

Mentoring measures as promoter of career planning in the surveying world with a special focus on DVW in Germany

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Key words: education, professional practice, young surveyors, career planning; Mentoring

SUMMARY

In a world full of information, opportunities and challenges, the question arises as to how young professionals are supported in their career planning. This topic is very acute due to the high degree of specialization and the lack of skilled personal, not only in the geo-community. How do we support, how do we encourage, how do we motivate our younger colleagues so that they feel comfortable, so that they can develop, so that they are enthusiastic about the profession?

The concept of mentoring offers a solution to this - a relationship between experienced and unexperienced colleagues. The experienced person should support the unexperienced person for a certain period of time, discussing topics, advising and promoting. A mentoring programme is less about technical topics, but more about social and ethical approaches, dealing with challenges, soft skills, networking, and giving feedback. Informal knowledge is passed on. Such a programme is offered at DVW (German association for Geodesy, Geoinformation and Land Management) to promote young talents.

Various aspects of career planning in STEM and especially in surveying are described and supplemented by experience reports from younger and older colleagues. In this context, reference is made to the current mentoring project of the FIG Young Surveyors Network (YSN) and the FIG African Regional Network (ARN). The DVW's mentoring programme will be presented, along with other options from Germany, Europe and in an international background, as well as their benefits for the development of young surveyors.

SUMMARY

In einer Welt voll von Informationen, Chancen und Herausforderungen stellt sich die Frage, wie junge Fachkräfte bei ihrer Karriereplanung unterstützt werden. Dieses Thema ist wegen der hohen Spezialisierung und des Fachkräftemangels nicht nur in der Geo-Community sehr akut. Wie unterstützen wir, wie fördern wir, wie motivieren wir unsere jüngeren Kolleg*innen, damit sie sich wohl fühlen, damit sie sich entwickeln können, damit sie vom Beruf begeistert werden? Hierzu bietet das Konzept des Mentorings einen Lösungsansatz - eine Beziehung zwischen erfahrenen und unerfahrenen Kolleg*innen. Die erfahrene Person soll die unerfahrene Person für einen bestimmten Zeitraum unterstützen und dabei Inhalte besprechen, beraten und fördern. In einem Mentoring Programm geht es weniger um fachliche Themen, sondern eher um soziale und ethische Ansätze, den Umgang mit Herausforderungen, die Soft Skills, das Netzwerken, sowie das Feedback geben. Es handelt sich um informelles Wissen, das weitergegeben wird.

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Ein solches Programm wird daher zur Nachwuchsförderung im DVW in Deutschland angeboten.

Verschiedene Aspekte der Karriereplanung im MINT Bereich und speziell in der Geodäsie werden beleuchtet und durch Erfahrungsberichte von jüngeren und älteren Kolleg*innen ergänzt. Auf das aktuell laufende Mentoring Projekt des FIG Young Surveyors Network (YSN) und des FIG African Regional Network (ARN) wird in diesem Zusammenhang Bezug genommen. Zudem werden neben dem Mentoring-Programm des DVW weitere Angebote aus Deutschland, Europa sowie im internationalen Kontext präsentiert, sowie deren Nutzen für die Entwicklungspotentiale von Nachwuchskräften.

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1. MOTIVATION

The Surveying World, like many other industries, suffers from a lack of professionals. According to a survey by the "Kompetenzzentrum Fachkräftesicherung" (Kofa 2014), around 44 percent of surveyors in Germany are currently over 50 years old and only available to the labor market for a limited time (Deutscher Städtetag 2019). It is becoming increasingly difficult to find suitable experts for vacancies in surveying offices, industry and public administration as well as in academic science, as the number of graduates decreases, as described in chapter 2 and 5.1.

There are various causes for this shortage of qualified personnel, such as leaving working life early or having more jobs with high demands. We are in the middle of a structural change and this means, for example: long waiting times for administrative services, staff absences, overload stress for the remaining employees, negative effects on the society. The shortage of skilled persons is a problem that can be addressed with various solutions. How to deal with these challenges (Fig. 1)? 1. A strategy is getting prepared, then 2. measures are taken and 3. a reflection and if necessary, a change of strategy takes place.



Fig. 1 Dealing with challenges

In this paper, the current labour market situation and various strategies against the well-known bottleneck are presented from different perspectives. The focus is particularly on young surveyors and their career planning. A suitable measure in this context is the mentoring programme, as it is being set up at the DVW (German Association for Geodesy, Geoinformation and Land Management) in Germany.

Mentoring programmes are offered in different ways to promote young people. For all types of programmes it starts with a formal matching of a mentee and a mentor either at universities or in public administrations and companies. How much influence gives this to the personal career?

2. LACK OF PROFESSIONALS IN STEM AND IN ENGINEERING SUBJECTS

The engineering monitor, created by the association of engineers together with a private economic research institute, shows the number of vacancies registered in relation to the number of unemployed (VDI, IW 2022). According to the quarterly study, there is a clear shortage of applicants in Germany, depending on the engineering discipline. An occupation is described as a bottleneck and it means that more than 100 vacancies are registered for every 100 unemployed

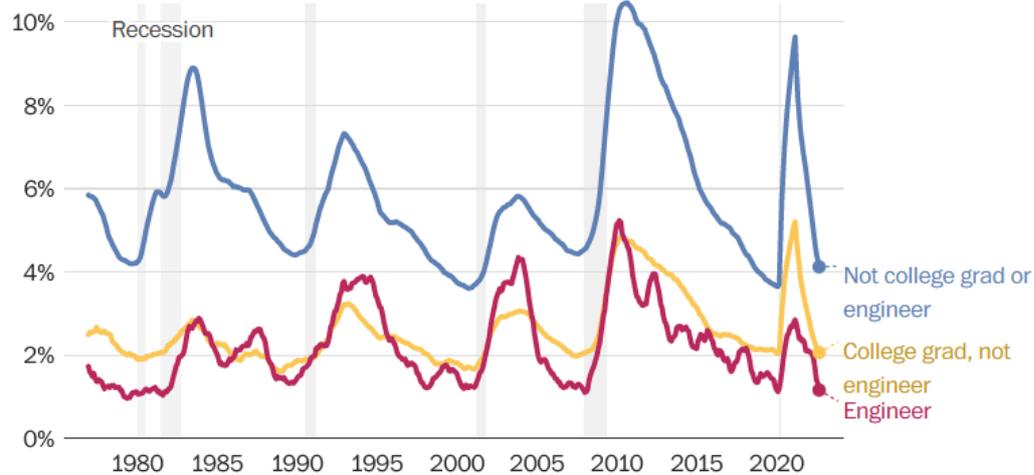
persons, e.g. 759 vacancies for surveying/construction/architecture in the 2nd quarter of 2022. This means that for every vacancy in the engineering field 0.13 applicants are available - an alarming number!

Looking at the number of surveying students at universities for the last 5 years a continuous decreasing of first year students is recorded. Hence no improvement of the situation can be expected in the next few years. Since the drop-out rates of students in STEM subjects are about 20 – 30 % and in addition not all graduates remain in the engineering field, it is important to support young professionals with special offers, such as mentoring.

According to the Bureau of Labor Statistics in USA, economic projections point to a need for approximately 1 million more STEM professionals than the U.S. will produce at the current rate by 2025 (Squires 2023), while the unemployment of engineers is on a historically low point, see Fig. 2 (Washington Post 2022).

U.S. engineer unemployment flirts with all-time lows

Unemployment rate by engineering background or education level, 12-month average



Note: dark line shows 12-month average

Source: Bureau of Labor Statistics harmonized by IPUMS

THE WASHINGTON POST

Fig. 2. U.S. engineer unemployment

3. MENTORING – WHAT IS IT?

Originally from greek mythology in Homer's epic poem about Odysseus' voyages astray (Odyssey), Mentor appears as the hero's friend and protector of his son Telemach. After Odysseus has gone to the Trojan War, the goddess Athena, who is well-disposed towards him, assumes the form of Mentor occasionally to watch over Telemach. Mentor therefore has both masculine and feminine qualities in the epic, suggesting an intense and complex relationship between him and his protégé." (Universität Konstanz 2023)

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Mentoring describes the relationship between a mentor and a mentee in a so-called tandem. Mentors share their own professional experiences with mentees, accompany their further development individually and provide advice and assistance in making decisions or difficult situations. Through this close relationship, the consolidation of a highly qualified and motivated specialist is promoted. At the same time, the mentee's entry into professional life is made easier and perspectives can be shown. Mentoring is often used as an instrument of personnel development (Koch et al. 2019).

Whether students, new professionals, career changers, minorities: the possible mentees may come from a broad group with different perspectives. Just as diverse are the topics offered, such as decision-making, integration, equal opportunities, career planning or an improved work-life balance. It can give the impression that mentoring is the tool for all target groups, from students to leaders and for all challenges and topics. Each mentor-mentee relationship is individual and not all topics are equally important to those involved. Mentor and mentee determine the focal points of their exchange and work through the goals in the mentoring phase. The advantages of this support and exchange are obvious. A mentoring programme for minorities can develop an individual both personally and professionally and change the business culture. The ethical parameters play an important role, since the development of competences is rarely taught in university courses. In any case, mentoring can provide support for both personal and professional development.

4. MENTORING MEASURES

Many definitions exist similar to the following “Mentoring is a learning relationship, involving the sharing of skills, knowledge, and expertise between a mentor and mentee through developmental conversations, experience sharing, and role modelling. The relationship may cover a wide variety of contexts and is an inclusive two-way partnership for mutual learning that values differences.” (EMCC 2023)

4.1 TYPES OF PROGRAMMES

The German Society for Mentoring has identified certain standards and quality features from practice that guarantee a qualitative mentoring programme and offers a certificate for this purpose (DGM 2023). There are several forms of mentoring programmes, which are shown below in Fig. 3. (Albert-Ludwigs-Universität Freiburg, 2023, Lange, U., 2023)

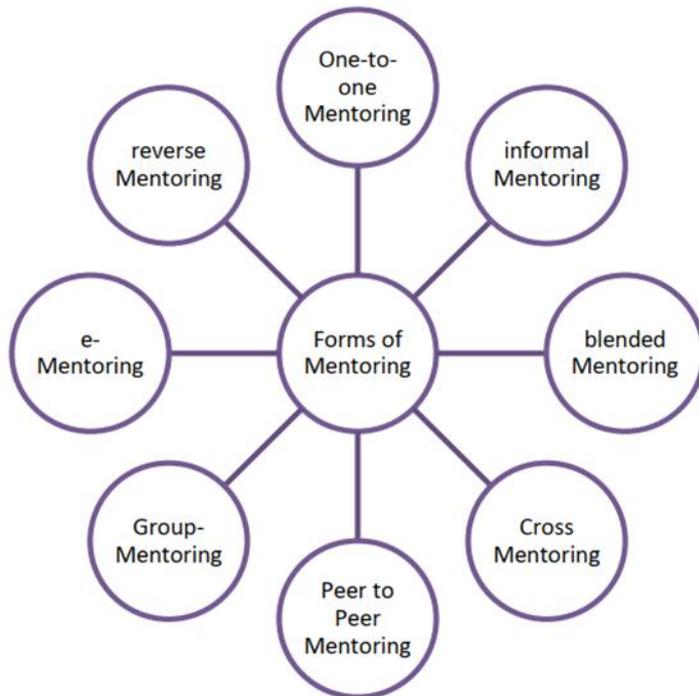


Fig 3. Types of Mentoring (Lange, U., 2023)

- One-to-one or classic mentoring: In classic mentoring, an experienced person passes on professional knowledge, social and ethical experiences, assessments as well as network expertise and contacts to the mentee. This is less about the technical knowledge, but about informal knowledge, which contributes to the professional development of the mentee. It is often used in the areas of training, the introduction of junior managers and succession planning.
- Group Mentoring: In this form of mentoring, each mentor is assigned a group of 2-3 mentees. Among other things, the mentees benefit from the questions and considerations of their group members. In addition, contacts can be established with each other (Albert-Ludwigs-Universität Freiburg, 2023).
- Peer mentoring: Peer mentoring is about enriching the learning process among like-minded people. This form of mentoring is often found in schools or universities, but also – with flattening of hierarchies – in many companies. After all, peer-to-peer mentoring also makes sense in a business context, for example in groups of trainees or junior managers. Tandems are formed that support each other.
- Recursive mentoring: the roles of mentors/mentees are swapped and the older generation can also learn something from the younger generation. This allows mentees to pass on their knowledge, e.g. from social media, or the modern design of websites, new marketing methods, new solutions.
- In addition, there are other forms of mentoring, such as e-mentoring (online only), blended mentoring (both classic and online), cross-mentoring (mentor and mentee from

different organisations), informal mentoring (mentoring without specific goals and content). The final form must be selected on a case-by-case basis.

4.2 TARGET GROUPS

A mentoring programme can be suitable and supportive for different people at various stages of life:

- Younger managers: People who are new to the leadership role. When changing from the employee to the management role, many new questions arise.
- Career starters and people who have changed jobs / positions: Companies often also want to promote employees who aspire to a specialist career. In most cases, the tandems are similar in their professional orientation, so that the mentor can support the mentee based on his professional skills and also advise him competently.
- Re-entrants after illness, parental / care leave: often these people are in doubt about their own competence, so that after a longer break from professional life with this support, the re-entry can take place carefree.
- Newcomers: People who grow up in non-academic families have additional barriers to choosing an academic career because the family does not have their own role models (Warkentin 2018).
- Re-entrants after unemployment: unlike absence due to parental or care leave, unemployment is a taboo topic. When re-entering the world of work, these people often need support.
- Professionals with a migrant background: it is particularly difficult for these people to fulfil their own potential. The reasons vary: language barrier, shyness, dealing with the new environment and situation, different processes in the new country compared to the country of origin.
- Underrepresented groups such as people from lgbtqia+, people with disabilities or women in male-dominated professions. These people face different obstacles: prejudice, sexism, ableism (Aktion Mensch 2023), gender pay gap, migration pay gap, lgbtqia+ gap, disability pay gap. – overall lack of acceptance in society (PushFar, 2023).

A mentoring programme is not a panacea for social inequality and injustice. Nevertheless, by working together in tandem, a person can develop positively and strengthen their self-confidence. The person can thereby change an established situation advantageously, demand fair treatment or strive for a reorientation. Mentoring can offer targeted support for this. A mentor can act as a role model for the mentee and motivate, upgrade and navigate through the world of work.

Depending on the phase of life in which the mentees are or which goals are pursued, an appropriate type of mentoring can be selected.

4.3 DIFFERENCE BETWEEN MENTORING AND OTHER INSTRUMENTS

Mentoring is often equated or confused with coaching. Both programmes have their reason for existence and, depending on the objectives or target group, it is necessary to define exactly which instrument is the right one for the respective situation.

The coach works as a consultant together with his clients process-oriented, which is primarily "help for self-help". The assumption is that the individual can develop the solution himself through support and targeted questions from the coach. Coaches work with a variety of methods to support clients' self-management skills and are paid for their services.

Mentoring is a long-term relationship and an exchange of experience and knowledge transfer between two or more people. The coaching is limited in time and strongly goal-oriented, as an economic background is given. Fig. 4 shows an overview of the main differences according to Jobteaser, 2021.

Coaching	Mentoring
task oriented	based on a relationship
with one's own methods	have know-how and experience in their field
Stimulates self-reflexion, so that one can find their personal path	shares knowledge and skills
asks questions and provide help to find a solution	advises and supports with their expertise, initiate development
gives no direction	show a possible way
takes place at eye level	exists a hierarchical gravient
neutral point of view	personal opinion is included in the advice
temporary relationship	long-term relationship
paid service	without a monetary benefit

Fig.4 Coaching vs. Mentoring

A professional coach usually documents his qualifications through well-founded formal training or further education towards his clients and clients, ensures the quality of his work through continuous practical reflection (supervision) and through membership in a professional association that has demanding admission criteria.

These requirements are not placed on mentors. Necessary counselling skills are usually qualified selectively and at short notice in introductory workshops for mentors, and there is often an offer of group supervision or individual coaching for them. Mentoring is referred to by some coaching experts as the semi-professional variant of coaching (Rauen 2014).

Both coaching and mentoring are a meaningful and important support option when it comes to personal development. While mentoring in companies was primarily aimed at career starters, it is now also established as a development tool for prospective and new managers.

4.4 FACTORS FOR SUCCESS

The success of the mentoring depends on several factors: did the cooperation in tandem work well? Have the mentor and mentee come together harmoniously? Were the desired goals of the mentoring programme achieved? There are different levels of success, depending on which aspect is scrutinized. A joint development progress of the participants, especially the mentees, is desired.

The mentoring programmes are often referred to as "win-win situations", as both the company (from business, science and administration), the mentor and especially the mentee benefit from them. Mentoring has three main functions for companies:

- As an instrument of personnel development, the knowledge and experience - both formal and informal knowledge - of the mentors is passed on to the mentees.
- The dialogue between up to four different active generations in the company - from the beginning of their careers to shortly before retirement - is improved.
- A mentoring programme has a prestige function: in times of "war for talents" this is a tool with which loyalty to the company is intensified and potential executives are attracted to a company (Niemeier 2009).

The mentoring concept enables mentees:

- to gain a better understanding of organisational contexts,
- to develop greater behavioural sovereignty,
- to clarify and initiate professional development opportunities,
- to improve self-assessment and thus make better use of strengths and practice dealing with weaknesses,
- to experience appreciation by the mentor and thereby strengthen self-confidence, motivation and job satisfaction
- to develop perspectives by addressing cross-professional issues in the sense of a work-life balance,
- to recognise and internalise ethical principles,
- and, if necessary, to establish long-term contact with the mentor beyond the time agreed upon in the programme.

A mentoring concept enables mentors:

- to be introduced to the industry culture and thereby shape it,
- to reflect on their own career, working style and leadership behaviour,
- to optimise social and communication skills
- to receive new impulses and ideas through the confrontation with the "fresh view" of junior staff.

Not only for the world of surveyors do these positive effects have an additional relevance. The professionals and managers become more committed, more productive and the communication and networking between the participants is stimulated. If the mentees communicate this enthusiasm for the profession to the outside world, this is a positive image for the profession. In the long run, this would be a measure against the shortage of skilled workers.

Often the further progress of a company is slowed down by some employees. The reason for this is fear of the "new". The advantage of the joint growth of mentors and mentees can also lead to better cooperation in a company, according to Albert Einstein's statement: "Progress lives from the exchange of knowledge" (Bendt 2000). In this context, more effective processes can be developed as well as communication between workers can be more appropriate.

5. CAREER PLANNING – EXAMPLES

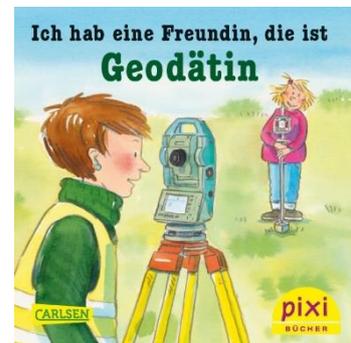
With respect to the recruitment of young talents, many initiatives have developed that offer both informal support and organised guidance with formal programme. Following the 14 % decreasing numbers of first-year students in surveying over the last 5 years (destatis 2023) an increasing shortage of surveyors is to be expected soon.

The insufficient availability of surveying experts in administration, economy and academia has been identified in various German publications (IGG 2018) and counter measures have been initiated. Early in 2014 the former DVW president Prof. Karl-Friedrich Thöne held a speech in Vienna, Austria about the need of experts and the strategy with activities "to improve the general image of the profession and its public perception" (Thöne 2013 and 2014). He predicted the trend regarding the decrease in the number of surveyors from the 90th to 2020 – only half of the specialists would still exist after 30 years.

The time of the CORONA pandemic has changed a lot and slowed down some activities. But since digital exchange over long distances is definitely a good possibility, networking between experienced professionals and newcomers is also still possible, as impressively demonstrated at INTERGEO digital 2020, for example. Other successful digital events have fortunately been replaced by LIVE meetings and conferences meanwhile or take place as hybrid events.

5.1 BEST PRACTICE IN GERMANY AND EUROPE

For some years now, the increasing lack of young people has been countered by a number of measures. Initiatives with the youngest children, such as the PIXI booklet, meanwhile available in english and special campaigns in schools are used to to arouse interest in the subject at an early age. There is an annual week in the federal states of Bavaria, Baden-Wuerttemberg and North Rhine-Westphalia to inform the public, and the younger in particular, about the diverse and interesting tasks of surveyors. In administrations and universities there are specific information days as well.



The proportion of women in particular also offers potential for attracting young people. Approximately 30 - 40 % of geodesy students are female (destatis 2023). Due to the lack of opportunities to reconcile work and family life, many women do not work at all or work part-time later in their careers. There is a lack of good role models so that women are willing and dare to advance their careers, e.g. as managers. In academia, too, there are only few applicants for female professorships and in terms of diversity requirements an increase in the female share is needed.

Universities offer tutorials, coaching and mentoring in variations, providing support for first-year students in surveying particularly. Mentoring is offered at the KIT in Karlsruhe, for example, as support for first-year students given by experienced students, called "student guides". A financial compensation for the mentors is included (Karlsruhe 2023).

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The University of Bonn chooses a different approach with its Geo-Mentoring together with the Economic Development Agency (Geo Business Region Bonn 2020). An experienced person exchanges ideas with a student over the year in order to raise knowledge of career opportunities, especially in public administration.

Other examples can be found at the Jade University and the University of Hanover, whereby the orientation is either more technical, in some cases more individual or also mixed. (Jade-Hochschule 2023, Leibniz Universität Hannover 2023).

The DVW, German Association for Geodesy, Geoinformation and Land Management, provided mentoring exclusively for female colleagues in a pilot phase last year. The one-to-one tandems were formed regionally to allow face-to-face exchanges, and the meetings took place at least once a month over a six-month period (DVW 2022). The aim is both sharing experience on job-related topics and informal knowledge and providing advice on career planning. The mentoring was organised by the network "Women in DVW" and will be offered this year as a programme for all surveyors in DVW.

In Greece a special female programme is available from an organisation called „Women on Top“. The organisation aims to promote women professionally and in terms of financial independence. As part of this promotion, a mentoring programme is offered by women for women. Either a three-month or six-month mentoring is provided, as well as a combination of mentoring and coaching; the programme can be chosen by the mentee for a small fee. The mentee can select a suitable mentor from a list of potential mentors and submits a cooperation request. If the mentor agrees, a tandem is formed. The purpose of this mentoring is the professional development of the mentee (Women on Top 2023)

In Austria, mentoring for students is similarly offered at the Technical University of Vienna. The focus is on professional support from successful students in higher terms (BLMA group - Blended Learning - Methods and Applications), so that deficits especially in mathematics can be eliminated at an early stage (Technische Universität Wien 2023). The drop-out rate is known to be as high as 30% in other countries as well. Corrective measures are needed at an early stage.

25 years ago in 1997, the DVW had only 6.8% female members. At that time, 4.3% of the DVW working group members were female (Przybilla 2019); this number increased to 24% in 2023 - encouraging, but there is still room for progress. The share of female students has remained constantly at 31% for years, but due to the overall decreasing number of students, 14% fewer women do studies of surveying in university since 2017 (destatis 2023).

The Institute of the German Economy reports 2021 the share of women in employment, liable for social insurance contributions, for the engineering jobs of construction/ surveying/building technology, architecture at 32.4 % (VDI 2021).

According to the article published in NATURE Communicate female peer mentors early in college have lasting positive impacts on female engineering students that persist beyond graduation (Wu et al. 2022).

Visible role models are important, they give young women self-confidence, awareness of possibilities, ensure broader acceptance of female careers and motivate them to pursue their own careers. (BMBF, 2020).

5.2 DVW RESULTS OF A SURVEY 2023

Mentoring gives intensive support as well as motivation and is to be considered as a helpful tool. A DVW survey among female colleagues showed the following settings according to Fig. 5 - 7 in the women's network:

1. working in surveying industry/real estate/geography/ landmanagement/geodata management

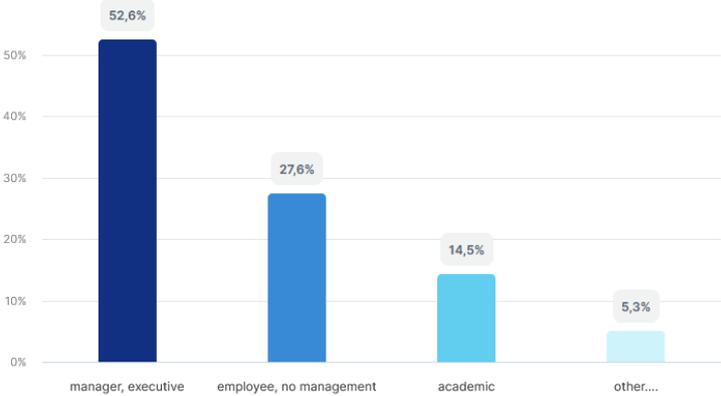


Fig. 5 working field

2. during education/ as young professional I got support by mentoring

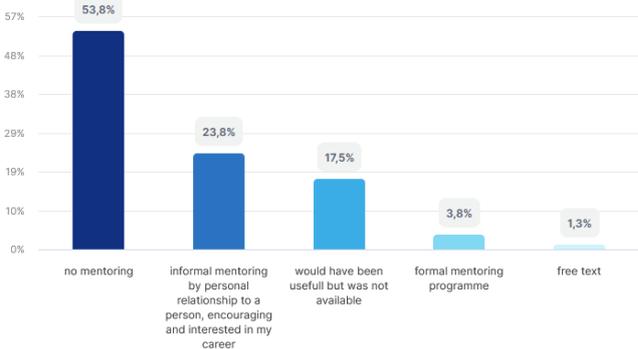


Fig. 6 support by mentoring

More than half of the participants work as managers and 54% had no mentoring support in the past. Around 25% had personal contacts that helped with career planning on an informal level. 17.5% would have liked to receive mentoring during their studies. 78.2% of respondents

recommend mentoring for people while they are in education or at the beginning of their career, and 19.2% would perhaps recommend it.

3. I would recommend a mentoring for education or career starters

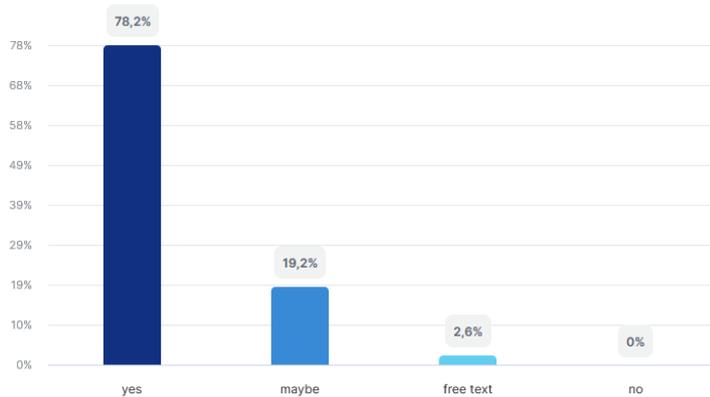


Fig. 7 recommend mentoring

In order to achieve a career as a manager mentoring in the job is now an established practice in public administrations and companies. It often depends on the women's own initiative to find and demand this mentoring. Women at leadership levels in surveying have remained rare, as in STEM fields overall (BMBF 2020). According to the UNESCO World Science Report 2021 (Unesco 2022), only 28 % of engineering degrees are completed by women. In the scientific environment at universities, for example, there are less than 10 % female professors in surveying education in about 25 universities offering different education programmes. In the field of publicly appointed surveyors “ÖbVI”, the number of female directors has been increasing over the last 25 years, but it is still below 20 % nationwide. In all cases of female employment, the combination of family and work is mostly only achievable with good childcare facilities.

5.3 BEST PRACTICE INTERNATIONAL AND AT FIG

The well-known initiative "Get kids into survey" in Great Britain starts with advertising for the profession among the youngest (Ball 2017) and successfully inspires the new generation of surveyors. Furthermore there are special young talent initiatives as well at ESRI like the booklet “Lindsey the GIS Professional” (Danielson 2023) such as the German “PIXI book”. In addition to the exciting topics of the profession for the little ones, there is a focus on students through mentoring.

In Australia, the Surveying & Spatial Sciences Institute SSSI has been offering the following mentoring for young professionals since 2021 (SSSI 2021 and 2023), as shown in fig. 8:

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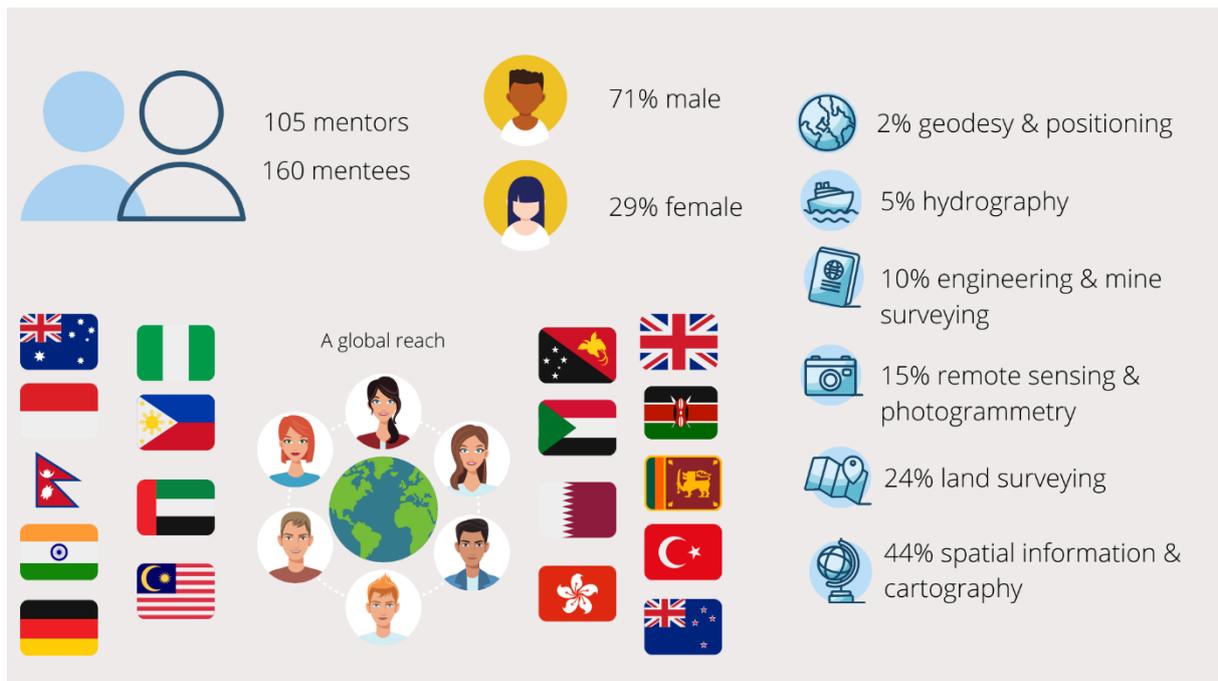


Fig. 8 Mentoring SSSI

Starting last year, the FIG YSN Mentoring Pilot Programme has been in place with an offer specifically for Africa - Africa Regional Network - ARN with the participation of Surveying & Spatial Sciences Institute, Australia. " It aims at engaging the youth leading to their integration into our professional and workplace structures providing them with opportunities and to promote resilience in the profession." (FIG 2022) This programme, once successfully implemented, should serve as a model and possibly could be scaled up to more participants.

6. CONCLUSION

To make jobs attractive to young professionals, a company must adapt to the needs of young professionals. Young professionals express their opinions more freely than previous generations and they want to be heard. They need personalized workplaces and they want to believe in the value of their work and the purpose of their company.

According to a survey amongst young students during INTERGEO 2022 in Essen, Germany, a work-life balance is very important to young professionals. While a high income is desired by the respondents, at the same time they need flexibility, caring employers and a healthy working environment. Since time off is very important to this generation, they want to be part of a team, but not managers. (DVW AK1 2022)

For these reasons, the skills shortage is a challenge for the surveying world. A mentoring programme can be the appropriate measure against this problem.

In Germany as well as internationally, there are many mentoring initiatives from different organisations. The focus of mentoring is mostly on young professionals or women, as potential is recognized there. The results of the survey among female professionals of the authors, more than half of them executives, confirm the positive benefits of a mentoring programme: almost 80% of the respondents would recommend a mentoring programme during education or at the beginning of their career.

A mentoring programme is a step towards optimally preparing young surveyors for the working world. At the same time, it is also an opportunity for the older colleagues to be open to new points of view and new impulses. It is the mobilization of several organisations for a better cooperation, for the promotion of younger and older colleagues. Furthermore it is a way to introduce more young professionals to the market and to be able to offer an attractive exciting workplace in the future.

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