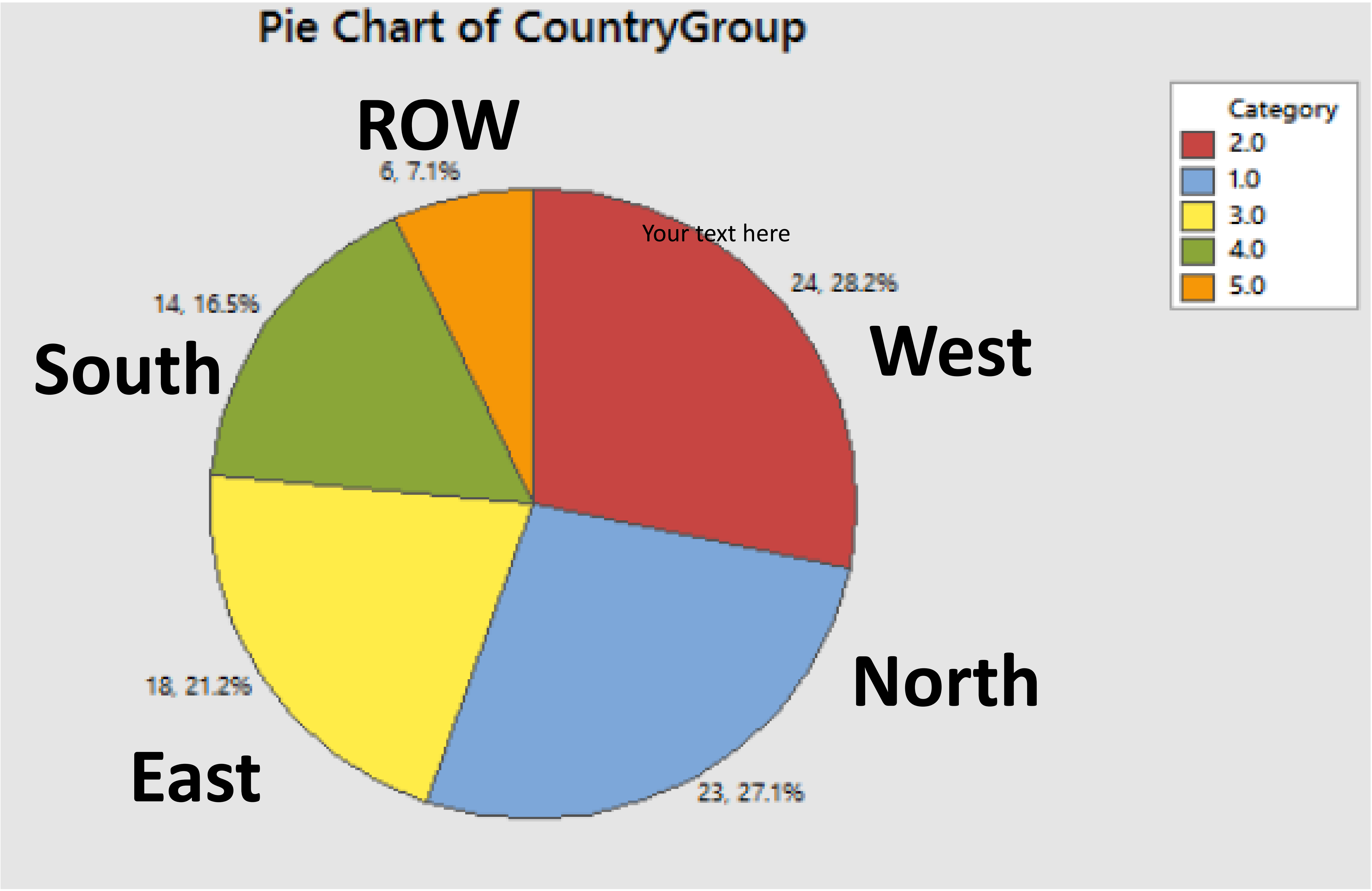
Core Chemical Engineering Knowledge

Click here for more details about our definition of "Core Chemical Engineering Knowledge". Links will open in a new browser tab.

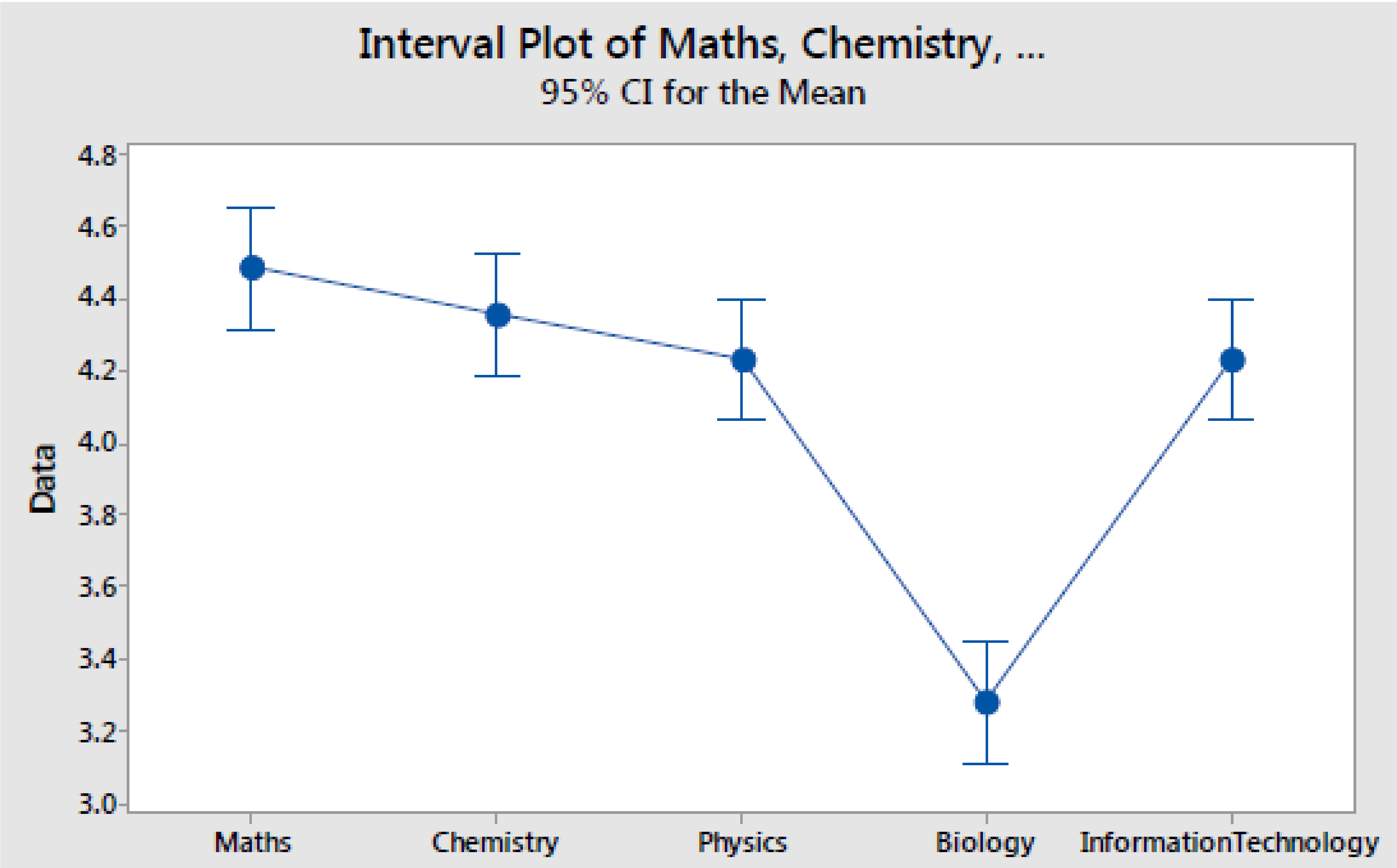
How important do you consider the following attributes for graduates' careers after graduation?

	Not at all Important	Somewhat Important	Neutral	Important	Very Important	N/A
Fundamentals	○	○	○	○	○	○
Modelling & Quantitative Methods	○	○	○	○	○	○
Process & Product Technology	○	○	○	○	○	○
Systems	○	○	○	○	○	○
Safety	○	○	○	○	○	○
Sustainability, Economics, Ethics	○	○	○	○	○	○

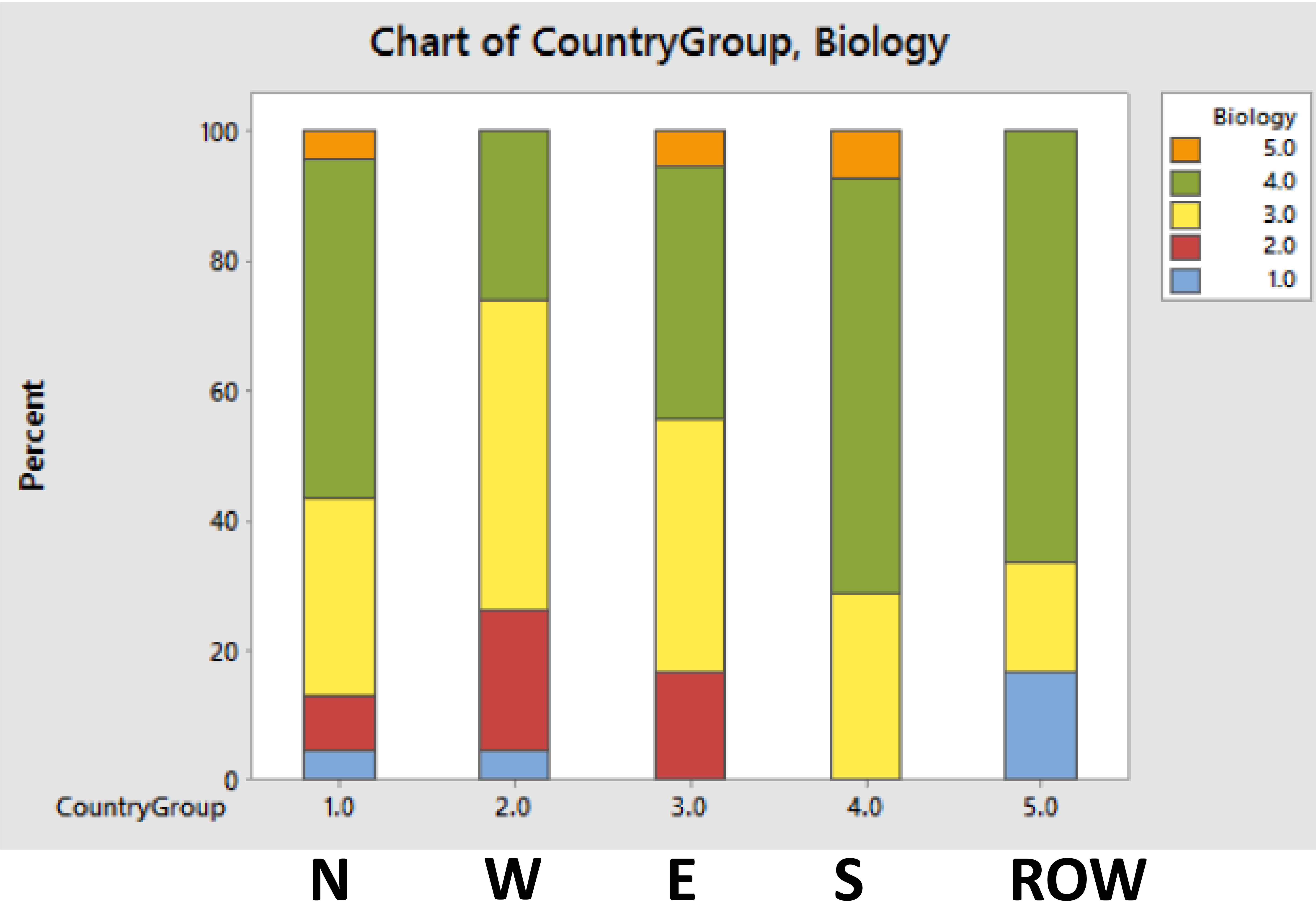
Some highlights – academics, importance of LO



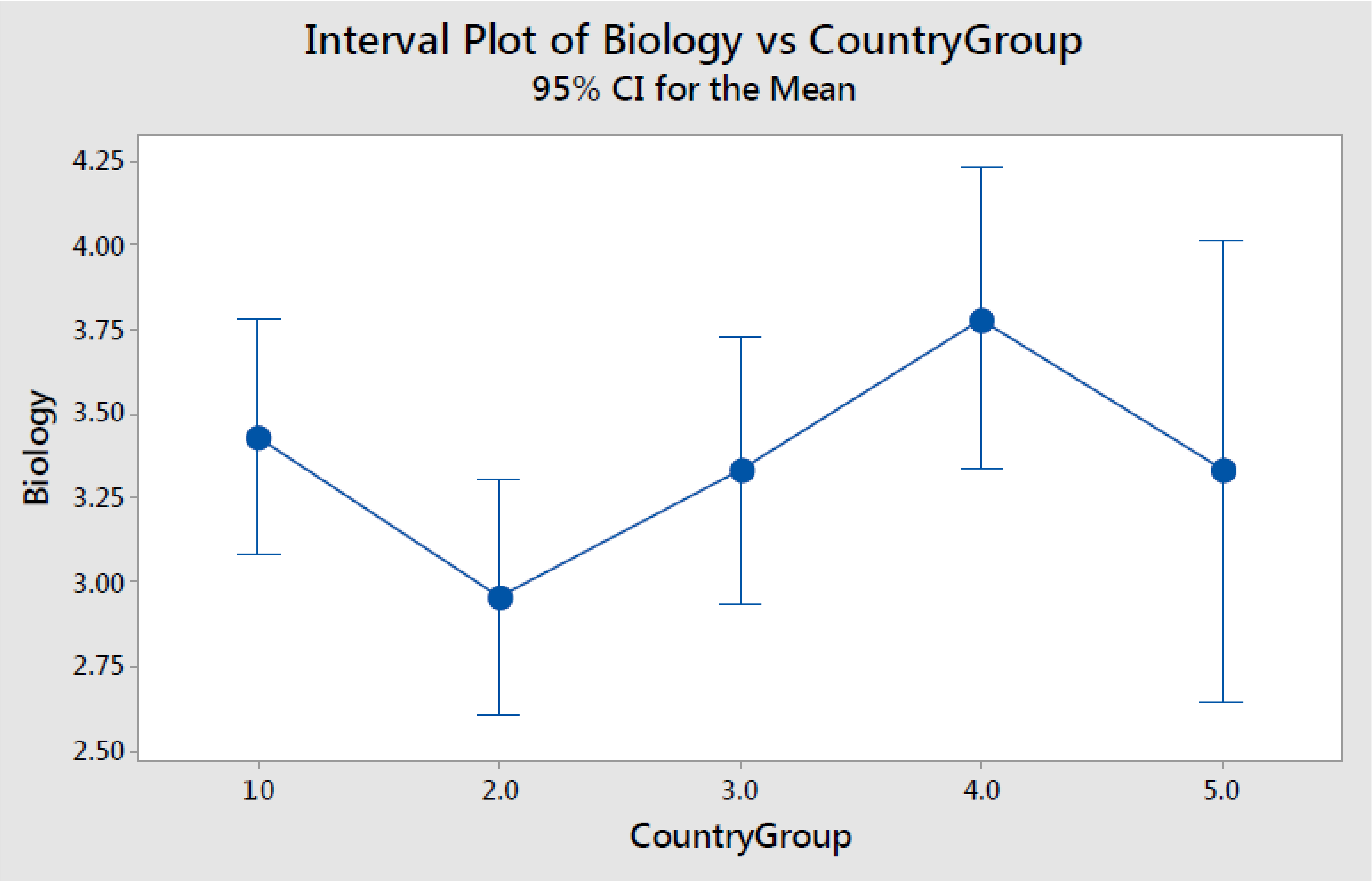
Underpinning sciences



Underpinning sciences

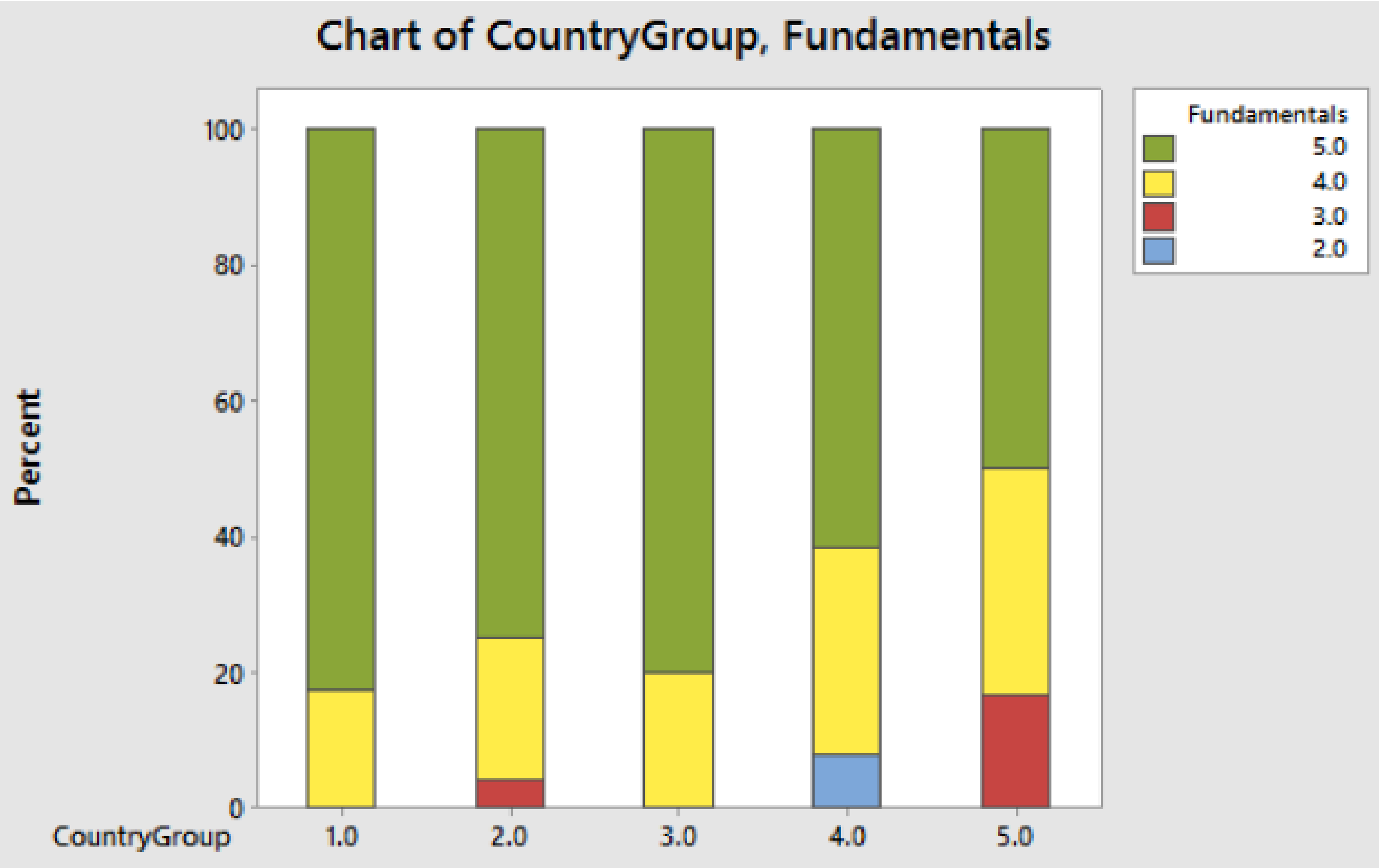


Underpinning sciences



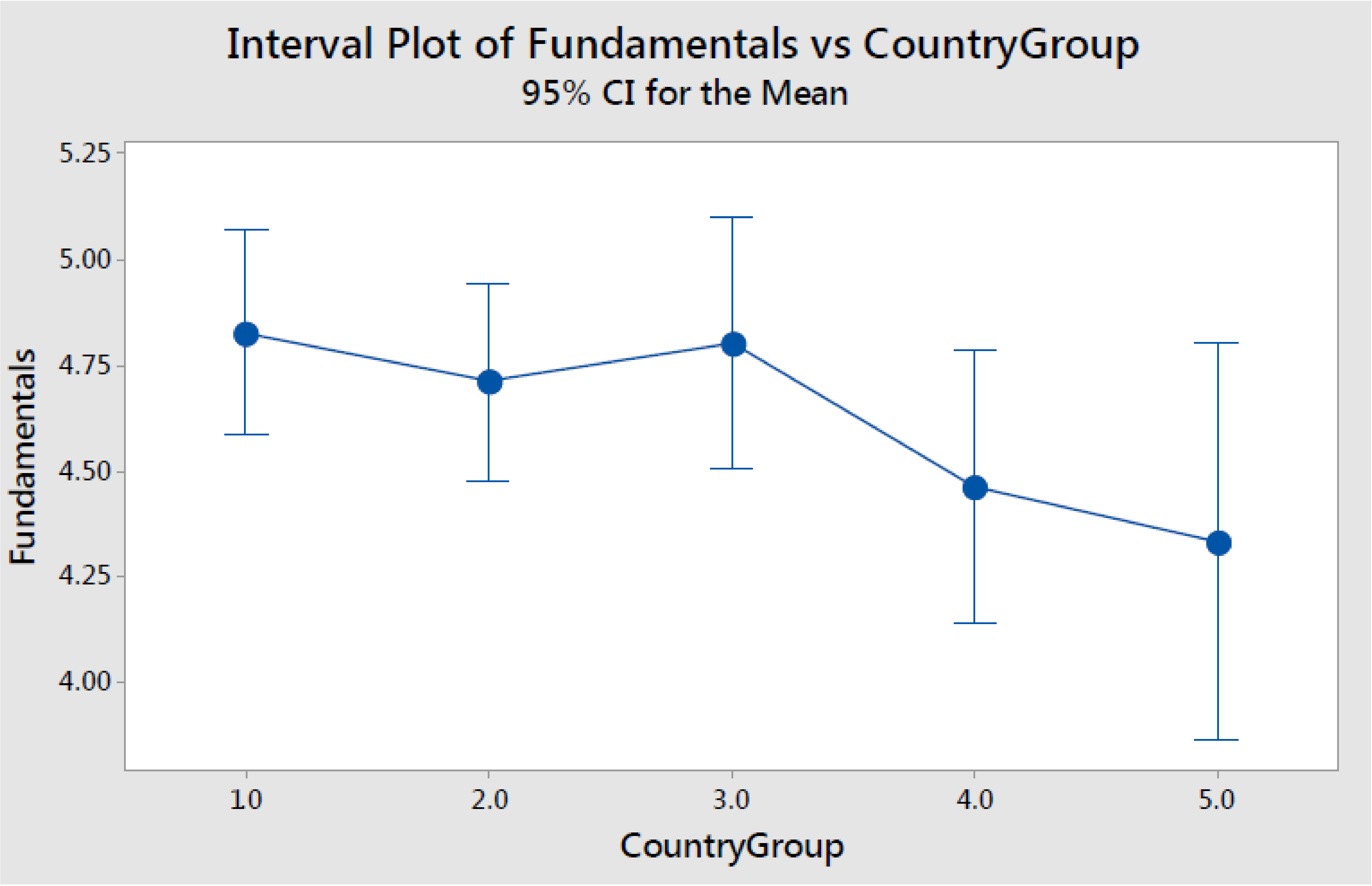
N W E S ROW

Core CE - fundamentals



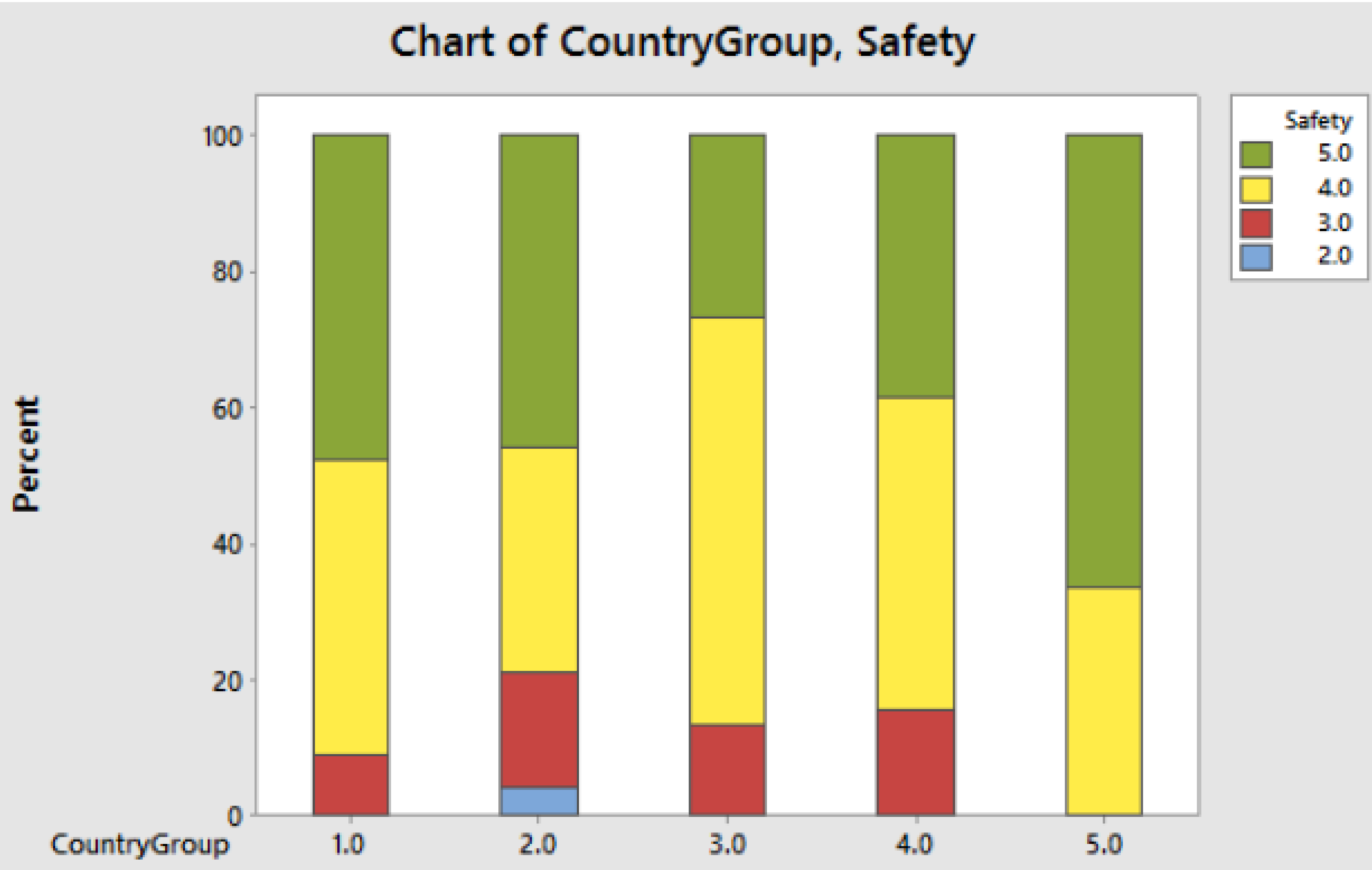
N W E S ROW

Core CE - fundamentals



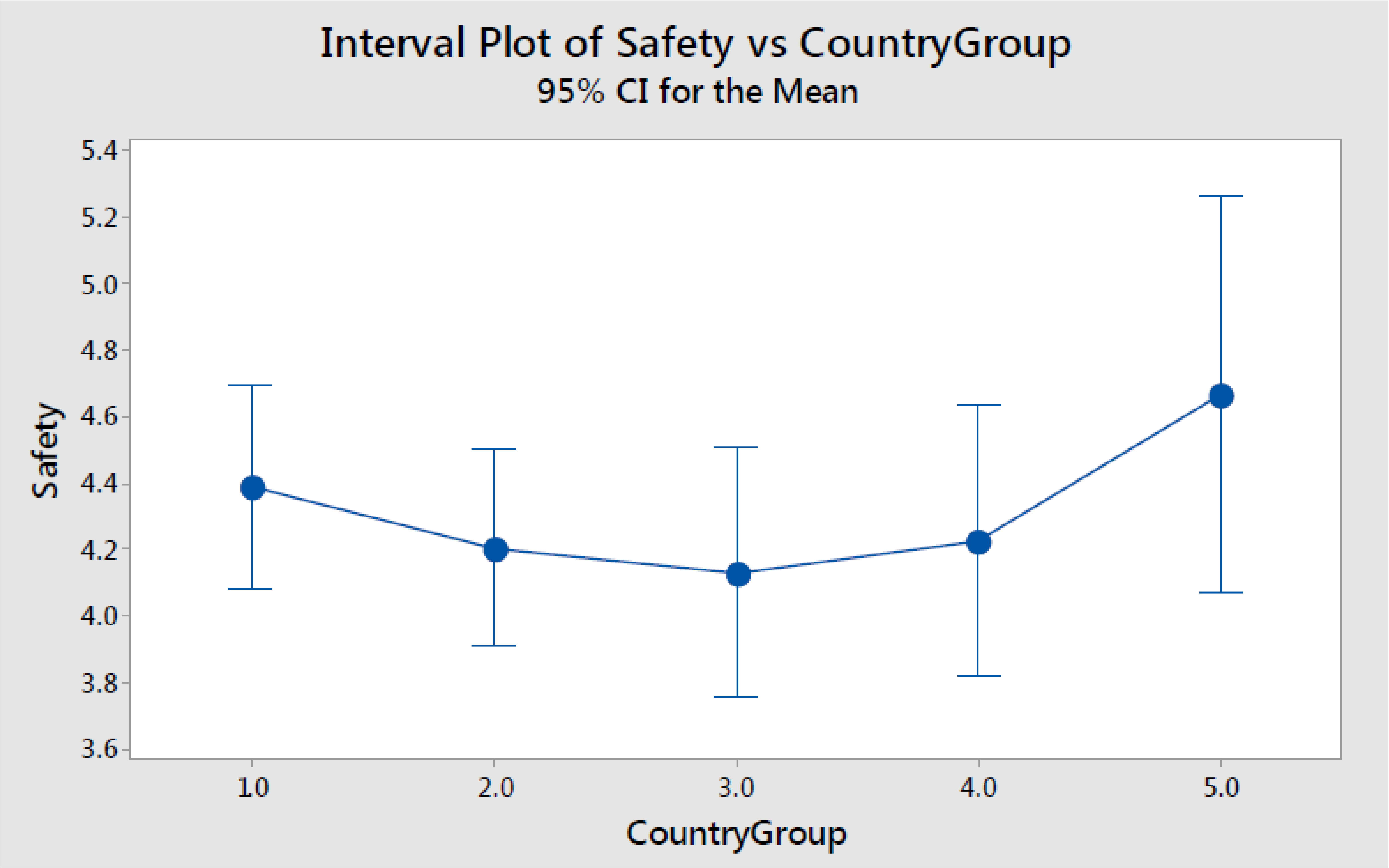
N W E S ROW

Core CE - safety



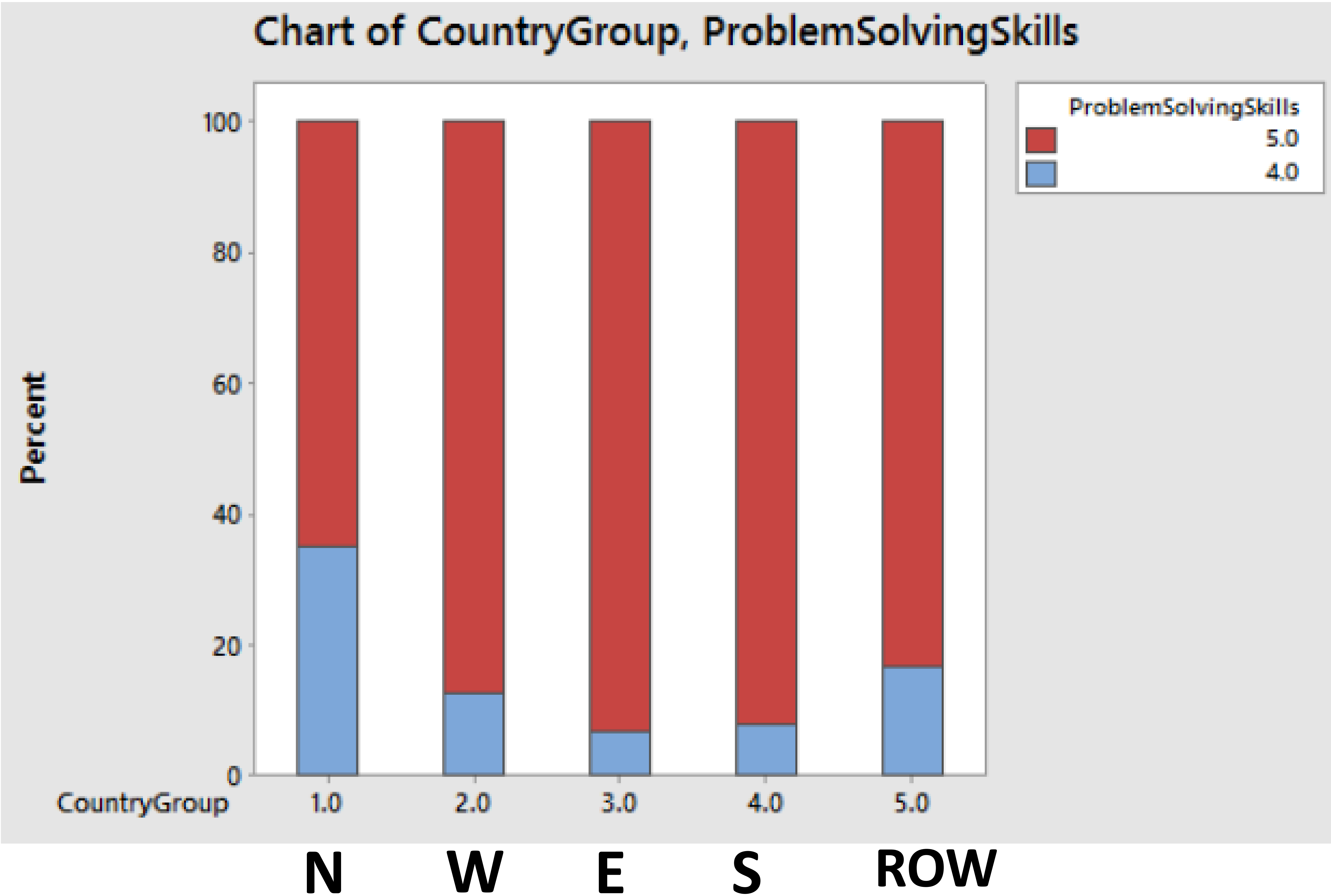
N W E S ROW

Core CE - safety

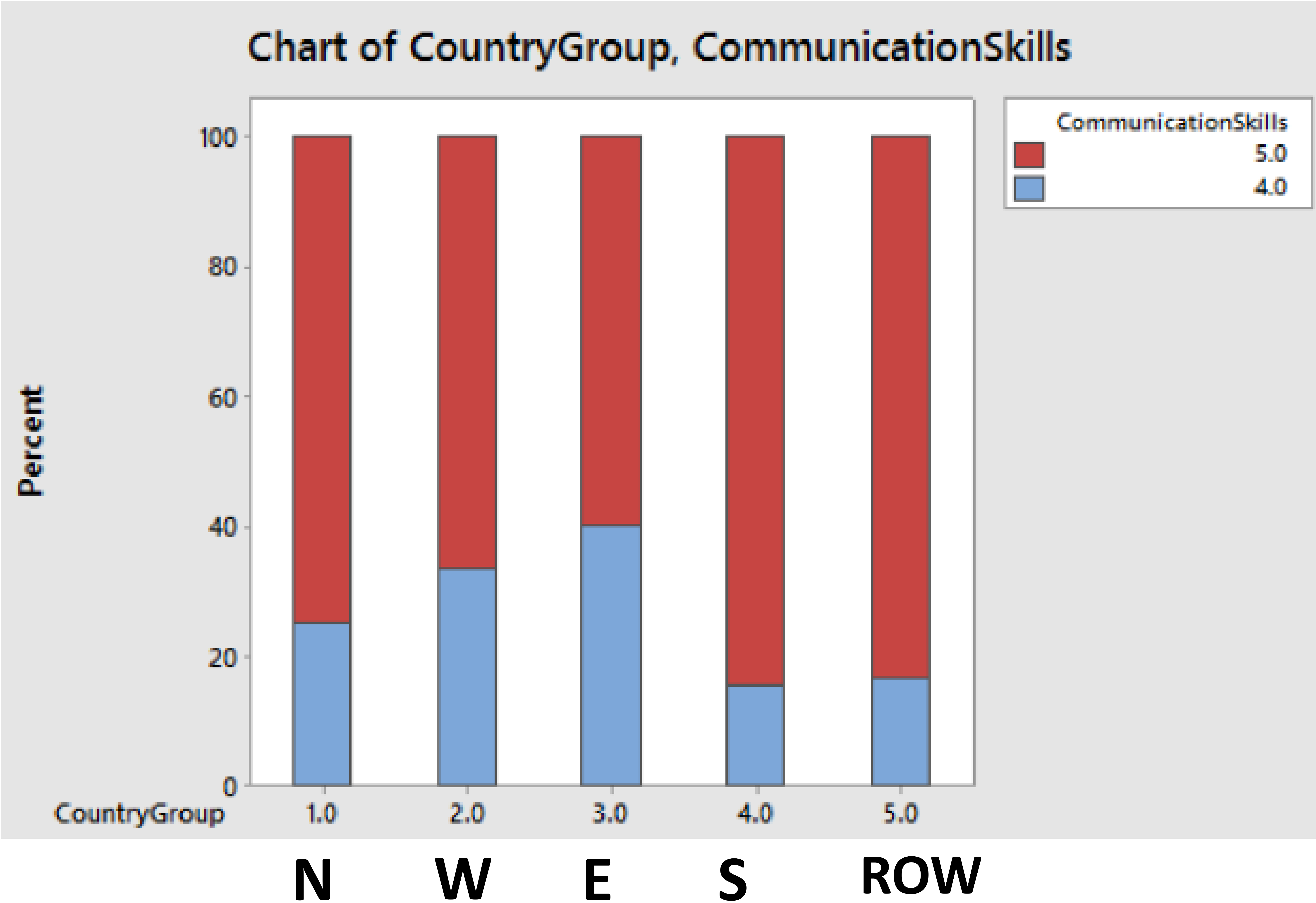


N W E S ROW

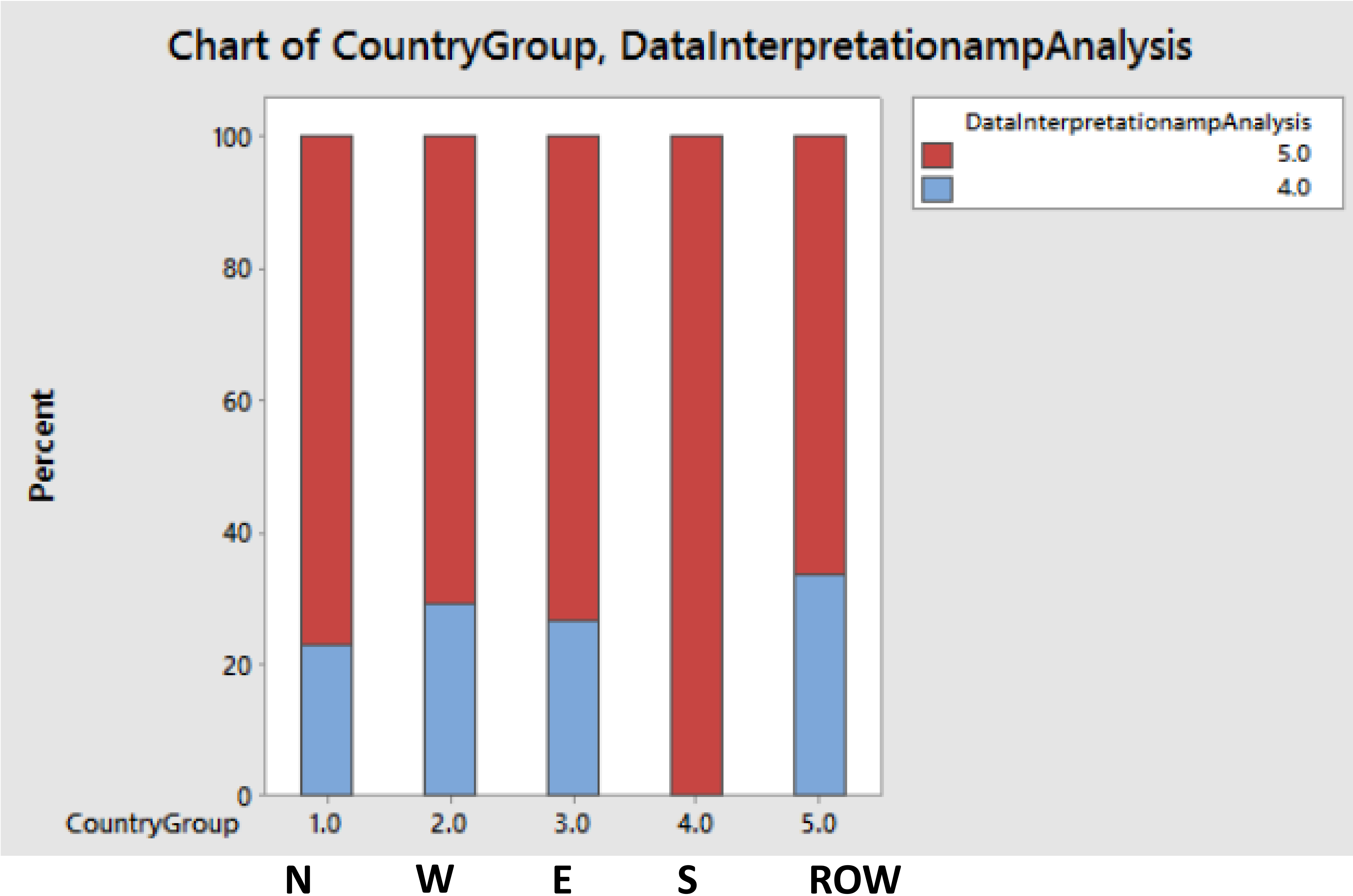
Importance of skills – problem solving



Importance of skills – communication



Importance of skills – data analysis



Questionnaires – CE knowledge and skills summary

- Further analysis to be carried out to compare differences between stakeholder groups
- MVDA methods was used on the quantitative responses, but no predominant themes were observed in the initial analysis
- The differences (even if identified as statistically significant) are typically just outside the CI, hence very close
- This is reassuring as it indicates overall agreement Europe-(world)wide about the importance of core CE knowledge and skills outcomes
- The influence of personal views of respondents is acknowledged
- Detailed report will be available on the project website (preliminary analysis already available)

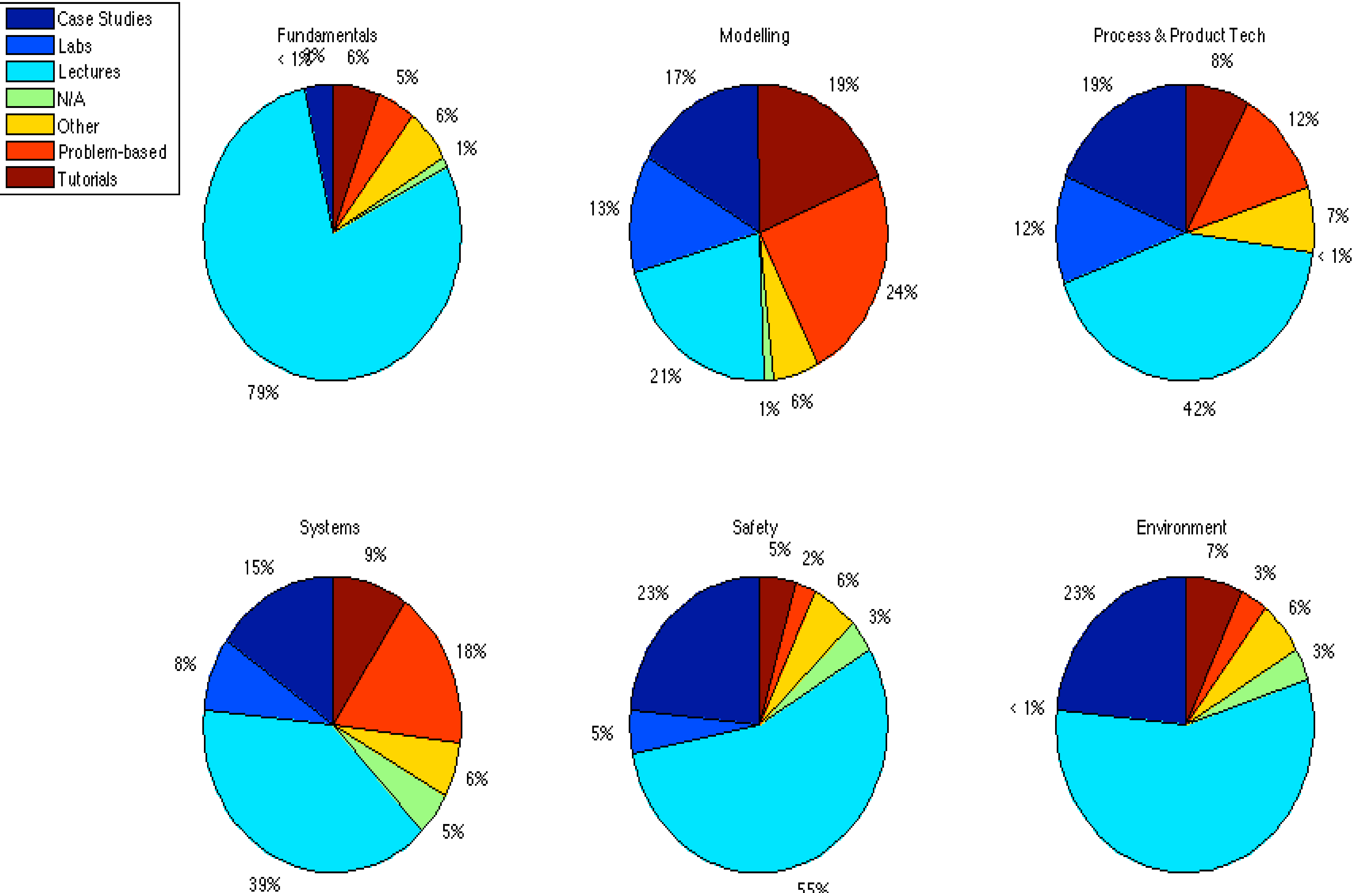
Predominant methods of delivery

Questions for you

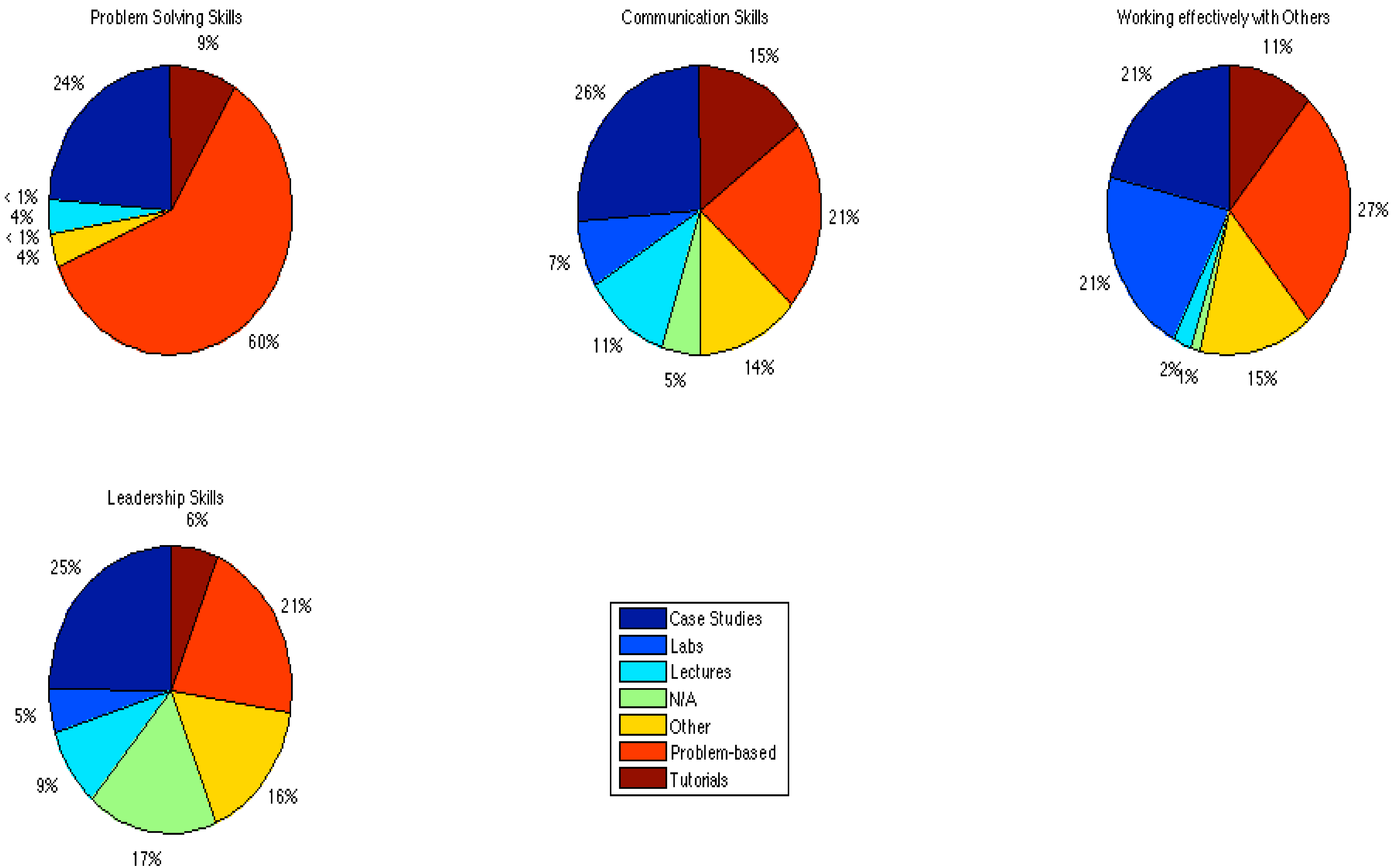
1. Which method of delivery do you believe was identified as predominantly used by institutions for the delivery of core knowledge?
2. Do you think any areas of core knowledge differed from this (fundamentals, modelling, process & product tech, systems, safety, environment) and if so how?
3. How about the other areas of CE curriculum (underpinning science, eng. practice, design, advanced (master) knowledge)?

Discuss in groups of 2-3 no more than 5 mins

Current position – core knowledge

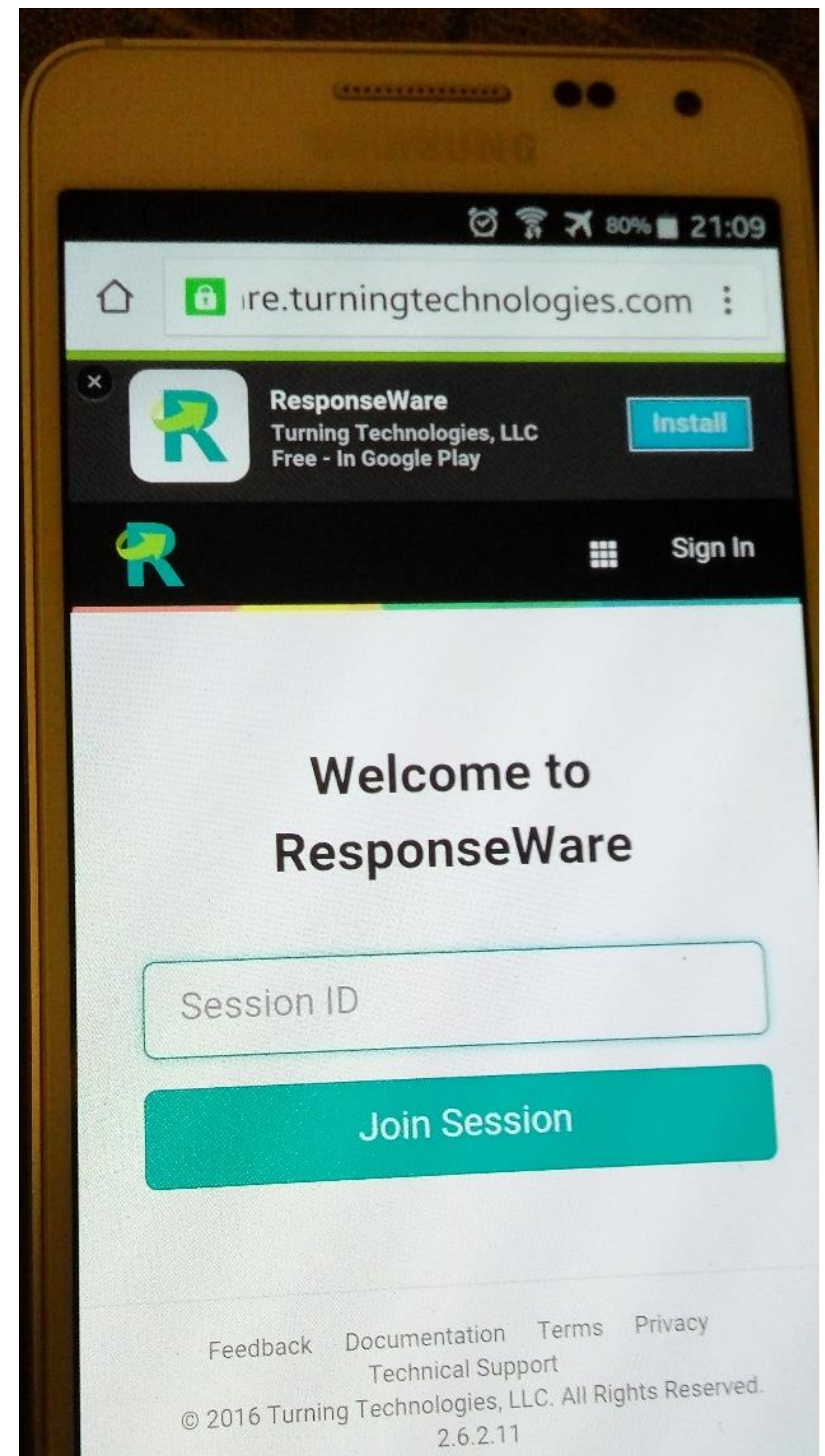


Current position - skills



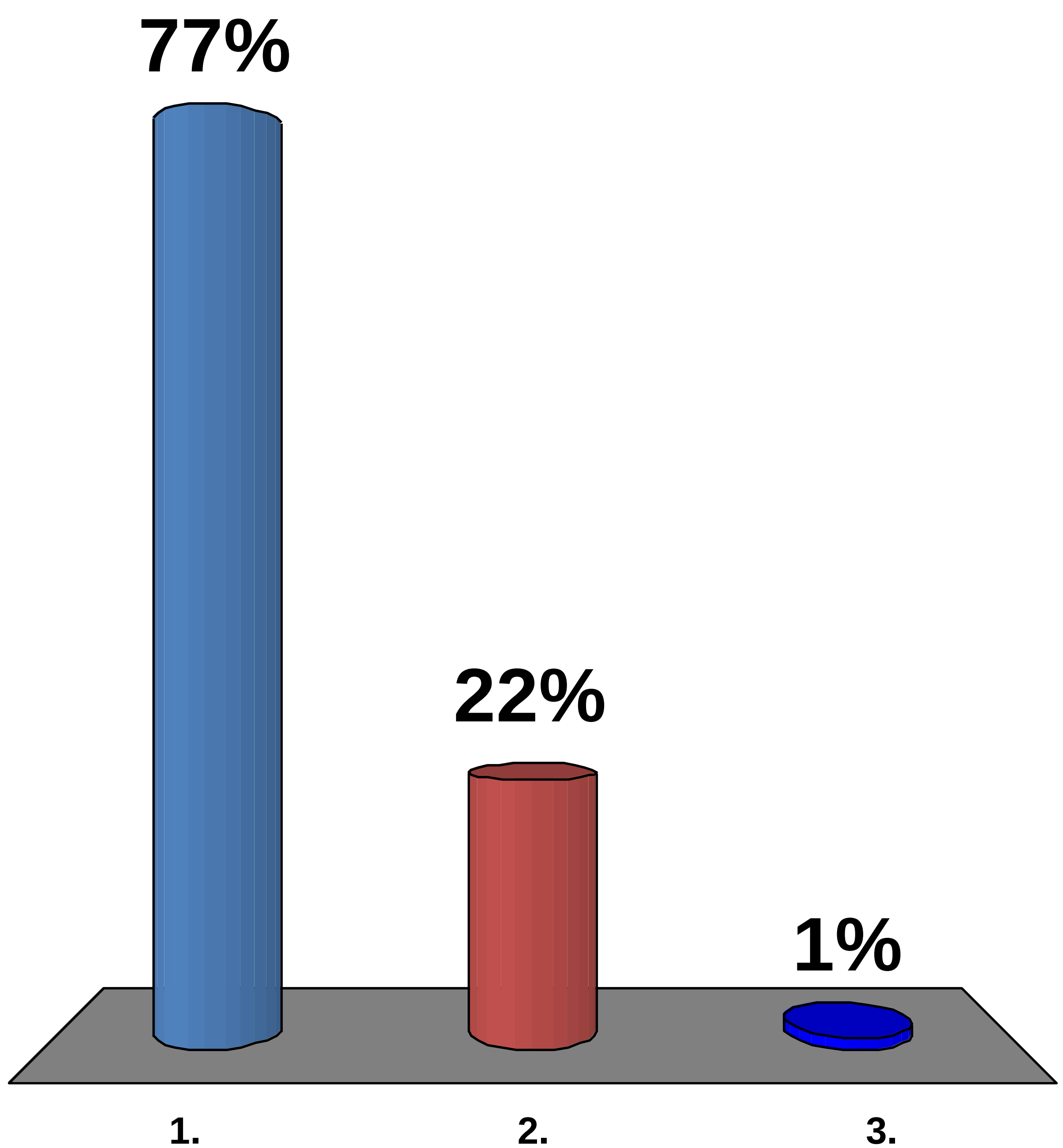
Engagement in lectures

- Expectation raising - ‘Why’ questions at the start
- Use of electronic voting



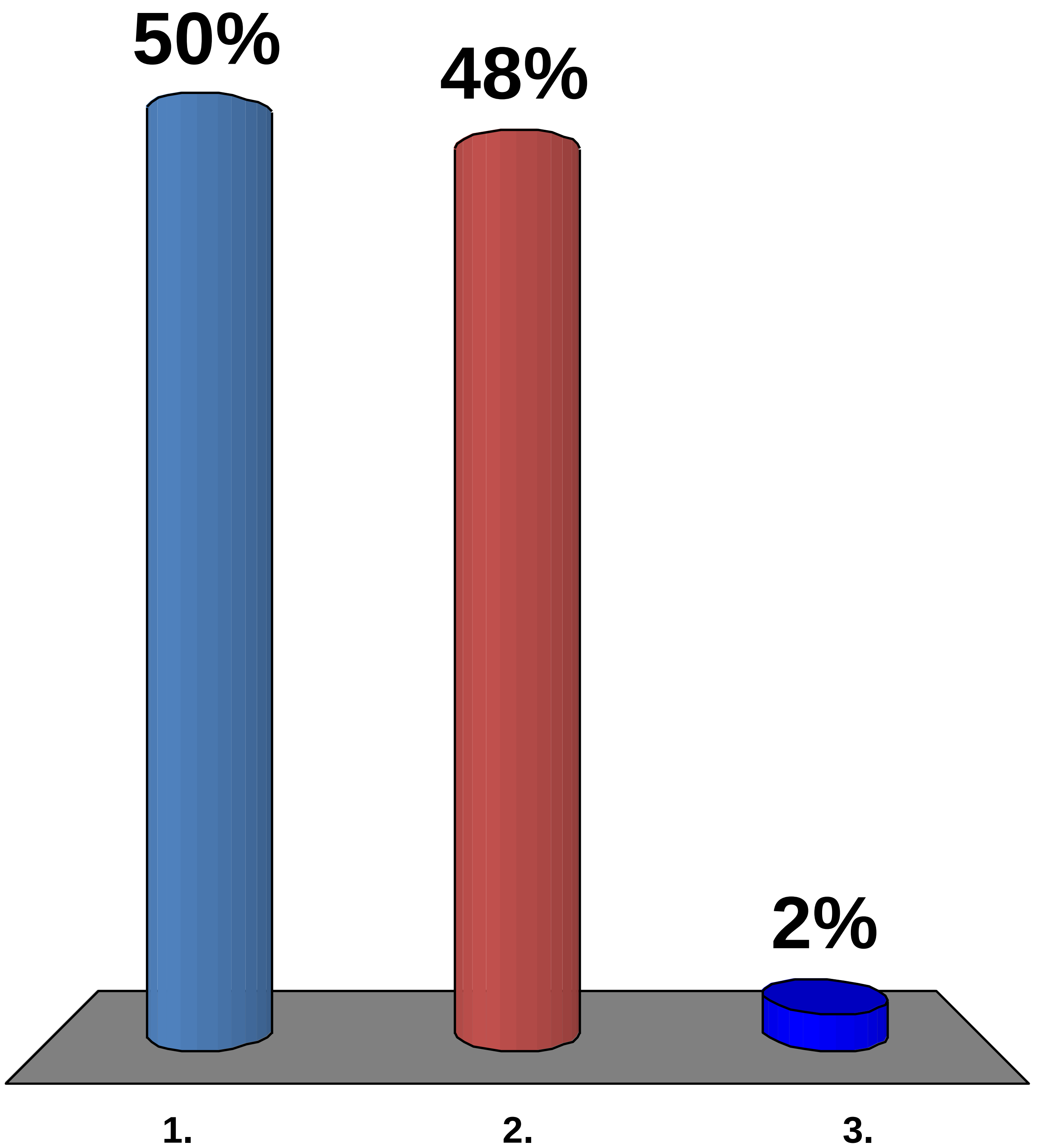
If activities of two enzymes are: E_1 = 0.05 kat and E_2 = 500 U is the activity:

1. $E_1 > E_2$
2. $E_1 < E_2$
3. $E_1 = E_2$



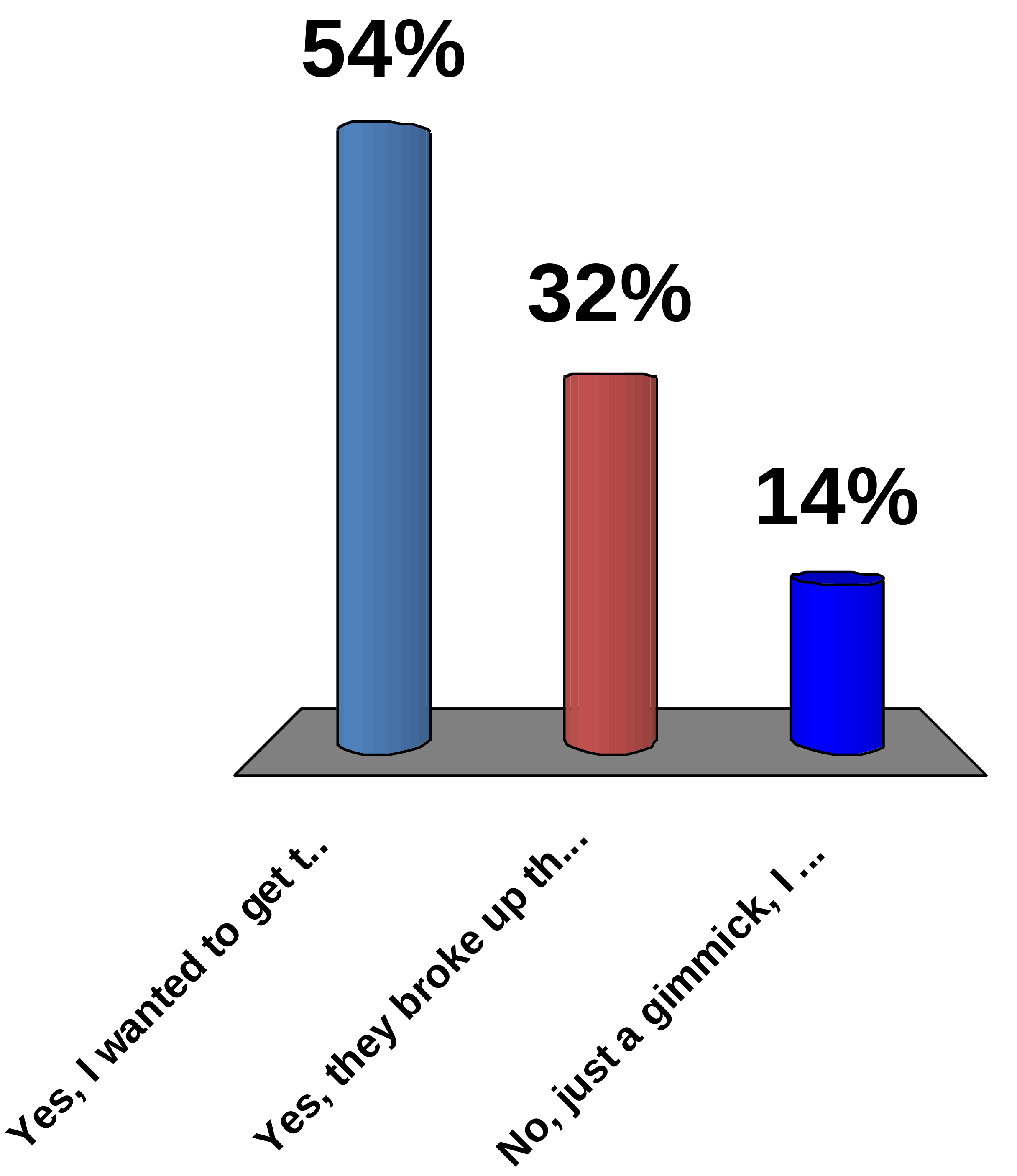
Given that 10^{-6} is the required sterility level and 10^{11} initial conc. of contaminants, D at 120 ^{0}C = 1.5 min, F =

1. 15 min
2. 25.5 min
3. 16.5 min



The clickers concentrated my attention

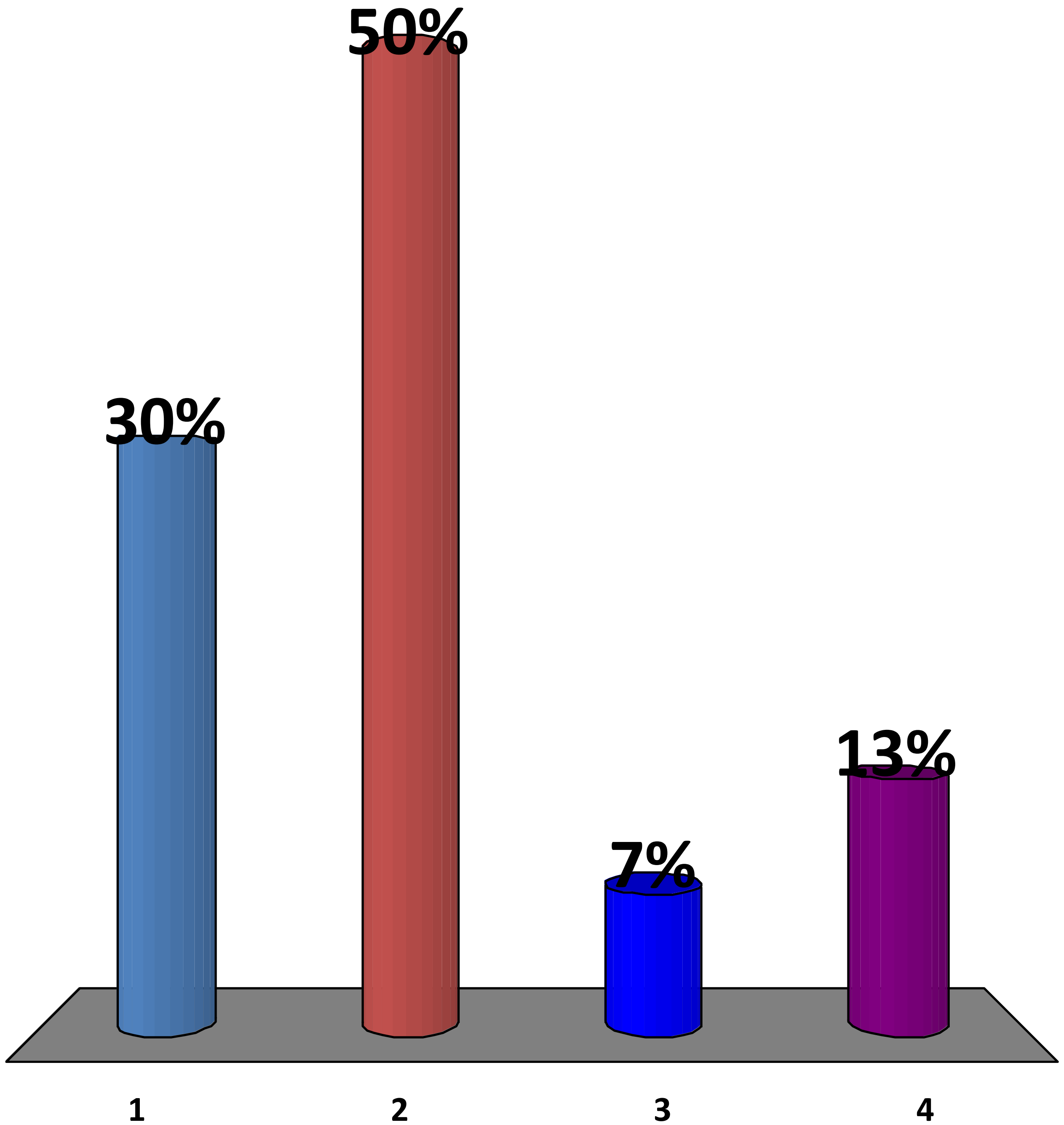
1. Yes, I wanted to get the answers right
2. Yes, they broke up the lecture, but I'm not bothered whether I get the answers right
3. No, just a gimmick, I pay attention anyway



n = 63, Stage 3

Seeing the question responses of the rest of the group helps me to gauge my performance

1. Strongly Agree
2. Agree
3. Disagree
4. Strongly Disagree



n = 136, Stage 1

Assessing the efficiency – how do we know we do it well?

- Academics

- Industry

State of the art and latest developments

- Very little ‘hard’ evidence in pedagogical literature
- Typically a single pedagogical approach compared to another, either based on student scores in tests and exams, independent test (Chemepass) or performance in specific tasks and student satisfaction
- Confounding effects rarely accounted for (overall improvement of student cohort from one year to next, staff change, other context changes, etc)
- Long-term impact rarely tested
- UK government linking the fee level to teaching quality
- Structure of TEF now clear, implementation not so

TEF in the UK

Department
for Business
Innovation & Skills

FULFILLING OUR POTENTIAL

Teaching Excellence, Social
Mobility and Student Choice

NOVEMBER 2015

Fulfilling our Potential: Teaching Excellence, Social Mobility and Student Choice

Presented to Parliament
by the Secretary of State for Business, Innovation and Skills
by Command of Her Majesty

November 2015

Success as a Knowledge Economy:

Teaching Excellence, Social Mobility
and Student Choice

May 2016

Department
for Business
Innovation & Skills

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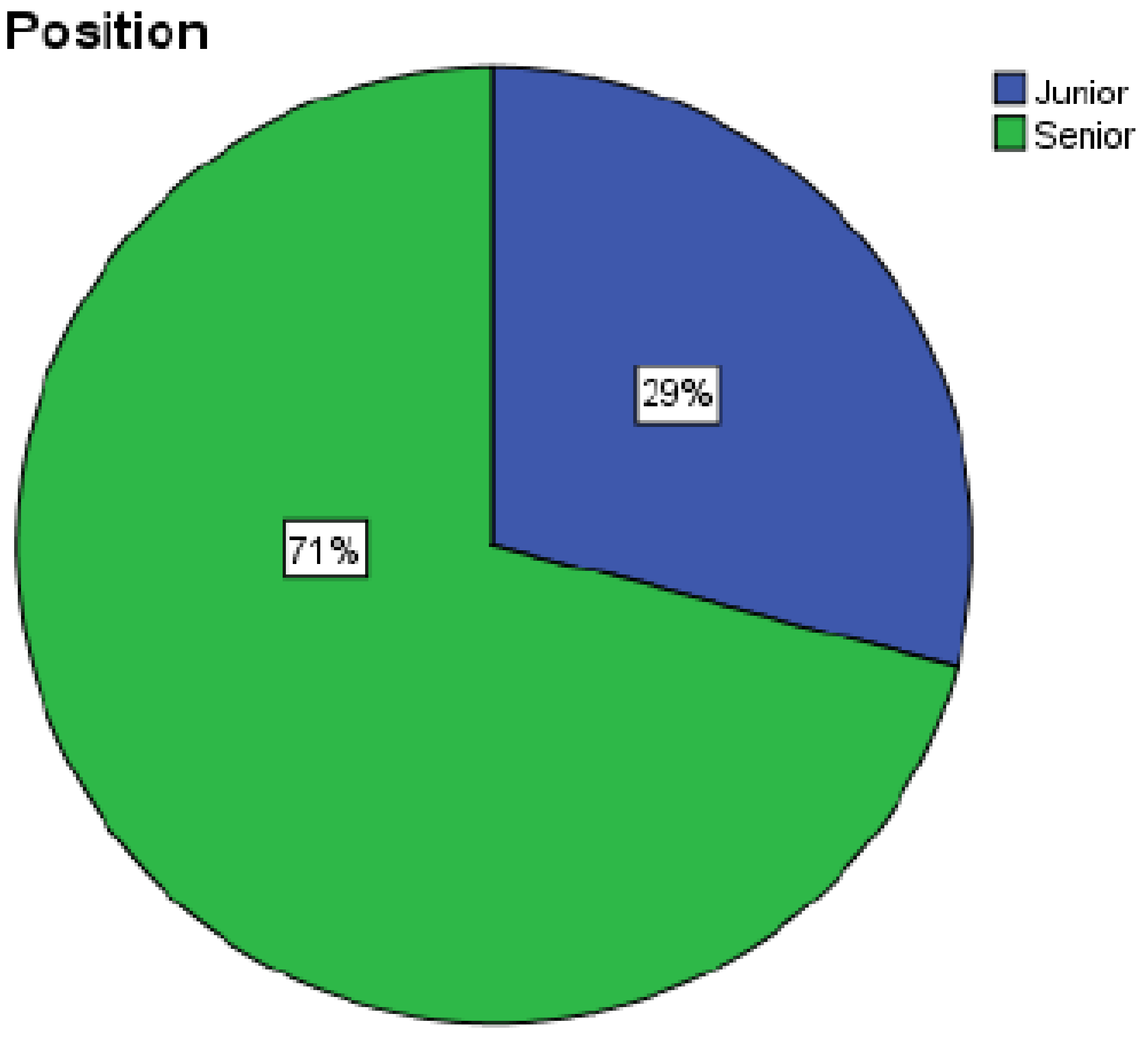
- Dr Alina Schartner, Dr Ulrike Thomas, Dr Chris O'Malley – Newcastle University
- All consortium full and associate partners
- All respondents to the questionnaires and focus groups
- EU Erasmus for funding the project
  Grant **539959-LLP-1-2013-1-UK-ERASMUS-EQR**

Education and Culture DG

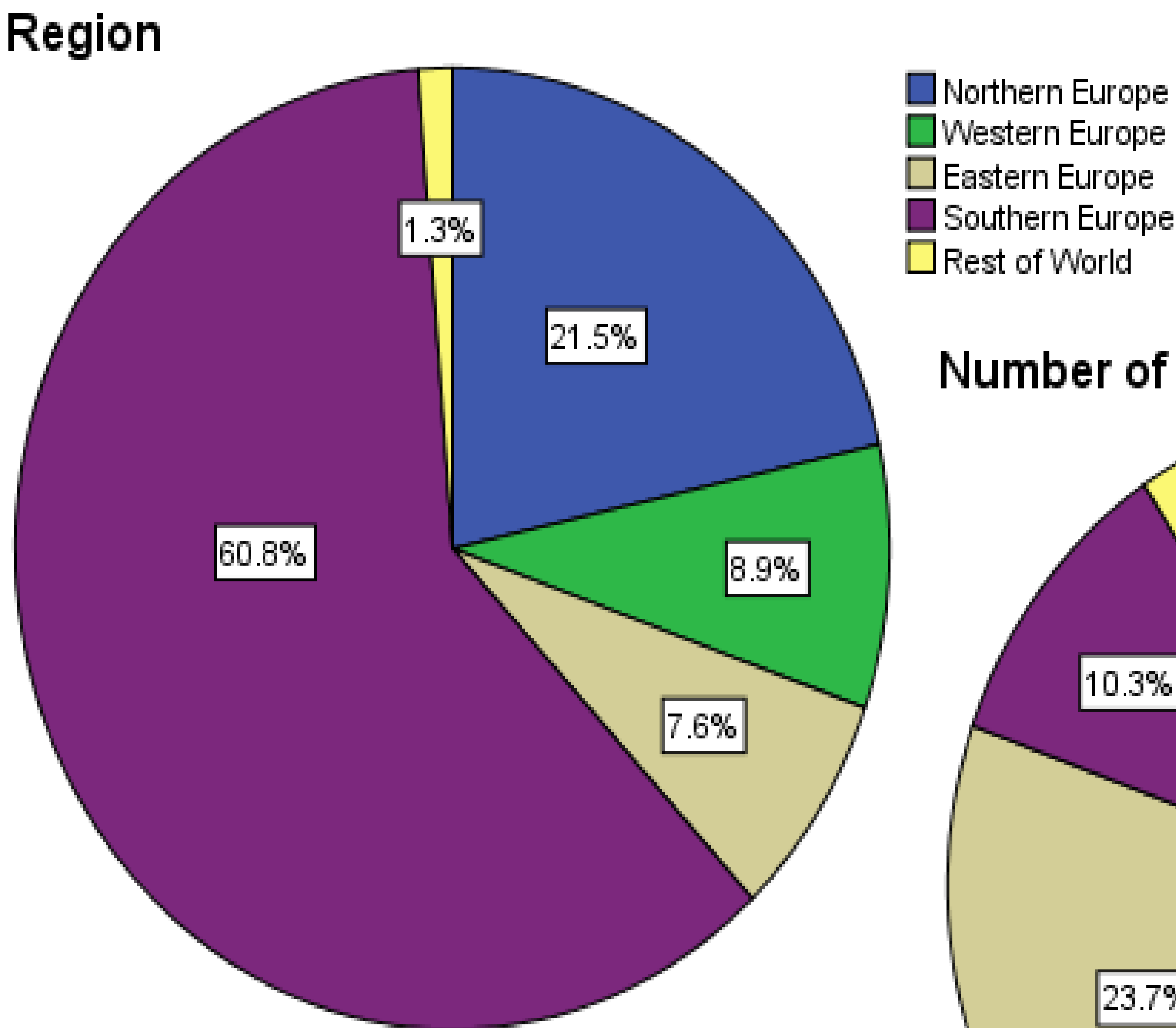
Lifelong Learning Programme

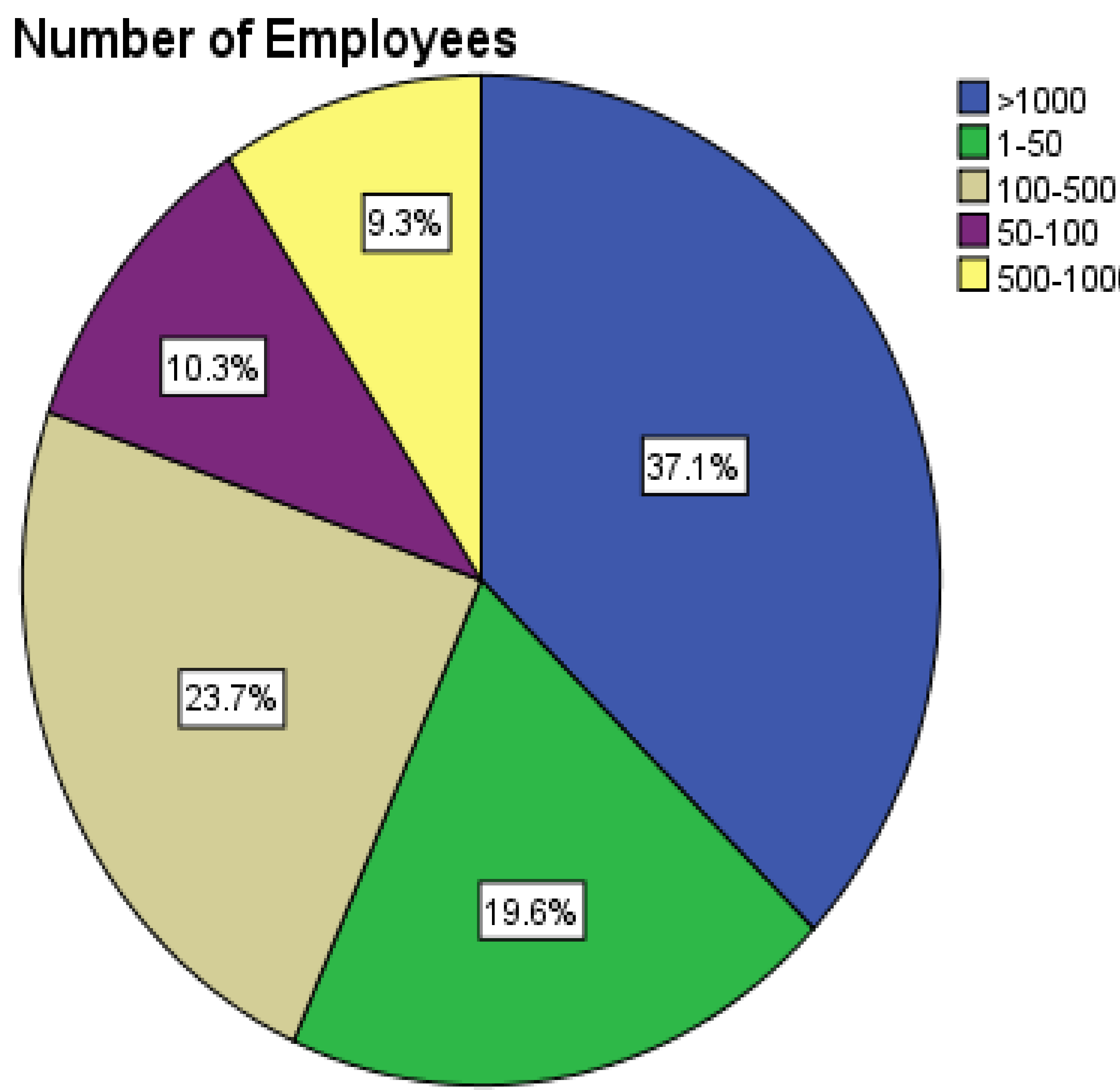
Response rates and demographics

- 97 academic, 97 employer and 70 graduate responses



Response rates and demographics





Response rates and demographics