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MINT (STEM) MENTORING IN BAVARIA:
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With lots of love to my children!

You always knew me as a mom,
who was working full-time and studying part-time.

.... wishing you will have a more traditional educational experience.

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Abstract

This research project develops an understanding of the MINT (STEM) mentoring programs geared to – and currently offered to – female students at Bavarian Universities of Applied Sciences.

Using survey responses from mentors, mentees, and program managers, a functional model of mentoring was tested, exploring the understanding and support – or lacking support - of these MINT mentoring programs in their organizational and societal context were explored. Furthermore, the matching process, the perceived factors that might contribute to success of mentoring, and the development and growth of individuals in the mentor-mentee relationship and the organization overall, were assessed. Lastly, the perceived need for female mentors in these mentoring programs were examined. Development and growth of the mentors and the organization's programs are perceived, but the same does not hold true for the mentees. Recommendations to enhance the program and to augment mentee growth and development are explored.

Key Words: Mentoring, STEM / MINT, Mentor, Mentee, Individual Development, Organizational Development, Formal Mentoring Programs

Chapter 1: Introduction/Context of the Study

“One of the factors a country's economy depends on is human capital. If you don't provide women with adequate access to healthcare, education and employment, you lose at least half of your potential. So, gender equality and women's empowerment bring huge economic benefits.”

~ Michelle Bachelet, 2014

As this quote above by the Chilean President Michelle Bachelet (2014) acknowledges, nations highly depend on utilizing all human resources available to them in order to ensure that economies continue to exist and thrive, especially in times of demographic changes; modern societies cannot afford to neglect a workforce's full potential, which includes fair and equal access for all to healthcare, education and employment to empower everyone, including women (United Nations Entity for Gender Equality and the Empowerment of Women, 2014). While it seems to be a concern worldwide that women are underrepresented, i.e. on corporate boards (Kang & Payal, 2012), and that the worldwide gender pay gap is, if anything, closing extremely slowly (Tilley, 2012) as documented through the World Economic Forum (2014), some European nations seem to place a particular emphasis on gender mainstreaming (Bundesministerium für Familie, Senioren, Frauen und Jugend, 2014; Europa - Summaries of EU Legislation, 2014) because they are at the same time dealing with the effects of demographic changes, a shrinking and aging population (Hoßmann, et al., 2008), and a smaller pool of eligible employees to hire from (Bundesministerium für Arbeit und Soziales, 2014; statista - Das Statistik-Portal, 2014).

To counteract the effects of lack of qualified labor, in particular in some of the highly specified fields in demand on the labor market such as mathematics, engineering,

natural sciences, and technology – known as MINT in Germany and known as STEM (science, technology, engineering, and mathematics) in the United States of America – the government enacted and supported programs at different European, federal and state levels (Bundesministerium für Bildung und Forschung, 2014; Steinbeis-Europa-Zentrum, 2014; Die Frauenbeauftragten der Bayerischen Hochschulen, 2014; Forum Mentoring - Bundesverband Mentoring in der Wissenschaft, 2014).

Mentoring in Higher Education

One of the initiatives is the mentoring program established at institutions of higher learning with the focus on gaining new female students, retaining them at the university, and ultimately placing the female graduates in industry with a particular focus on the MINT degree programs (Forum Mentoring - Bundesverband Mentoring in der Wissenschaft, 2014). Due to the fact that education in Germany is not considered to be a responsibility of the federal government, but is the responsibility of the individual states based on the sovereignty guaranteed to them (Konferenz der Kultusminister, 2014), the sixteen German states have different approaches to mentoring programs in place (Forum Mentoring - Bundesverband Mentoring in der Wissenschaft, 2014).

Focal points of this paper are the mentoring programs in the state of Bavaria, which are differentiated in mentoring at research universities and universities of applied sciences (UASs, also known as Hochschulen für angewandte Wissenschaften – HAW) (Die Frauenbeauftragten der Bayerischen Hochschulen, 2014). There are 17 public UASs, 11 private UAS's which have an association with a particular organization or religious denomination (Bayerisches Staatsministerium für Bildung und Kultus,

Wissenschaft und Kunst, 2014) plus 19 research universities with similar mentoring programs in place (Ludwig-Maximilian-Universität München, 2014).

Three Levels of Mentoring for Career Advancement

Over the past few years, three different levels of gender mentoring were developed at the Bavarian universities of applied sciences. Initially, the program started out in 2005/06 with the mentoring of female students in semesters three and up, who were mentored through females that already were established in industry (Die Frauenbeauftragten der Bayerischen Hochschulen, 2014). This particular level of mentoring is now referred to as “professional steps”. The aim here is predominantly to prevent drop-out from the degree program due to demanding and sometimes hostile social conditions (Die Frauenbeauftragten der Bayerischen Hochschulen, 2014). In the often times male-dominated MINT programs, the study climate can be demotivating; furthermore, it is typical for doubts to appear that a degree program and future career can actually be achieved by females in these fields (Falk, Kratz, & Müller, 2014). Therefore, these programs place an emphasis on providing role models and a potential path to enter industry, so the goal of becoming successful and building a career, especially in traditionally male-dominated areas, appears more realistic (Die Frauenbeauftragten der Bayerischen Hochschulen, 2014).

Another level of mentoring was established in 2008/09, which is called “first steps” and is actually addressing the needs of mentees at a slightly earlier stage in their study career (Zentrum für Gender und Diversity, 2014). Here, female students of higher semesters are available to mentor first and second semester females. The aim here, once

again, is to ensure that the young students see that females can also advance in these degree programs, even if they might sometimes just make up less than 10 % of the student population in a particular cohort of the MINT fields (Gleichstellungskonzept OTH AW, 2014). The predominant reason for females to drop out of the degree programs in their first and second semester are typically the challenging subjects of the initial year; here, mentorship through higher semester female students provides not only subject-matter assistance, but also displays the possibility of success in every encounter and encourages to stay with the degree program (Die Frauenbeauftragten der Bayerischen Hochschulen, 2014).

The third level, “MINToring”, started in 2011/12 and encourages the enrollment of female students in the MINT study fields. As part of this mentoring level, university mentors are introducing the MINT study fields at local high schools and technical secondary schools to cause potential female students to be more open towards and gain their interest in choosing a technical study field. To achieve this, university mentors visit schools with an interactive project that gets the students involved in thinking about the different technical and business disciplines necessary to bring a particular product, such as a coffee machine, to market. Consecutively, students are then invited to visit the university labs to receive an introductory lecture by one of the lab engineers or professors. Afterwards, they tour the campus with their university mentor and get a brief introduction to student life. This program’s intent is to increase awareness of MINT study fields in female high school students and raise their interest in the field. Ultimately the mentoring program is designed to increase the number of enrollees.

Purpose and Outline of the Study

This paper seeks to develop an understanding and gain knowledge of the MINT mentoring programs geared to - and currently offered to - female students at Bavarian universities of applied sciences (UASs). Within the research of this paper, only public UASs within the geographical area of Bavaria were examined with their respective MINT mentoring programs.

This analysis focuses on one and level two mentoring (professional steps and first steps) as described above. Level three, MINToring, is excluded because it takes place at the high school level and does not feature ongoing engagement with an industry or university mentoring.

In chapter two, the relevant mentoring literature is reviewed, providing insights into the bases of mentoring, such as learning, social, and developmental theory, and then continues to discuss the inputs required for mentoring to take place. Furthermore, the processes and relationships between mentor and mentee are reviewed as well as relevant outputs of the mentoring process, all within specific contexts of mentoring.

Based on this literature, the research questions are introduced in chapter three, which is also dedicated to presenting the methodology used for researching the research questions. The presentation of the methodology also entails a discussion of the quality criteria of objectivity, validity, and reliability for the methods used.

Chapter four uses survey responses from the mentors, mentees and program administrators at Bavarian UAS's, to examine how well the programs are understood by the mentors and mentees, and how the program managers understand and communicate the programs within their respective university settings as well as to the industry

mentors, where some of the mentors are gained from. Other topics in the survey included, the organizational or societal context and support received – or lacking – while carrying out the mentoring program, the matching process, the perceived factors that might contribute to success of mentoring, the development and growth of individuals in the mentor-mentee relationship and the organization overall. Lastly, the perceived need for female mentors in these mentoring programs was examined.

In chapter five, the findings are compared to existing concepts and programs in the scholarly literature, where the relevant concepts of mentoring were reviewed. This comparison allowed for determination of what elements, issues, or relationships are not sufficiently addressed in the current 3 level mentoring programs. This determination entails also the potential lack of understanding in respect to some dynamics not thought about in the design of the program.

Ultimately, all of the above-named aspects surveyed should lead to a better understanding of the current mentoring programs and add insights through exploring issues and relationships while at the same time elucidating and expanding knowledge. In the final chapter, I make recommendations for how to improve the processes of Bavarian UASs mentoring programs based on my findings. In addition, the comparison of my findings and the literature exposed inaccuracies and gaps in the literature, which I articulate in the discussion and conclusions sections. Lastly, implications of this research and recommendations for gender mentoring programs are discussed.

Terminology

Some of the literature is utilizing the terms of mentor and mentee (Giscombe, 2007; Dominguez & Hager, 2013); others prefer to refer to mentor and protégé (McKeen & Bujaki, 2007; Kram, 1983). In this paper, the terms mentor and mentee are used because of their more active attitude towards mentoring (Garvey, Stokes, & Megginson, 2014).

Furthermore, some of the researched literature is occasionally also addressing sponsoring (Ibarra, Carter, & Silva, 2010; Sandberg, 2013) instead of, or simultaneously to and part of (Eby L. T., 1997), mentoring. In this case, a clear distinction must be made; while mentoring is providing social and psychological support to assist protégés in their professional and personal development, sponsoring is predominantly concerned with the referral and recommendation for particular job vacancies at higher organizational levels (Ibarra, Carter, & Silva, 2010; Hewlett, Peraino, Sherbin, & Sumberg, 2010). Typically, sponsors are holding far senior positions and take influence and advocate for the protégé's advancement (Ibarra, Carter, & Silva, 2010; Hewlett, Peraino, Sherbin, & Sumberg, 2010). Therefore, within this paper the terms are not utilized interchangeably, but instead clearly relate to the above described concepts and their different meanings.

Chapter 2: Literature Review

The literature review follows the structure of a proposed model of a functional perspective on mentoring, which is guided by theoretical influences on mentoring programs and entirely embedded in the context of mentoring going on (see Figure 1).

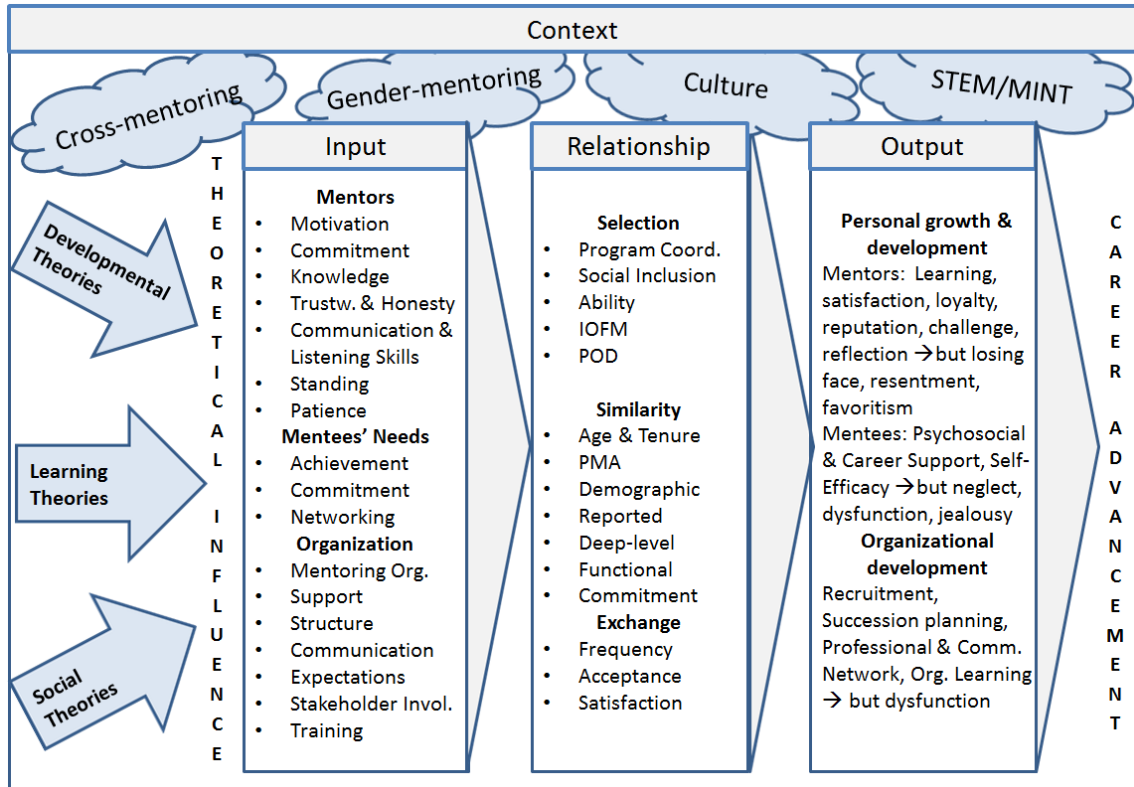


Figure 1: Functional Model of Mentoring
(Source: own depiction based on literature)

In order to follow this proposed functional model of mentoring, the literature review begins with exploring the development of theoretical concepts and frameworks underlying the understanding and practice of mentoring, mostly following a structural approach based on an article by Dominguez and Hager (2013).

The first section describes the treatment of mentoring in development, learning and social theories. The second section present literature regarding cross-mentoring,

gender mentoring, culture, and MINT programs. With the exception of gender mentoring which is a concept tested in my research, these literatures provide historical background and provide information on the contextual framing surrounding my functional. Reviewing these literature is necessary for understanding of the construct of mentoring but they are not directly tested in my analysis.

The concepts that are the primary focus of my analysis are the different inputs required for mentoring to take place, the relationship develops between mentor and mentee as assisted through potential organizational processes such as the selection and matching taking place as reflected in the literature and the output of mentoring in the form of development for the individual and organization. These are presented sequentially and the potential benefits and shortcomings are discussed.

Derived from the literature review in each of the sections described above are the research questions, as they pertain to the design and evaluation of the MINT mentoring programs at Bavarian UASs. These questions are embedded in the functional model (Figure 1) and provide the basis for research question testing.

Development of Concepts and Frameworks of Mentoring

As with any other practice, concepts of mentoring and their underlying frameworks developed throughout the ages. Much of what is known about the mentoring origins today stems from historical narratives (Garvey, 2011).

Early Mentoring in History

The earliest example of mentoring found seems to be in Greek mythology presented in *The Odyssey* told by Homer; here, Odysseus entrusts his son Telemachus to Mentor while going away to fight the war in Troy. Mentor was supposed to be a guardian to Telemachus with the intent to advise, nurture and protect him and the entire royal household (Garvey, 2011; Garvey & Westlander, 2013). According to Carruthers (1993, p. 9) "...[a] Mentor had to be a father figure, a teacher, a role model, an approachable counsellor, a trusted adviser, a challenger, an encourager..." Furthermore, Little (1990) elaborates that "...the relationship required of Mentor was a full measure of wisdom, integrity and personal investment", which entails an intentional manner of carefully and purposefully concluding his entrusted tasks towards Telemachus and enabling him to live up to his full potential (Anderson & Shannon, 1995; Clutterbuck, 2014).

At a later point in history, British and French literature started to use the term mentor to mean 'wise counselor' as of the 1700s as well as in the education of teachers (Garvey & Westlander, 2013). Up to this point, mentoring, if at all, took place in a somewhat unorganized or informal manner (Russell, 1991); the first documented formal mentoring program was established by *The Jewel Tea Company* in 1931, where new employees with an MBA were matched with experienced senior managers to mentor them during the initial stages of their career within the company (Douglas, 1997; Russell, 1991).

From this point on, simultaneously to informal mentoring, formal mentoring programs and matching of mentors and mentees took place in many different contexts and locations (Russell, 1991).

Theoretical Concepts Influencing Mentoring Approaches

While the practice of mentoring is evolving and further developing, several underlying theoretical concepts have influenced mentoring approaches (Dominguez & Hager, 2013; Garvey, 2011); the three major influential theoretical approaches onto mentoring programs (see Figure 2) are considered to be developmental, social, and learning theories (Dominguez & Hager, 2013).

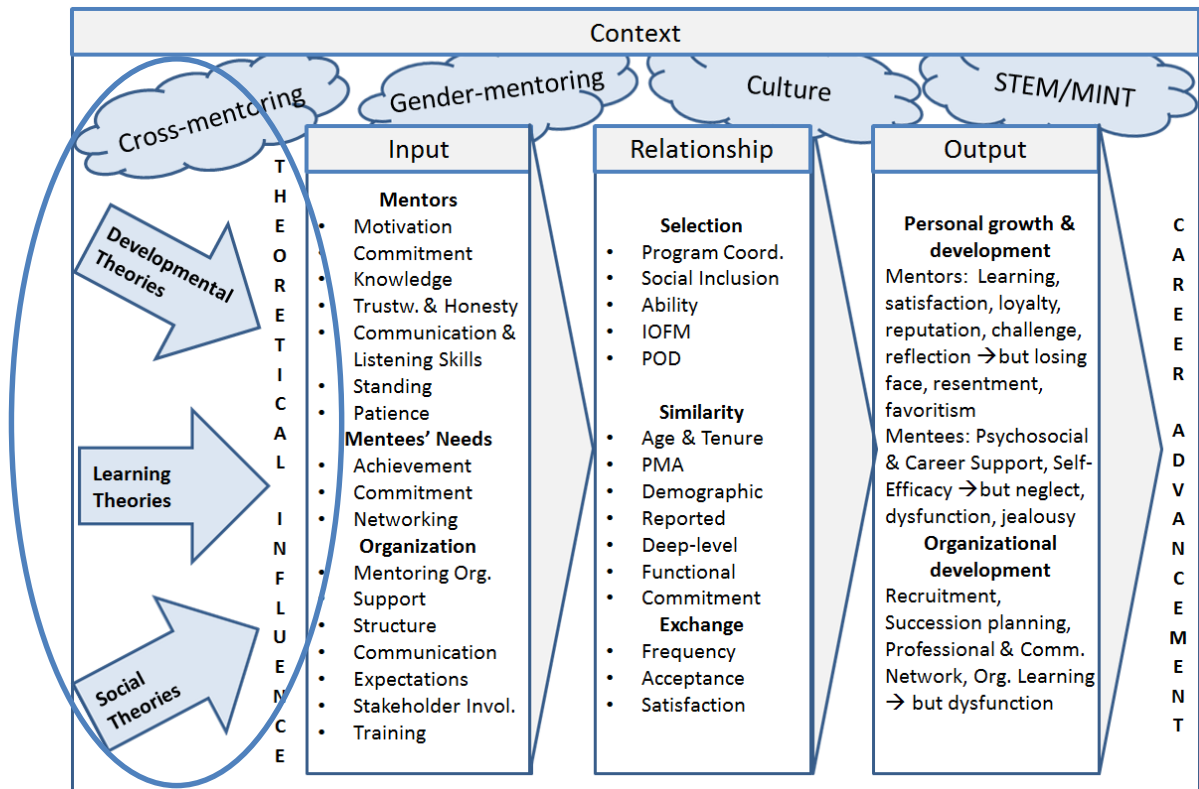


Figure 2: Focus on Theoretical Influences of the Functional Model of Mentoring
 Source: (own depiction)

The predominant developmental theories, such as Levinson's life stage theory (Levinson, Darrow, Klein, Levinson, & McKee, 1978), Kram's mentoring phases (1983), and Kegan's developmental stages (1982), all offer insight into the theories related to mentoring concepts. Similarly, learning theories pose a theoretical base for mentoring, such as andragogy (Holton III, Swanson, & Naquin, 2001), behaviorism (Schermerhorn Jr., et al., 2008), cognitivist learning theory (Leonard, 2002), constructivism, action and social learning (Dominguez & Hager, 2013), as well as transformative learning (Leonard, 2002). Additionally, social theories such as socialization, human or social capital theory, social network theory and communities of practice also seem to be influential (Dominguez & Hager, 2013). Given the overarching research question and the research design, these bodies of literature are all outside the scope of this inquiry and are not reviewed herein. The literature focus, instead is restricted to the literature that is salient to the research.

Contexts

These theoretical frameworks all take place in different contexts, that also might influence the inputs, processes and outcome of the mentoring.

Gender and Race Cross-Mentoring

Cross-mentoring in gender and racial contexts were deliberated on in a study by Lyons and Oppler (2004), who confirmed through their study that racial effects in mentoring dyads had no impact on satisfaction with the mentoring process, while gender composition only had minimal influence. Ragins and McFarlin (1990) also

indicated that the most important difference between mentoring across gender is socializing after work for the potentially perceived sexual nature and inappropriateness of time spent together outside the organization.

In a related approach of (cross-gender) mentoring, women as well as men determined more similarities than differences in what they considered to be important in mentoring functions and relationships, with the only exception being that for women confirmation, championing, and acceptance are more important than for men (Levesque, O'Neill, Nelson, & Dumas, 2005).

In a qualitative study by Barrett, Cervero and Johnson-Bailey (2004), they found that black employees in the human resource development department were not only more challenged in the workplace in general due to belonging to a minority group, but they also had a harder time finding a mentor, which ultimately resulted in them being mentored by their direct supervisor after not being able to find someone to be matched with.

Lastly, a particular form of mentoring, e-mentoring, is found to be a suitable tool for women either returning to the workplace or attempting to advance, so long as the matches made between mentor and mentee are made based on careful psychological profiles and analytical skills (Headlam-Wells, Gosland, & Craig, 2005). In general, Ensher and Murphy (2007) claim that mentees receive mostly the same benefits through e-mentoring as in regular face-to-face mentoring programs, while organizations not only reap greater commitment, retention rates and loyalty, but additionally benefit from cost-effectiveness.

STEM Mentoring

In their qualitative study of female Latina engineers and scientists, San Miguel and Kim (2014) found that determinants of various mentoring types and numerous mentors actually can lead to success of mentoring as long as a mutual agreement and social support of mentors is provided to the mentees. In her work, Anderson (2005) also discusses the importance of having mentors, in particular in biotechnology, another STEM field that is a fast-moving industry requiring networking, to assist in advancing women's careers. Anderson (2005) advocates for formal programs, so females do also receive a chance to be exposed to informal corporate networks so crucial in having their career sponsored – regardless of male or female mentor – to ultimately assisting them to move upwards in the organizational hierarchy and consequently having a chance to function as mentors and role models themselves.

Also in a scientific research and development setting, Borredon and Ingham (2005) concluded in their case study that communication is crucial and questioning of fundamental assumptions of mentors and mentees imperative for a good mentoring process, even though it cannot be avoided that some gaps appear between what mentors and mentees perceive to be necessary for learning.

Cultural Influences

In their multi-level analysis, Gentry, Weber and Sadri (2008) examined mentoring in respect to career development and managerial performance while using results of the GLOBE study as basis, with the indication that mentoring seems even more important and necessary the higher the performance orientation of the respective

culture is. Since the above study provides a rather high-performance orientation score for Germany, one would gather that mentoring in order to achieve career success would be all the more important in the context of this paper, which is researching mentoring taking place at Bavarian universities.

Structured Approach to Mentoring

This section presents two structural frameworks from the literature that were adapted to create the middle components of the author’s function model of mentoring. First is Baugh and Fagenson-Eland’s (2007) framework for formal mentoring relationships. They start by regarding structural features also using an approach of inputs in form of characteristics of mentor and protégé, then looking at the process of mentoring along with training and organizational support, and coming to its conclusion with outcomes derived for mentors, protégés and organization (see Figure 3).

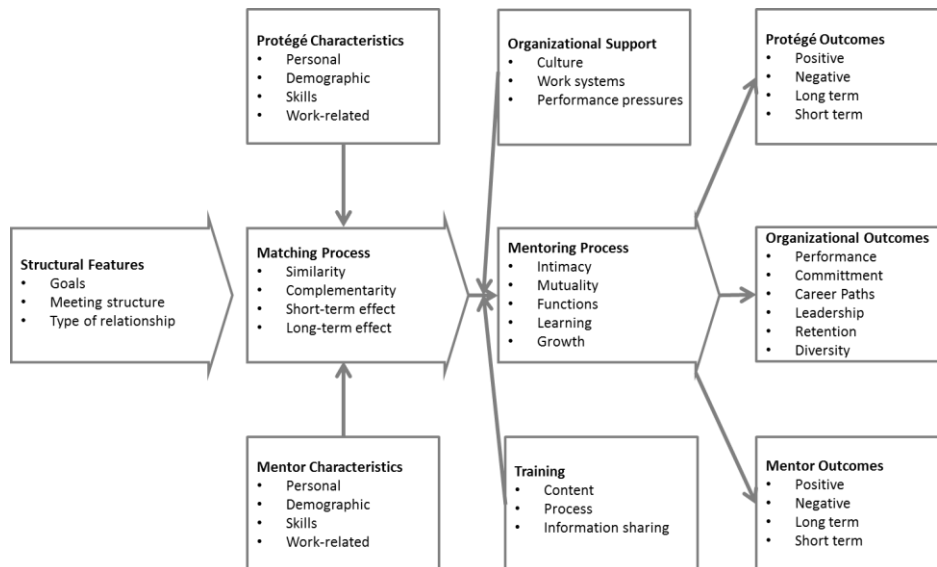
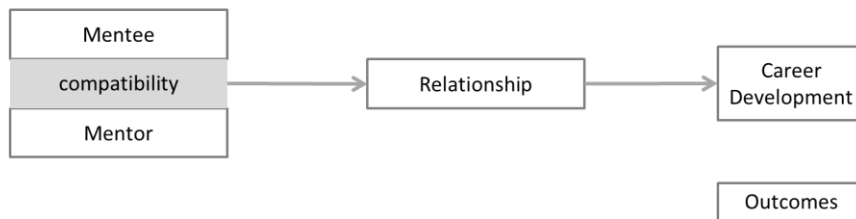


Figure 3: Framework for Investigating Formal Mentoring Relationships

Source: (Baugh & Fagenson-Eland, 2007)

On the other hand, Thorndyke, Gusic and Milner (2008) use a more basic approach by examining the needs of the mentee and the skills of the mentor working together in a project, where outcomes and relationships develop simultaneously and lead to career advancement, as can be seen in Figure 4 on the following page.

„Traditional“ Mentoring



Functional Mentoring

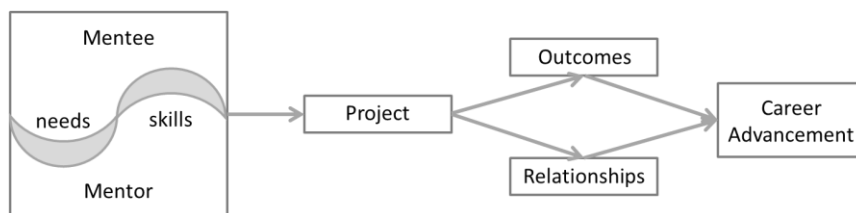


Figure 4: Traditional vs. Functional Mentoring

Source: (Thorndyke, Gusic, & Milner, 2008)

Instead of the approaches discussed briefly above, the author, in her model, adopts different aspects in the categories of inputs required, processes taking place, and finally outputs desired and achieved. These three categories are further elaborated in this part of the literature review, starting with the inputs. For clarity and ease of reading, the individual aspects identified in the literature and included in the model are bold-printed. At the end of each subsection, the specific variables that will be included in this research are identified.

Inputs Required

Within the functional model of mentoring, first the inputs consisting of mentors and their respective traits, then the needs of the mentees, and lastly the structural components within the organization need to be considered.

Mentors

According to Kathy Kram (1983, p. 616) mentoring serves "...psychological functions..." as well as career functions. In order to perform these functions of a mentor well, literature suggests for mentors to possess several qualities.

Clutterbuck (2004) is outlining ten mentor competencies that make an effective mentor: 1. Self-awareness and understanding oneself so to identify and deal with one's own behaviors within the mentoring relationship; 2. Behavioral awareness and understanding others and why patterns of behavior might occur between personalities or groups of individuals; 3. Business knowledge and experience; 4. Sense of good humor, since appropriate laughter can be invaluable to build rapport; 5. Communication competence made up of a variety of skills such as listening, observing, producing the right words for the situation and emotions, and exiting; 6. Conceptual modeling made up of a portfolio based on knowledge and experience; 7. Commitment to life-long learning for oneself; 8. Solid concern for developing other individuals; 9. Maintaining relationships and building rapport through trust, focus, empathy, congruence and empowerment; and lastly 10. Clarity of goals of what is to be achieved and why. Some of these aspects elaborated on by Clutterbuck will be further discussed below based on specific articles.

Since mentoring requires a significant amount of energy and time on part of the mentor, motivation to serve as a mentor seems to be of primary importance (Allen, 2003), but the underlying motives for doing so may be manifold. While the motivation of being helpful seems to be the most relevant motivation for career mentoring, other-oriented empathy accounts more for psycho-social mentoring (Allen, 2003). Additionally, research has indicated that individuals who volunteer to become mentors, even though not necessarily highly committed to their own organization or performers of exemplary behavior, certainly do have aspirations to further their own career (van Emmerik, Baugh, & Euwema, 2005).

Similarly, a **mentor's commitment** to the formal mentoring relationship as estimated by both, mentor and protégé, is positively related to the quality of relationship perceived by both individuals (Allen & Eby, 2008). Surprisingly, though, this study found that the commitment does not have as strong of an impact on female protégés as on male ones, even though females in general seem to find relational commitment more important (Allen & Eby, 2008).

Knowledge and good understanding of the organization or industry as well as the value system within it or the people working in it are qualities important for a mentor to provide effective mentoring (Allen & Poteet, 1999). Similarly, Salter (2014) stresses that mentors of leaders or teachers not only need to understand the organization's culture, but also need to have specific knowledge in order to fulfill their mentoring function effectively.

Along with the intimacy that develops based on the psycho-social mentoring provided through mentors, the relationship requires a large amount of **trust** into the

mentor in order to flourish (Kram, Phases of the Mentor Relationship, 1983; Allen & Poteet, 1999; Son & Kim, 2013). Closely related is also the mentor's integrity and honesty, which is imperative in order to remain credible as a role model for the mentees (Allen & Poteet, 1999).

Furthermore, relational skills need to be present in the mentor in order to function effectively; those entail foremost and importantly **listening and communication skills**, which include being an excellent listener and wording something – verbally or in writing – clearly and concisely (Allen & Poteet, 1999). Furthermore, communication abilities must be coupled with conscientiousness, extroversion and openness in order to approach mentees (Niehoff, 2006). Similarly, novice mentors need to carry on learning conversations with more experienced mentors and need to absorb and be trained on how to become effective mentors through communication (Orland, 2001). Nonetheless, these communication skills should also include the mentor's ability to "...hold back uninvited advice" (Garvey, 2011, p. 10).

Additionally, **mentor's standing and socialization** within the organization is positively related to the support mentees receive in terms of their own socialization as well as role modeling and career functions (Yang, Hu, Baranik, & Lin, 2013).

Patience seems to be one of the last significant requirements for effective mentors, since for the mentor to pass on skill and knowledge requires being patient with the mentee (Allen & Poteet, 1999).

Mentees

After having collected many different qualities required from mentors in literature, now a closer look must be taken at the needs and requirements of mentees that may be considered prerequisite of them.

One of the required antecedents for mentoring to be effective is the desire by mentees to achieve in their career field (Lewellen-Williams, et al., 2006; Clutterbuck, 2004), which holds particularly true for those individuals who have a strong motivation through **achievement needs**; this desire coincides with the expectation to receive social or career support (Young & Perrewé, 2004).

Protégés that are highly committed to the mentoring process are far more willing to take on the advice of their mentor; however, the strength of their **commitment** depends strongly on the quality of the mentoring relationship perceived by the protégés (Son & Kim, 2013).

Willingness to be part of a mentoring program depends on personality traits – in particular openness to new experiences and agreeableness – as well as a positive help-seeking attitude; additionally, anticipation to fail or test anxiety along with a low level of perceived social support increase the inclination of individuals to participate in mentoring programs (Larose, et al., 2009).

Networking behavior, especially in early career stages of employees, facilitates self-initiated attempts to seek contact to potential mentors and subsequently receive mentoring as well as to achieve a higher position and higher income in an intermediate timeframe (Blickle, Witzki, & Schneider, 2009).

Furthermore, Clutterbuck (2004) also indicates that a mentee should possess some characteristics that make the individual valuable to the organization, i.e. intelligence that might be used to detect and resolve business-related issues, ambition for career advancement, and as such related succession potential in case the mentor moves up throughout the organization also.

Additionally, mentees describe their needs to be twofold: the developmental needs are made up of assistance in **forming career goals**, receiving **coaching and feedback** from their mentors, and support in **problem-solving** tasks, while the psychosocial needs entail **role modeling** and increased **self-confidence** (Ortiz-Walters & Gilson, 2013).

Organizational Inputs

In addition to the inputs provided by the traits of the mentor and the needs of the mentee, the functional model of mentoring also considers organizational characteristics as inputs to a functioning mentoring relationship.

According to Garvey, Stokes, and Megginson (2014) the typical mentoring organization possesses characteristics of a supporting culture; mentoring here would entail a strong connection to business issues and measurements of outcomes. Senior and top management would also be involved as mentors as part of the overall cultural change process and would support a strategic talent management that is clearly framed and publicized within the organization as such (Garvey, Stokes, & Megginson, 2014).

Organizational caring and support is perceived in incidents, where a mentor offers visibility, exposure and sponsorship of the protégé to other senior management in form of endorsements; similarly, protégés **perceive organizational support** when

psychosocial support is rendered by mentors in the form of role modeling (Baranik, Roling, & Eby, 2010). This is also supported by another study of Eby, Lockwood and Butts (2006), which indicates that psychosocial and career-related support as well as mentors' willingness to mentor are positively related to apparent management support of mentoring programs. This management support may also be expressed in the form of organizational rewards offered for the development of protégés (Allen, 2004).

In terms of structural attributes of formal mentoring programs provided by organizations, Lyons' and Oppler's (2004) research suggests that the organization clearly needs to communicate the expectations, such as frequency and process of assignment, to both mentors and mentees; according to them, these attributes seem to be highly related to satisfaction with the mentoring program, whereas demographic characteristics, such as gender or race, only seem to play a minor role.

Furthermore, it seems to be imperative for organizations to **clearly communicate** purpose and mission of the mentoring programs, where objectives should be unmistakably stated (Eby & Lockwood, 2005).

Part of this communication would also include program administrators' management of **realistic program expectations** through guidelines and purpose as early as in the formation phase of the mentoring relationship, since program participants will utilize this information as a basis for the evaluation of their mentoring program's success (Young & Perrewé, 2004).

Additionally, Stokes and Merrick (2013) postulate that organizations that are designing mentoring programs need to ensure **senior stakeholder involvement** along

with scheme purpose clarification, the proper matching process, and appropriate supervision and support for mentoring, all of which need to be evaluated regularly.

Furthermore, another component of organizational inputs – **training of mentors** – needs to be considered, since skill-development should be clearly tied to purpose and has an impact on the mentoring activity itself, whereas the mentoring program itself should to be evaluated regularly (Garvey & Westlander, 2013). Another application of training is to counteract reluctance to mentor, particularly in cross-gender or cross-racial dyads, by dispersing stereotypes and by helping to construct more solid interpersonal relationships despite demographic diversity (Lankau, Riordan, & Thomas, 2005). Training topics for protégés and mentors alike are suggested to ensure that a broad range of skills are conveyed that are potentially needed to deal with (negative) experiences in the relationship, such as trust-building issues, conflict management, pros and cons of mentoring, identification of problems, and building up realistic expectations towards the mentorship program (Eby, Butts, Durley, & Ragins, 2010).

So according to the literature, the inputs required on part of the mentor consist of the mentor's commitment to the mentoring relationship, knowledge and understanding of the programs, trust in their abilities and those of their mentees, their own good listening and communication skills, their standing and socialization in the organization, and the patience they have with their mentee. Furthermore, inputs on part of the mentees are prerequisites; their personality should be made up of achievement needs, strong commitment to the mentoring relationship, forming of career goals, coaching and feedback, problem solving skills, role-modeling, and self-confidence. Finally, organizational inputs including perceived organizational support, clear communication

of the programs along with realistic expectations, senior stakeholder involvement within the organization, and training of mentors are important to the literature.

Process and Relationship between Mentors and Mentees

Now that the inputs of the proposed functional model of mentoring have been considered as part of this literature review, it is time to turn to the different components of the aspect of process and relationship. To do this, this section first considers the matching process, then the similarity perceived between mentor and mentee, and finally the qualities of the exchange between both.

Selecting and Matching Mentors and Mentees

While with informal mentoring the relationship develops through mutual choosing of both mentor and mentee, often based on a mutual process of identification due to perceived similarity, formal mentoring employs program coordinators (in the case of UASs in this paper they are called program managers) who match mentors with mentees centered around certain criteria ranging from functional areas, randomness, career goals to personal characteristics (Ortiz-Walters & Gilson, 2013).

Even though the argument for formal mentoring programs consists mostly of social inclusion to render equal opportunities and offer diverse talents a chance to enter organizations and succeed in them and an intent to provide a clear purpose for mentoring, informal mentoring is still often times seen as the preferred alternative where possible since it is assumed to create stronger and more long-term trust-relationships (Allen & Eby, 2003) and is founded on better competencies, in particular

coaching and communication skills (Clutterbuck, 2004). Furthermore, informal mentors are perceived as more effective by their protégés (Ragins & Cotton, 1999).

So, it seems not surprising that Eby and Lockwood (2005) observed one common problem with formal mentoring programs causing protégés and mentors alike to see room for improvement: mismatches between mentors and protégés made up by a wide range of differences leading to feelings of discomfort with the relationship.

One alternative to avoid mismatches in the own organization would be an inter-organizational formal mentoring (IOFM) program, which would assist (in particular) underrepresented groups to potentially find a more fitting match by accessing mentors outside of their own organization, thereby making the pool of obtainable mentors larger, which ultimately may also include access of protégés to legitimate power as well as partaking in the sharing of social capital and psychosocial support and trust across old-fashioned organizational frontiers (Murrell, Blake-Beard, Porter, & Perkins-Williamson, 2008).

A second alternative entails the Peer-Onsite-Distance (POD) model, which is combining traditional mentoring and network mentoring by defining content areas as well as interaction skills to focus on and then convey these critical areas either through peer mentoring onsite or through network meetings with more formal exchanges to enhance specific skill sets (Lewellen-Williams, et al., 2006).

When it comes to mentors selecting protégés, the key factor for their criteria seems to be the **perceived ability** or expected potential of the protégés rather than the protégés' actual need for support and assistance, which might be explained through the expected greater success of the protégés with higher abilities within the organization

and simultaneously improving chances for potential organizational rewards for the mentor (Allen, Poteet, & Russell, 2000).

Later on, Allen (2004) also found out that **protégés' willingness to learn** was a more critical aspect for mentors motivated by intrinsic satisfactions, whereas those motivated through self-enhancement paid more attention to protégés' ability.

Similarity

The second aspect as part of the proposed functional model of mentoring to be considered to define the process and relationship between mentor and mentee is their perceived similarity.

It seems central for effective mentoring to strike the proper balance between necessary difference to achieve benefits from the developmental mentoring relationship and adequate similarity to establish a good basis for rapport building (Garvey, Stokes, & Megginson, 2014).

While protégés and mentors to a large extent evaluate the developmental relationship and frequency of communication between them congruently, large differences in organizational tenure or age between mentor and protégé lead to less congruence in their perception and more discrepancy in how they perceive their dyadic relationship (Fagenson-Eland, Baugh, & Lankau, 2005).

In particular, it seems career mentoring provided is less available – and when available for a shorter time period and closer in hierarchical level – the older the mentee is, while at the same time **absolute age** also seems to change the perception of reciprocal learning (more mutual when older) and the features of the mentorship taking place (Finkelstein, Allen, & Rhoton, 2003).

Another dimension of similarity may consist of the shared extent of understanding what the mentoring relationship should entail and how it is defined – also called the Protégé-Mentor-Agreement (PMA); this PMA, which became even more enriched when mentors and protégés had similarly high traits in extroversion, openness and agreeableness, is positively linked to the job satisfaction of both, mentor and mentee, and also organizational commitment (Waters, 2004).

When regarding **demographic similarity**, gender seems to be of particular relevance. However, Ragins and McFarlin (1990) were able to find merely little differences between mentoring of same or cross-gender dyads, with the most important ones to be the reduced likelihood of cross-gender protégés to be involved in joint activities outside the job with their mentor for the presumed perception of impropriety and the important aspect of female-female mentoring relationships to serve the role modeling function, especially in regard to dealing with gender-related obstacles to career advancement and achieving work-life-balance including family responsibilities; therefore, Ragins and McFarlin deem it important to further develop the opportunity for female protégés to be mentored by females in both informal and formal mentoring relationships. On the other hand, Lyons and Oppler (2004) found that same-gender or cross-gender mentoring did not yield significant differences in satisfaction with the mentoring relationship.

Another aspect of surface-level demographics, race, seems to play a role in matching mentors and protégés because same-race matching appears to render the greatest amount of not only interpersonal comfort and trust, but ultimately leads to psychological support (Ortiz-Walters & Gilson, 2013). Contrary, Lyons and Oppler

(2004) found race composition of the dyad does not influence protégé satisfaction, but the particular study allowed protégés to request specific mentors, which overall might lead to higher satisfaction in general.

Reported similarity of the protégés to the mentors is related to psychosocial mentoring while reported similarity does not take the same important role in career mentoring in a formal context, presumably because it is administered with clear business directions (Wanberg, Kammeyer-Mueller, & Marchese, 2006). Here Wanberg et al. suggest that perceived similarity in formal mentoring programs should be regarded, besides experience and expertise when matching mentor and mentee, where possible.

Whereas **demographic similarity** is of greater importance to mentors and leads to greater and higher quality of learning (Allen & Eby, 2003), possibly because of perceived interpersonal blockades due to race or gender, deep-level similarity – consisting of the following six sub-questions: personal values, work values, problem-solving approach, interests, personality, and outlook on organizational issues – is equally important to mentors and mentees alike (Lankau, Riordan, & Thomas, 2005). Therefore, training of mentors could alleviate reluctance to be part of a cross-race or cross-gender dyad, and most importantly, formal programs should utilize personality assessments or inventories in order to optimize matching based on sharing of deeper-level characteristics of mentors and mentees (Lankau, Riordan, & Thomas, 2005). On the other hand, **functional similarity** leads to less liking of protégés, which can be explained through mentors fearing the perception that unfair benefits and insights are

offered to mentees or eventually their own displacement through a capable mentee (Lankau, Riordan, & Thomas, 2005).

In cases of self-reported **similarity of commitment** between mentor and mentee, the dyads described greatest satisfaction with the mentoring relationship when the commitment was equally high (Poteat, Shockley, & Allen, 2009).

Quality of Exchange

The third and last aspect as part of the proposed functional model of mentoring to be considered to define the process and relationship between mentor and mentee is the quality of the exchange between the two.

One of the most common descriptors referred to for the quality of exchange is the **frequency** of the actual mentoring meetings. It was found that the more frequent the meetings between protégés and mentors took place, the more satisfied the protégés were with the mentoring relationship and the quality of the formal program, which implies that formal programs should schedule frequent meetings on a regular basis (Lyons & Oppler, 2004; Baugh & Fagenson-Eland, 2007). Similarly, Eby and Lockwood (2005) determined that amount of time spent together, frequency, structural separation as well as availability all have an impact on protégé satisfaction achieved as a result of the mentoring relationship.

Good vs. bad experiences are means to describe the quality of exchange in mentoring programs and the related intention of protégés and mentors to remain in the mentoring relationship (Eby, Butts, Durley, & Ragins, 2010); it is found that good relational experiences for both clearly should outweigh bad ones in order to maintain and upkeep the mentoring relationship (Eby, Butts, Durley, & Ragins, 2010).

Protégés' willingness to **accept and take mentors' advice** within formal mentoring relationships is positively impacted the stronger the protégés' commitment is, the more protégés trust their mentors, and the more the relationship is regarded as beneficial (Son & Kim, 2013).

Greater satisfaction of mentors derived from mentoring relationships is achieved through greater confidence in their own skill to mentor and relatedly the perceived usefulness of training received, all resulting in the mentors' feeling of self-efficacy (Martin & Sifers, 2012). Similarly, Xu and Payne (2013) indicate that mentoring satisfaction of protégés is important because it has direct impact on their job satisfaction and relatedly intentions to remain in their job or leave.

The quality of exchange in and satisfaction with a mentoring relationship may be more likely to be perceived positively if the expectations into formal mentoring are managed; specific actions early on, particularly by program managers, concerning realistic expectations can lead to perceptions that the mentoring exchange is positive and sustainable (Young & Perrewé, 2004).

The quality of and the satisfaction with the mentoring exchange and relationship is impacted also by race and gender differences between mentors and mentees; here, the demographic dissimilarity might present interpersonal hurdles for mentors to overcome since they might hold stereotypes in respect to performance of mentee while these demographic differences hardly appear to matter to mentees (Lankau, Riordan, & Thomas, 2005).

Findings indicate that male mentors might be more beneficial than female ones in the **gender/mentor-protégé relationship**, especially since females might lack

organizational support, which works directly against gender matching and its positive characteristics of offering psycho-social support (Pompper & Adams, 2006). Similarly, male respondents of the same study working with female protégés or mentors were seen as escaping direct male competition, again accentuating the perception that females are not intimidating because of their low status (Pompper & Adams, 2006).

Even though females are equally satisfied in formal programs (Lyons & Oppler, 2004), **cross-gender mentoring** seems to place women at a disadvantage because females, for the appearance of inappropriateness, exclude themselves often from social activities with their mentors after work – however, these activities might be particularly important to strengthen the mentoring relationship and assist in effective networking (Ragins & McFarlin, 1990).

To summarize, literature deems it important to match based on perceived abilities of the mentees and their willingness to learn. Furthermore, similarity, especially in regard to reported demographic and functional similarity, and the similarity in commitment matter. Literature stresses the quality of exchange to be measured in the frequency as well as in the willingness to accept and take mentor's advice. While some literature indicates that male mentoring might be more beneficial than female mentoring, females might be at a disadvantage in cross-gender mentoring relationships in social situations.

Outputs Expected

The remaining component of the functional process model of mentoring is the output. This section divides outputs into those derived on a personal level, as well as on

an organizational level. For each, literature concerning the positive as well as negative aspects of mentoring are described.

Personal Level Outputs

Here, the development and growth achieved may be possible for both, mentors and mentees, so outputs based on literature can be further categorized into advantages and potential risks for mentors, and similarly for mentees.

Advantages of Mentoring for Mentors

Literature points out many benefits of mentoring relationships for mentors, which can be subdivided into subjective and objective characteristics.

The short and long-term objective career benefits of mentoring consist of mentors achieving higher job performance, being promoted at a higher rate, and receiving higher salaries, which might be explained by higher organizational visibility and increased perceived competence (Allen, Lentz, & Day, 2006; Tong & Kram, 2013).

In particular, one of the subjective benefits of mentoring concerns **learning** facilitated by listening to perspectives of the mentees (Wanberg, Kammeyer-Mueller, & Marchese, 2006) and explaining own intuitive reasoning in discussions with the mentee, or also reiterating concepts, which ultimately leads to good practice (Garvey, 2011; Clutterbuck, 2004; Eby & Lockwood, 2005; Poulsen, 2013; Weinberg & Lankau, 2011).

Furthermore, the **personal satisfaction** that mentors gain from personal relationships developing with their mentee (Eby & Lockwood, 2005; Allen, Poteet, & Burroughs, 1997; Weinberg & Lankau, 2011; Parise & Forret, 2008), gratitude and

pride concerning their mentees' achievements (Eby & Lockwood, 2005; Clutterbuck, 2004), and actually making a difference in someone's life by assisting talented employees grow, providing psychosocial support or career development to their mentees is one of the typical benefits derived from mentoring others (Clutterbuck, 2004; Allen, Poteet, & Burroughs, 1997). Additionally, personal satisfaction also might be resulting from providing career mentoring to others that ultimately leads to feelings of competence and self-efficacy (Allen, 2003).

Another benefit perceived is the mentor's augmented and **loyal** skills base available through the mentee, which also potentially betters the mentor's **reputation** or organizational power (Ragins, 1997) within the organization if successful mentoring results become visible to other organizational members and mirror the mentor's competence and decision (Clutterbuck, 2004; Allen, Poteet, & Burroughs, 1997; Ragins, 1997; Tong & Kram, 2013).

Similarly, mentors also benefit from being involved and intellectually challenged, especially if the assignments take them away from their familiar comfort zone by working on issues that they are not directly responsible for (Clutterbuck, 2004).

Moreover, mentors also gain the opportunity to create reflective space for themselves despite their busy schedules because mentoring demands from them to slow down and adapt to the mentees' pace of processing (Clutterbuck, 2004; Eby & Lockwood, 2005).

Risks of Mentoring for Mentors

Despite the well-known fact that mentoring requires a considerable amount of time (Allen, Poteet, & Burroughs, 1997), energy, and effort if done well (Clutterbuck,

2004), feeling inadequate as mentors (Allen, Poteet, & Burroughs, 1997; Eby & Lockwood, 2005), being threatened in their position (Kram, 1983), or relationship expectations not being met (Eby & Lockwood, 2005), there are also some other potential downfalls that the mentor might face as a result of mentoring others, which fall into one of three problem groups (Eby, Durley, Evans, & Ragins, 2008): mentees' performance problems, destructive relationships, and interpersonal issues.

Especially since mentors place their trust in their mentees by providing them with special insights and sometimes also personal, confidential or intricate information, the breach of confidentiality on part of the mentee poses a potential risk to the mentor (Clutterbuck, 2004).

Additionally, mentors might **risk losing their face** in case the mentee is not successful, and therefore the credibility of the mentor to sponsor this particular mentee might be questioned due to the failing of the mentee (Clutterbuck, 2004). This risk of losing face is even more relevant in case mentoring is taking place in diversified gender or race relationships, since visibility is magnified in both instances: in case of failure, it is attributed to the minority member, regardless whether in the role of mentor or mentee, and in case of success, it is attributed to the majority member (Ragins, 1997).

Furthermore, the mentors might be accused of favoritism (Allen, Poteet, & Burroughs, 1997) and consequently face **resentment** of other subordinates due to the fact that they do not receive the same amount of attention and time to develop them or their careers as the mentees' (Clutterbuck, 2004; Eby & McManus, 2004).

In some instances, mentors' distancing behaviors are affective events that may trigger destructive emotions in mentees resulting in uncivil acts against their mentors (Ghosh, Dierkes, & Falletta, 2011).

Some mentors also might feel that their protégés are abusing their mentoring relationship for their own benefit (Allen, Poteet, & Burroughs, 1997; Scandura, 1998), while at the same time mentors also need to be cautious concerning possible misconstructions that socializing, especially after work, with mentees of the opposite sex might be perceived as sexual in nature (Ragins & Cotton, 1999).

Advantages of Mentoring for Mentees

Results of mentoring relations for the mentees are significantly beneficial, in particular concerning the two main functions, those of psychosocial support and career development (Allen T. D., Eby, Poteet, Lentz, & Lima, 2004; Tong & Kram, 2013), even according to research that is rather cautious of mentoring in general (Burke & McKeen, 1997).

Psychosocial support, especially in terms of personal counseling, developing friendship and acceptance and confirmation, are some of the prime benefits of mentoring (Eby & Lockwood, 2005; Allen T. D., Eby, Poteet, Lentz, & Lima, 2004) along with emotions of pride for selection as a mentee (Eby & Lockwood, 2005).

One of the major benefits of mentoring for mentees is the **learning** achieved through training programs, observing of role modeling leading to a sense of identification (Athalye, 2010), increased confidence and competence (Tong & Kram, 2013), and open communication and reciprocal feedback between mentee and mentor (Allen & Poteet, 1999), but also on how the organization works and how different

work-related issues might be solved (Eby & Lockwood, 2005). In addition to these, learning insights assist mentees in achieving career clarity (Wanberg, Kammeyer-Mueller, & Marchese, 2006).

Additionally, **career development** functions may be the result of mentoring as is evident through objective career success indicators such as income, position or rank (Allen T. D., Eby, Poteet, Lentz, & Lima, 2004; Clutterbuck, 2004). This is all a result assisted by ongoing coaching, short and long-term career planning, having key behaviors role modeled, obtaining access to networks, and receiving sponsorship within the organization as well as for promotions (Eby & Lockwood, 2005; Clutterbuck, 2004), which seem to be more intensely available from male mentors at the beginning of a mentoring relationship, but then are matched by their female mentors in the long run (Weinberg & Lankau, 2011).

Overall, the positive mentoring experiences and satisfaction derived from the mentoring relationship lead to higher job satisfaction of the mentees and refute intentions to leave the organization (Xu & Payne, 2013).

When it comes to their perception within their respective organizations, mentees are perceived as more competent leaders, leading to role and **self-efficacy** of the mentee (Hoigaard & Mathisen, 2009; Martin & Sifers, 2012) and the display of positive individual attitudes (Lyons & Oppler, 2004; Egan & Song, 2008).

Risks of Mentoring for Mentees

Despite the fact that mostly benefits for mentees are perceived with mentoring programs, some potential risks also exist for them which may go as far as leading to

negative mentoring experiences, which are related to intentions of leaving mentoring relationships, even if not all negative experiences lead that far (Burk & Eby, 2010).

Especially in formal programs, where expectations are clearly communicated to participants, it might be a disappointment for the mentee when these expectations concerning psychosocial support or career development are not met due to poor mentoring (Eby & Lockwood, 2005; Clutterbuck, 2004; Tong & Kram, 2013).

Even worse, mentees might perceive neglect or distancing behavior in the case that the mentors are not committed sufficiently, which might show by ignoring the mentee or by displaying disinterest (Eby & Lockwood, 2005; Eby, Butts, Lockwood, & Simon, 2004; Baugh & Fagenson-Eland, 2007).

Furthermore, risks mentees face also include being exposed to deviant workplace behavior in dysfunctional relationship experiences with their mentors (Tong & Kram, 2013; Eby L. T., 2007), ranging from exploitive or egocentric to malevolent deception, sabotage or even harassment (Scandura, 1998), but most instances consist of forms of sabotage of projects, tyranny of the mentees, credit taking by the mentors for work the mentees accomplished, and inappropriate delegation of tasks (Ghosh, Dierkes, & Falletta, 2011; Eby & McManus, 2004).

Additionally, it needs to be considered that mentees selected to participate in a formal mentoring program might face jealousy or resentment by other organizational members not selected to participate, which at the same time also increases the pressure that mentees feel placed on them to perform extraordinarily and fear potentially not to live up to expectations (Kram, 1985). Especially when perceiving this pressure, mentees might resolve the situation by over-dependence on their mentors (Day, 2001).

On the other hand, mentoring relationships may become destructive when the mentors feel threatened by their mentees through excellent and highly visible performance within the organization, which then in turn may lead to attempts of undermining the mentees' credibility and holding them back (Kram, 1983) or to retaliate against them (Tong & Kram, 2013).

Organizational Level Outputs

Benefits and risks of mentoring can not only occur on a personal level, but may also be observed on an organizational level according to the literature.

Advantages of Mentoring for the Organization

While it is apparent that career development functions benefit the organization overall through higher qualified human resources, and mentoring's psychological support functions contribute to personal satisfaction of individuals, some additional benefits may also arise for the organization through mentoring.

While formal mentoring programs might not only help to on-board new employees through absorption of behavioral norms, but also **recruit** through an improved corporate culture and retain organizational knowledge as well as employees past the critical initial months because of increased employee satisfaction, employees might at the same time be more highly motivated and display a positive organizational attitude (Clutterbuck, 2004; Tong & Kram, 2013). Similarly, it appears that retention rates are drastically improved with well-implemented mentoring systems; same is true for job commitment, which is one of the key indicators measured in studies of mentoring programs (Clutterbuck, 2014).

Furthermore, larger companies report that formal mentoring programs facilitate better **succession planning** because ambitions, strengths and weaknesses of junior employees are reviewed in a talent pool and can then be considered for advancement by partaking in a protégé network (Clutterbuck, 2004; Blicke, Witzki, & Schneider, 2009).

Additionally, communication becomes more direct because different hierarchical levels of organizational members, from top management as mentors to junior management as mentees, exchange information informally; similarly, familiar language and terminology provide for a richer informal **communication network**, which leads to more efficiency and productivity in the organization (Clutterbuck, 2004).

Just as with communication, formal mentoring programs also contribute to the development of personal networks within the organization, or even with members outside of it, which might be particularly beneficial in some sectors of industry, such as in academia, because it allows the mentee to develop with a portfolio of mentors and broaden horizons within a **professional network** (de Janasz & Sullivan, 2004). Along the same lines, the plea is made for developmental mentoring networks to provide changing organizational structures and more mobile and flexible individuals with their careers an access to intelligent networks in order for individuals and businesses to flourish (de Janasz, Sullivan, & Whiting, 2003; Higgins, Chandler, & Kram, 2007).

Similarly, some organizations utilize mentoring schemes to contribute to **organizational learning** at different levels within an organization, whether for individuals or as collective learning especially at higher organizational levels (Borredon & Ingham, 2005), often times used intentionally in order to bring forth organizational change (Boyatzis, 2007).

Risks of Mentoring for the Organization

While the overall organization typically benefits from formal mentoring programs as displayed above, there are also a few exceptions that pose risks to mentoring.

In formal or informal mentoring taking place, jealousy of peers or other subordinates working with the mentee for the mentor may occur since the feeling of favoritism towards the mentored person may arise, ultimately leading to a dysfunctional or toxic work climate and an organizational culture of jealousy and mistrust (Allen, Poteet, & Burroughs, 1997; Clutterbuck, 2004; Day, 2001; Kram, 1985).

To summarize, when it comes to the outputs, literature provides for mentors benefiting from mentoring programs through learning, personal satisfaction, loyalty of their mentees, better reputation if mentoring is successful, but on the other hand risking to lose face or be resented. On part of the mentee, literature indicates beneficial outcomes to consist of psychosocial support, learning taking place, career development, and self-efficacy. Organizations benefit from improved recruitment, effective succession planning, development of professional communication networks and overall organizational learning according to the literature.

Based on the above literature review and the functional model of mentoring, the Bavarian mentoring system at universities of applied sciences was reviewed to answer the research questions presented in the next chapter.

Chapter 3: Methodology

This chapter lays out the research questions examined, the respective research questions derived from them, and the methodological framework used to find the corresponding answers.

Research Questions

In this case study of mentoring programs at Bavarian universities of applied sciences, the functional model of mentoring is utilized to evaluate particular inputs, Activities/Processes and output/outcomes of the MINT mentoring. These three phases of the functional model consider perspectives of mentors, mentees, as well as program managers concerning program understanding, relationship support and development and growth achieved by the participants, as can be seen in Figure 5 on the following page to provide an overview of the organization scheme of the research process. The literature of mentoring was carefully reviewed in the previous chapter, offering a range of research questions in order to evaluate the program and at the same time contribute to knowledge and understand the functions of the program better while evaluating it.

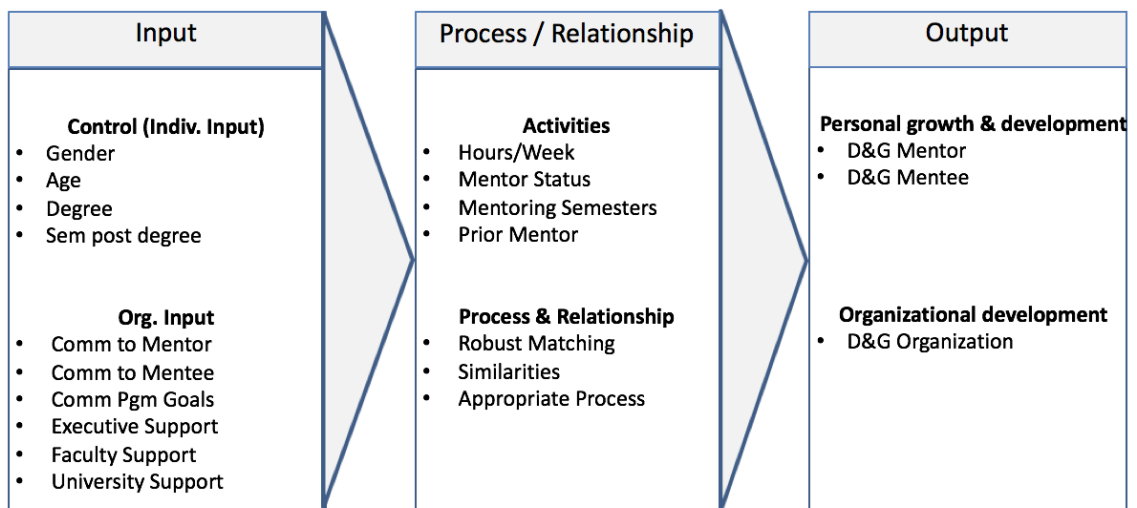


Figure 5: Testing of the Functional Model

Source: (own depiction)

Correspondingly, the following model-related research questions are examined as follows in Table 1:

Table 1: Overview of Model-Related Research Questions

Source: (own depiction)

INPUTS	PROCESS / RELATIONSHIP	OUTPUTS
Are the MINT mentoring program goals communicated properly, understood and supported?	What are the participants' perceptions of the processes and relationships developed in the MINT mentoring programs?	To what extent are the development and growth expectations of the MINT programs met?
RQ _{1a} : Do program managers communicate the mentoring program goals?	RQ _{2a} : Do prior and current mentoring activities of the participants improve the mentoring programs?	RQ _{3a} : What are the perceptions of mentors' development and growth?
RQ _{1b} : Do mentors and mentees understand the mentoring program goals?	RQ _{2b} : Is the process for matching mentors and mentees robust?	RQ _{3b} : What are the perceptions of mentees' development and growth?
RQ _{1c} : Do all involved perceive support from the mentoring program?	RQ _{2c} : Do mentors and mentees identify similarities within the mentoring tandem?	RQ _{3c} : Do all involved perceive the mentoring program's contribution to organizational development and growth?
	RQ _{2d} : Is the process for matching mentors with mentees appropriate?	
CONTEXT	LOGIC OF MODEL	
How important is it to have gender-matched mentors?	What are the influences of the inputs and processes / relationships on the MINT program mentoring outputs?	
RQ ₄ : What are the perceptions of mentoring by females only?	RQ _{5a} : Do Inputs positively influence the quality of Activities / Processes?	
	RQ _{5b} : Do Activities / Processes positively influence the quality of the mentoring program Outputs?	
	RQ _{5c} : Do Inputs positively influence the quality of mentoring program Outputs?	
	RQ _{5d} : Do Inputs and Activities / Processes positively influence the quality of mentoring program Outputs?	

Research Questions and Associated Variables

As shown in Figure 5, the first four research questions describe the variables in each of the columns in the model and in the context of gendered mentoring. Then, the fifth research question tests the various components of the logic model by testing the bivariate and multivariate relationships occurring between the columns. Therefore, the following research questions related to UASs in Bavaria were derived. These research questions and the respective research sub-questions are presented below:

1. **Research Question - Inputs:** How well are the MINT mentoring program goals communicated, understood, and supported?
 - RQ_{1a}: Do program managers communicate the mentoring program goals?
 - RQ_{1b}: Do mentors and mentees understand the mentoring program goals?
 - RQ_{1c}: Do all involved perceive support from the mentoring program?

2. **Research Question - Activities/Processes:** What are the participants' perceptions of the processes and relationships developed in the MINT mentoring programs?
 - RQ_{2a}: Do prior and current mentoring activities of the participants improve mentoring programs?
 - RQ_{2b}: Is the process for matching mentors and mentees robust?
 - RQ_{2c}: Do mentors and mentees identify similarities within the mentoring tandem?
 - RQ_{2d}: Is the process for matching mentors with mentees appropriate?

3. **Research Question - Outputs:** How well are the development and growth expectations of the MINT mentoring programs met?
 - RQ_{3a}: What are the perceptions of mentors' development and growth?

RQ_{3b}: What are the perceptions of mentees' development and growth?
RQ_{3c}: Do all involved perceive the mentoring program's contribution to organizational development and growth?

4. **Research Question - Context:** How important is it to have gender-matched mentors?

RQ₄: What are the perceptions of mentoring by females only?

5. **Research Question - Logic Model Testing:** What are the influences of the inputs and processes/ relationships on the MINT program mentoring outputs?

RQ_{5a}: Do Inputs positively influence the quality of Activities/Processes?

RQ_{5b}: Do Activities/Processes positively influence the quality of mentoring program Outputs?

RQ_{5c}: Do Inputs positively influence the quality of mentoring program Outputs.

RQ_{5d}: Do Inputs and Activities/Processes positively influence the quality of mentoring program Outputs?

Research Design

The assessment of the perceived effects of the mentoring program are measured through a cross-section, one-time survey of the target group (those involved in MINT mentoring programs as managers, mentors or mentees). This “one shot design” makes it possible to measure contentment with the program and the perceived change, where the type and size of change is operationalized as retrospective self-evaluation and evaluation of others (Bortz & Döring, 2006). However, this method cannot fully capture causal relationships, since several other effects may influence participants' outcomes. In addition, the research design cannot control, nor estimate the results that would have occurred without the intervention (Bortz & Döring, 2006).

Since the lack of specific goals in form of key performance indicators (KPIs) made it hard to measure the efficiency of the programs and the advancement towards the stated goals of achieving more female participation in studying MINT fields and helping students to adjust, the interpretative research design suggested by Carnall (1986) was employed. In this project, the evaluation of change processes towards the practical experience and knowledge as well as the subjective perception of mentoring program participants is used. Greif, Runde and Seeberg (2004) found a close relation between the subjective evaluation of change perceived and the success of reaching a set goal. Following their research approach, subjective evaluations were collected and the results were triangulated by participant type, namely the groups of industry mentors, UASs mentors, mentees and program managers.

Research Instruments

To investigate the research questions and test them as explained above with the research design presented, the research instrument of online surveys was used. The subjective assessment of program success was gathered from participants (mentors from industry and university alike, and mentees) and managers via four surveys, one for each type of participant. According to Schnell, Hill and Esser (2013), a survey, which presents a mostly quantitative technique to collect data in large volumes from subjects, may be distributed via an online-tool or a paper version.

While the online-tool generally has the methodical disadvantage of not allowing even access to all groups of a general population (e.g. limitations due to computer affinity), the drawing of samples, and the potential lack of cooperation due to anonymity (Schnell, Hill, & Esser, 2013), this did not apply to this research project,

since the population in question was addressed in its entirety and consisted of either student mentees and program managers within their university settings, or mentors employed in organizations, who could all be assumed to possess the needed technological skills, have access to computers or other mobile devices, and have the computer affinity to answer an online-survey.

Furthermore, through the support offered by the Bavarian Speaker of the State Conference of Women's Representatives at UASs (Sprecherin der Landeskonferenz der Frauenbeauftragten an bayerischen HAWs) and emphasized in a support letter that accompanied the mail with the online link, the questionnaires were distributed through the mail distribution list regularly used to contact all regional offices of program managers, who then forwarded the request to the mentors and mentees (Süß-Gebhardt, 2015).

While the survey conducted without the personal presence of an interviewer requires the utmost precision in developing the questionnaire so it can be clearly understood without further assistance provided by the interviewer, it furthermore has the methodological advantage not to allow for interferences by the interviewer and at the same time offering more honest answers due to anonymity (Bortz & Döring, 2006). At the same time, respondents may take more time to think about their answers and are able to potentially concentrate better (Schnell, Hill, & Esser, 2013).

The questions in the surveys were highly structured in that they either consisted of closed questions, multiple-choice questions with the hybrid option to add additional comments or insights, or matrix answers requiring rating or ranking of options provided. There were four surveys that were administered to reflect the four types of

participants in the Bavarian UASs MINT mentoring programs: 1) University mentors, 2) industry mentors, 3) mentees, 4) program managers. The content of each survey was structured very similarly with the exception that the program managers were asked to provide perceptions related to both mentors and mentees and also to answer additional questions concerning the institutions' evaluation of programs; therefore, to avoid unnecessary duplication of the same document, only the German and English¹ version of the project coordinators questionnaire is provided in the Appendix. All human research related documents, and in particular the surveys, were approved in the German and English version by IRB # 7450 on 14 Nov. 2016 (see Appendix).

Seven of the questions in the survey had multiple sub-questions to measure various aspects of a single construct. For the questions that were originally measured on a Likert type scale, the sub-questions scores were added together and then divided by the number of sub-questions that were answered by each participant to create an Index variable. For questions that presented multiple choices and the participant could select as many as they desired, the number of responses for each participant was added up to create an interval level Count variable. Additive indexes were constructed to represent a single concept.

To test the reliability of reflective constructs (Eberl, 2004) – such as in this study: the reflection if mentoring was perceived to help develop individuals or organizations or if matching was perceived to be effective – Cronbach Alpha is often used (Töpfer, 2010). The value for Cronbach Alpha is always between 0 and 1, which indicates the correlation between the sub-questions; the higher the correlation, the higher Cronbach Alpha (Zinnbauer & Eberl, 2004). Literature often demands a value of

¹ Reminder: The German to English translation might not reflect the true concepts by participant type.

at least 0.7 for a construct to be considered reliable (Zinnbauer & Eberl, 2004; Töpfer, 2010). According to Schnell, Hill, and Esser (2013), attention must be given to apparent causality attributed to correlations; instead, numerous so-called multivariate analyses should be used, reaching from simple table analysis to structural models that are able to consider many different variables to offer indicators for causal relations.

The first set of questions in the survey collected demographic data of the participants that could be used as control variables. These included questions for gender, age, highest degree achieved and the number of semesters since the last degree was completed. **Gender** was measured as a dichotomous variable with a value of 1 representing males. The survey respondents were asked to give their year of birth. This data was transformed into a dichotomous variable named **age**, with 1 representing those born before 1990. This transformation was necessary, since the majority of mentee respondents and almost half of the mentor respondents are still attending university; this causes the age variable to be highly skewed and transformations were not successful in mitigating this threat to validity. **Degree** was question with five sub-questions. The responses were arranged into five ordinal categories. **Semesters post degree** asked the participant to provide the year they graduated, or in case of current students, the year they are in. This variable was transformed into an ordinal variable with three categories. Table 2 presents the Control variables and the transformations.

Control variables used are Age and Degree, while SemPostDegree was not used in the regression later on due to too many missing cases (63). Similarly, gender was not used because it has extremely high values for skewness (5.156) and kurtosis (24.928), as can be seen in Table 3.

Table 2: Control Variables and their Transformation

Source: (own depiction)

Category	Variable	Variable Type	Transformed Variable Type
Control	Gender	Dichotomous	1=Male
Control	Age	Year	Dich, 1=<1990
Control	Degree	Ordinal, 5 sub Q's	Ordinal, 5
Control	Sem (Post Degree)	Year	Ordinal, 3

Control variables used are Age and Degree, while SemPostDegree was not used in the regression later on due to too many missing cases (63). Similarly, gender was not used because it has extremely high values for skewness (5.156) and kurtosis (24.928), as can be seen in Table 3.

Table 3: Control Variables

Source: (own depiction)

	Gender	Age	Degree	SemPostDegree
	145	143	143	82
Missing	0	2	2	63
Mean	.03	.52	1.99	2.24
Std. Deviation	.183	.501	1.120	.763
Skewness	5.156	-.099	.578	-.447
Kurtosis	24.928	-2.019	-1.081	-1.143
Minimum	0	0	1	1
Maximum	1	1	5	3

These questions were followed by a section about their subjective perceptions concerning the program inputs – including communication of the programs' goals to be achieved through mentoring which was measured with three survey questions. The first questions had 12 sub-questions asking about how the university communicated the goals of the mentoring program. **Communication of Program Goals.** The second and third assessed the level of understanding the mentor and the mentee had of the

mentoring program goals. Each participant answered a question with 10 sub-questions related to the mentor and another to the mentee. For example, the mentors assessed themselves and their mentee, the mentees assessed themselves and their mentor and the program managers assessed the mentors and the mentees. **Mentor Understands.**

Mentee Understands. Each of these were transformed into index variables.

The support perceived from officials in the UAS's was measured with three survey questions asking about **Executive Support, Faculty Support, University Support.** There were multiple sub-questions for each of these three survey questions and participants could check multiple boxes. Within the subquestions, different positive, negative and neutral options were offered. For a positive perception of support, the translated words were enthusiastic, supportive, appreciative and approving. Selecting one of these boxes yielded a score of 1. For the negative attributes, depreciative and undesirable were used and the score for checking one of these boxes was -1. The neutral categories were tolerating the programs or is not known for me and the associated value was 0. The score across the subquestions were added up to measure Support with the highest possible value of 5 and the lowest possible value of -2. For example, if a participant selected enthusiastic and approving as well as undesirable and tolerating, then the Support score for this respondent would be $1 + 1 - 1 + 0 = 1$. Table 4 presents the Input variables and the transformations.

Inputs entail variables such as program goals, communication taking place with mentors and mentees, and the support rendered through university executives, faculty, and other university staff (see Table 5). Standard deviation, skewness and kurtosis are reasonably within acceptable boundaries and can be used in regression.

Table 4: Input Variables and Transformations

Source: (own depiction)

Category	Variable	Variable Type	Transformed Variable Type
Input	Comm Pgm Goals	Likert, 12 sub Q's	Index (0-3, 99)
Input	Mentor Understands	Likert, 10 sub Q's	Index (0-3, 99)
Input	Mentee Understands	Likert, 10 sub Q's	Index (0-3, 99)
Input	Executive Support	Categorical, 8 sub Q's	Additive
Input	Faculty Support	Categorical, 8 sub Q's	Additive
Input	University Support	Categorical, 8/10/12 ² sub Q's	Additive

Inputs entail variables such as program goals, communication taking place with mentors and mentees, and the support rendered through university executives, faculty, and other university staff (see Table 5). Standard deviation, skewness and kurtosis are reasonably within acceptable boundaries and can be used in regression.

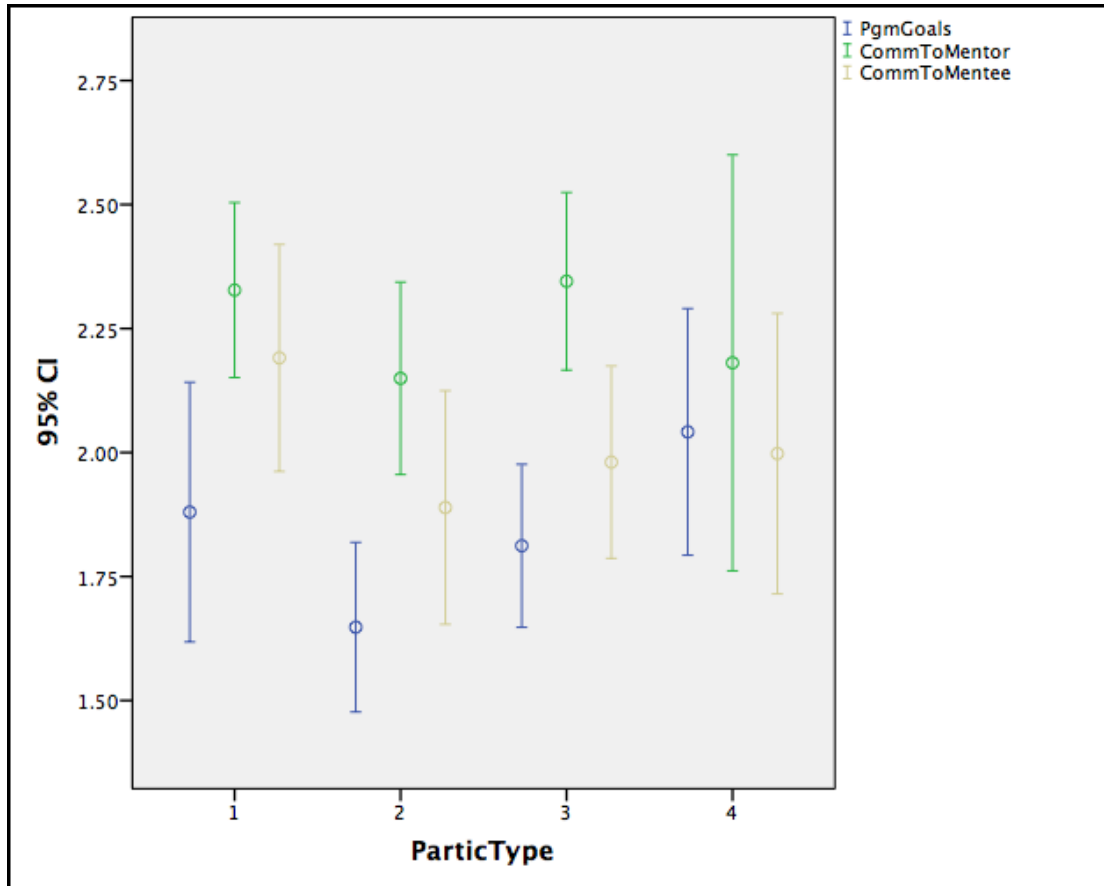
Table 5: Inputs

Source: (own depiction)

	Pgm Goals	CommToMentor	CommToMentee	ExecSupport	FacultySupport	UnivSupport
	110	109	113	145	145	145
Missing	35	36	32	0	0	0
Mean	1.809	2.260	1.998	0.58	1.0	1.57
Std. Deviation	.532	.515	.568	1.549	1.161	1.378
Skewness	.122	-.507	-.474	.788	.919	.197
Kurtosis	.158	-.498	.408	-.507	.295	-.995
Minimum	.333	.900	.000	-1	-1	-1
Maximum	3.000	3.000	3.000	4	4	5

² For the university support, program managers were asked two additional sub-questions unique to introductory training and engagement of new mentors, and for the industry mentors four additional sub-questions were asked unique to the recognition and support they received from their company. A majority of program managers and industry mentors did not respond to these sub-questions. The responses to the additional sub-questions represents only 1.5% of the results for all sub-questions. Therefore, the influence of these two, respectively four, additional sub-questions for these participant groups has no statistically significant or substantive effect on the results and additional transformations were not completed.

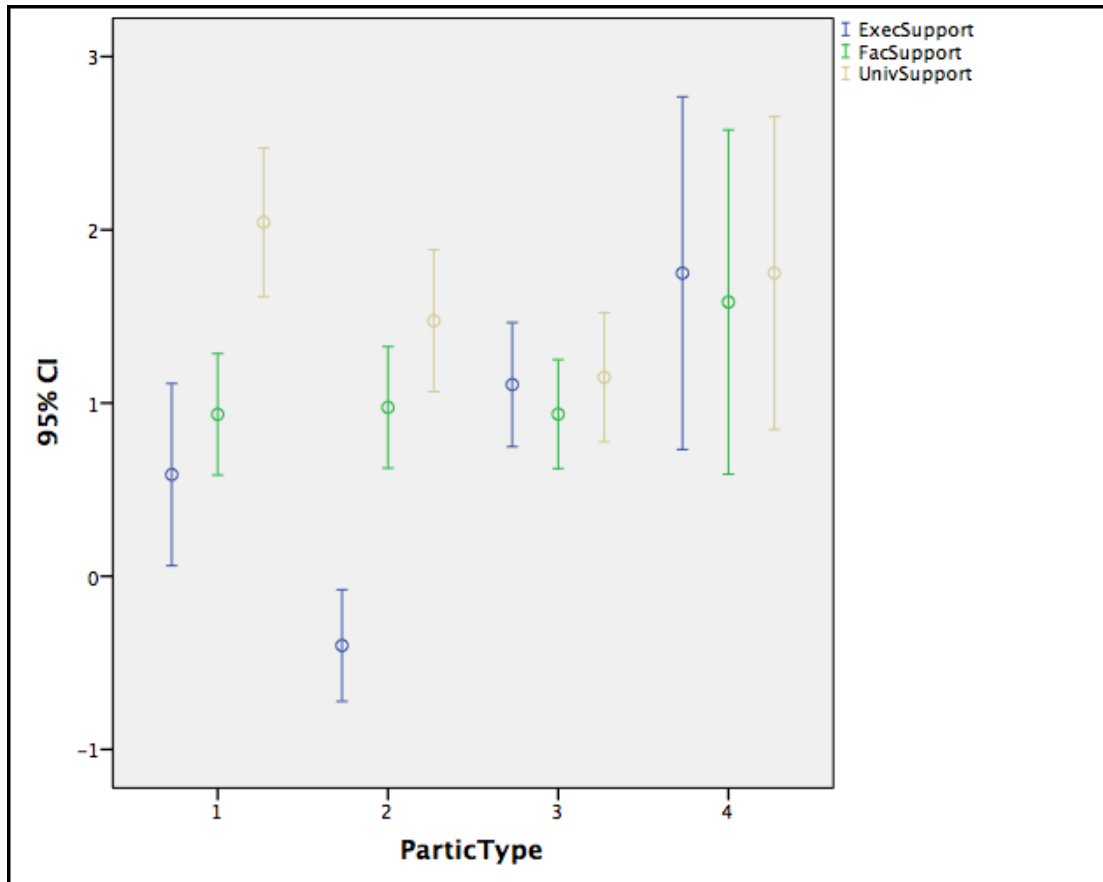
When looking at the overall distribution of the input variables in clustered error bars (see Figure 6) by all four groups, it is confirmed that all four groups regard the respective variables similar enough to include them in the analysis, despite the fact that program managers seem to see their own communication biased and better than other groups.



Participant Type: 1 – Mentees; 2 – University Mentors; 3 – Industry Mentors; 4 – Program
Figure 6: Summary of Input Variables: Program Goals and Communication
 Source: (own depiction)

There are differences in the level of support perceived by different types of participants. For executive support, the mentee respondents have a significantly different and lower perception. This is intriguing, since they seem to be far closer and

internal to the university compared to the industry mentors. Perceptions regarding faculty and university support do vary within and between groups, but are not significantly different.³



Participant Type: 1 – Mentees; 2 – University Mentors; 3 – Industry Mentors; 4 – Program

Figure 7: Summary of Input Variables: Support

Source: (own depiction)

Next, the survey asked questions about the participants’ activities related to mentoring and the MINT program’s processes and the relationships that had developed between mentor and mentee. Included in this section were questions about prior and

³ Similar to footnote 2, two additional sub-questions unique to introductory training and engagement of new mentors and four additional sub-questions for the industry mentors were asked. The extremely low number of responses has no statistically significant or substantive effect on the results.

current activities related to mentoring. **Hours per week. Mentor Status. Mentoring Semesters Prior Mentor.** The next question inquired about the robustness of activities in the matching process using seven sub-questions. This variable was transformed into a count variable. **Matching Robust.** The perceived similarities were queried in a question with 6 sub-questions and the results were transformed into an index variable. **Similarities.** The final question about the appropriateness of the mentor and mentee matching process using three ordinal categories. **Appropriate Process.** Table 6 presents the Input variables and the transformations.

Table 6: Activities Related to Mentoring

Source: (own depiction)

Category	Variable	Variable Type	Transformed Variable Type
Activities	Hours/Week	Interval	Dich 1=<1hour
Activities	Mentor Status	Categorical	Categorical x 4
Activities	Mentoring Semesters	Interval	Dich, 1=2+
Activities	Prior Mentor	Categorical	Dich, 1=Yes
Process	Robust matching	Categorical, 7 sub Q's	Count
Process	Similarities	Likert, 7 sub Q's	Index, (0-3, 99)
Process	Appropriate Process	Ordinal, 3	Ordinal

In the evaluation of the activities variables, MentorStatus has a high number of missing answers, which results in this variable not being used in the regression analysis later on. While the means are not centered, as can be seen based on the kurtosis (mean closer to the top with a negative sign), they are left in for the regression and are treated the same (see Table 7).

Table 7: Activities

Source: (own depiction)

	HoursWeek	MentorStatus	MentoringSemesters	PriorMentee
	142	83	130	130
Missing	3	62	15	15
Mean	1.44		.35	.35
Std. Deviation	.499	.000	.480	.478
Skewness	.229		.618	.654
Kurtosis	-1.975		-1.643	-1.597
Minimum	1	1	0	0
Maximum	2	1	1	1

When looking at the process variables, RobustMatching, Similarities, and AppropProcess are used. Here standard deviation, skewness, and kurtosis are within good ranges, and the missing cases are acceptable (see Table 8).

Table 8: Processes

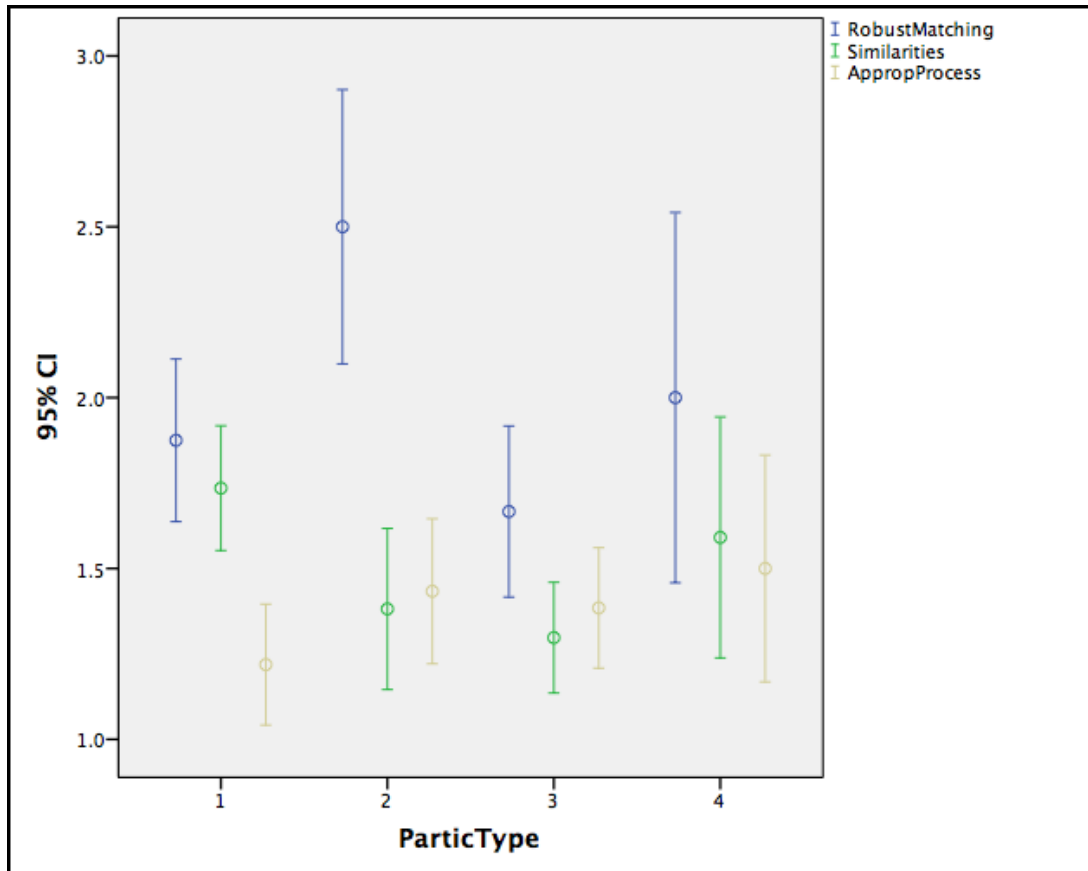
Source: (own depiction)

	RobustMatching	Similarities	AppropProcess
	145	113	114
Missing	0	32	31
Mean	1.55	1.47	2.64
Std. Deviation	1.136	.569	.534
Skewness	.375	.590	1.116
Kurtosis	-.122	.349	.226
Minimum	0	.285	1
Maximum	5	3.000	3

However, when looking at the clustered error bars for the process variables (see Figure 8), it becomes apparent that university mentors perceive the matching process far more robust than any other group - in particular industry mentors regard the process rather low.

This might be explained through university mentors knowing the process from both perspectives, being rather familiar with the degree programs and potentially the mentees already, while industry mentors come in as strangers to the university, do not

know the (majority of) students, and then are matched in what appears a rather non-transparent process to them.



Participant Type: 1 – Mentees; 2 – University Mentors; 3 – Industry Mentors; 4 – Program

Figure 8: Summary of Process Variables

Source: (own depiction)

Next, the survey inquired about the perceived development and growth of mentors and mentees as well as the university’s mentoring program. Mentors and mentees evaluated themselves as well as their mentoring partner. Program managers answered three questions related to growth and development– one about mentors, one about mentees, and one about the organization. These questions all had multiple sub-

questions which were used to create four Index variables: **D & G Mentor, D & G Mentee, and D & G Organization**. Table 9 presents the Input variables and the transformations.

Table 9: Development and Growth (D & G)

Source: (own depiction)

Category	Variable	Variable Type	Transformed Variable Type
Dev & Growth	D & G Mentor	Categorical, 12 / 15 ⁴ sub Q's	Index (0-3, 99)
Dev & Growth	D & G Mentee	Categorical, 16 sub Q's	Index (0-3, 99)
Dev & Growth	Organization	Categorical, 7 / 9 ⁵ sub Q's	Index (0-3, 99)

As far as the output variables are concerned, again a threat to validity becomes apparent in the many missing cases (66) for the variable D&G_Org. This variable cannot be included in the regression, therefore also limiting the predictor variables of the model. Overall, it can be assumed that the survey was far too long, resulting in many individuals not responding to the entire survey or dropping out. Standard deviation, skewness and kurtosis are within acceptable limits for the remaining variables of D&G_Mentor, D&G_Mentee and MaleMentor, which can be seen in Table 10.

⁴ For the development and growth question, industry mentors were asked three additional sub-questions unique to their companies concerning the perception of their mentoring. The influence of these three additional sub-questions for this participant group has no statistically significant or substantive effect on the results.

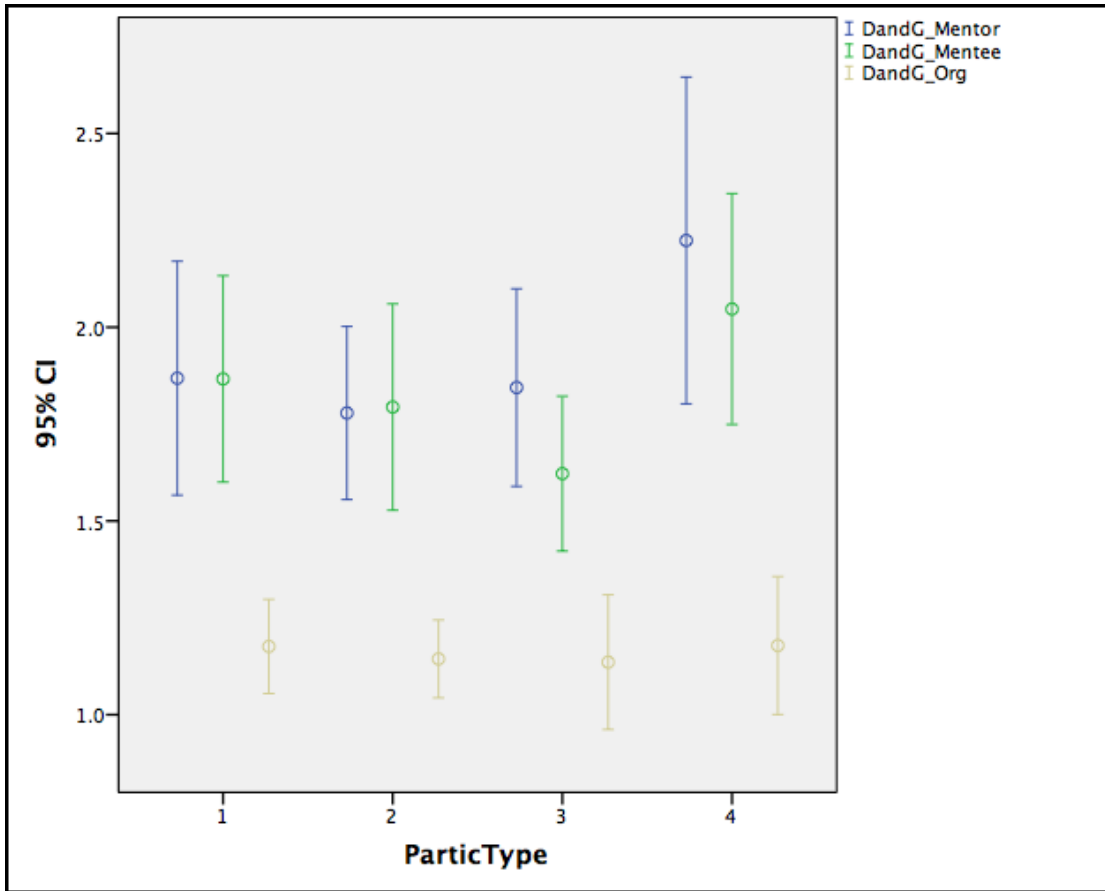
⁵ For the development and growth question, industry mentors were asked two less sub-questions, since they were not expected to know about the failure-rate in exams or the drop-out rate of students, whereas university mentors, mentees, and program managers were assumed to have this knowledge. The vast majority of participants did not know; therefore, the influence of these two sub-questions for this participant group had no statistically significant or substantive effect on the results.

Table 10: Outputs

Source: (own depiction)

	D&G_Mentor	D&G_Mentee	D&G_Org	MaleMentor
	101	106	79	145
Missing	44	39	66	0
Mean	1.812	1.786	1.148	.80
Std. Deviation	.590	.649	.276	.855
Skewness	.089	-.198	1.181	.804
Kurtosis	-.004	1.047	1.942	.172
Minimum	.000	.000	.500	0
Maximum	3.000	3.000	2.000	4

Attention needs to be paid to the comparably low mean of D&G_Org ($\bar{x} = 1.15$) in relation to D&G_Mentor ($\bar{x} = 1.81$) and D&G_Mentee ($\bar{x} = 1.79$). While the findings are not statistically significant, it still appears to be a major finding that needs to be further researched in the future. It also is visualized in Figure 9 that all groups are in agreement that mentors and mentees are making development and growth progress through the mentoring programs, while all agree that no learning is taking place on part of the organization. In particular, considering the perceived high level of support previously reported from executives, faculty, and the university in general, this finding seems contradictory to the expected development and growth of the organization.



Participant Type: 1 – Mentees; 2 – University Mentors; 3 – Industry Mentors; 4 – Program

Figure 9: Summary of Output Variables

Source: (own depiction)

Finally, a question about gendered mentoring with 8 sub-questions was asked. Since there were so few males in the program who completed the survey, the variable is only described and no correlational or causal modeling is done using this variable because of the low response rate and highly skewed distribution. **Male Mentor**, as can be seen in Table 11.

Table 11: Male Mentoring

Source: (own depiction)

Category	Variable	Variable Type	Transformed Variable Type
Gender Matching	Male Mentor	Categorical, 8 sub Q's	Ordinal, 3

Quality Criteria

To evaluate the quality of research projects, the standard quality criteria of objectivity, reliability and validity are typically used (Bortz & Döring, 2006). Furthermore, Lienert (1994) also mentions supplemental quality criteria of comparability, norming, usefulness, and efficiency, which will not be further elaborated on in this context.

Objectivity

A survey or questionnaire is deemed objective, if different users with the same subjects arrive at the same results, which indicates that the results are independent from the person administering the questionnaire (Bortz & Döring, 2006). It can further be distinguished between subcategories of objectivity, namely between: (1) transaction objectivity, where no influence is taken by the researcher on the transaction or interaction with the subjects, (2) evaluation objectivity, where the same score for the same answer is assigned, regardless who the administering researcher is, and (3) interpretation objectivity, which is given if no individual interpretations of an evaluating researcher are possible through a norm or comparable values for certain clusters of individuals (Bortz & Döring, 2006).

Objectivity can be assumed in standardized quantitative research procedures and if research is conducted by trained individuals; usually, objectivity is the easiest quality

criterion of research to be achieved, even in self-constructed questionnaires, as long as it is predetermined how to complete the test, how to assess it, and how to interpret it (Bortz & Döring, 2006).

Reliability

Minimal requirement for a test instrument is that repeated measures of an unchanged object will return the same values when using the same instrument, which is then considered the reliability of a test (Schnell, Hill, & Esser, 2013), or to put it in other words, the precision, with which the tested parameter is measured (Bortz & Döring, 2006).

Specific forms of reliability tests are as follows (Schnell, Hill, & Esser, 2013; Bortz & Döring, 2006):

(1) retest reliability, which consists of the same test being administered to the same sample of subjects with a time laps of several weeks, which should present a high correlation of test values if the test is reliable,

(2) parallel-test reliability, which requires the preparation of two test versions both utilizing the operationalization of the same construct. Then both tests are filled out by subjects one after the other, and the closer the test results, the less of an error is present; and

(3) split-half reliability, which contrary to the other two procedures does not require much of an extra effort since only one test is prepared and filled out by subjects. Consecutively, two test values each based on half of the sub-questions per subject are determined, where the method for splitting the test may be based on randomization, even and uneven numbers, or first and second test halves. The correlation of the test

values of one half with the other half represents the reliability of the test, which indirectly makes it a sub-form of parallel tests. This method typically underestimates the reliability since it assumes half the test to represent a whole test, and because the more sub-questions are tested, the higher the precision; the reliability score can be adjusted using the Spearman-Brown-Prophecy formula.

(4) internal consistency, which is considered an extension of the split-half reliability and considers a test not only to be broken down into test-halves, but further into smallest parts represented by each sub-question. Therefore, it treats each sub-question as a small parallel-test and returns the correlation between sub-questions as the variance. It can be measured by either using the so-called Kuder-Richardson-Formula or the Cronbach-Alpha, which can be used for dichotomous or polytomous sub-questions. When using Cronbach-Alpha, it may however underestimate the reliability of heterogeneous or multi-dimensional tests.

If a test has a weak objectivity measure, then the reliability will also suffer, since any discrepancies amongst test administrators will also result in errors; so consequently, reliability at the most can be as high as a test's objectivity (Bortz & Döring, 2006).

Validity

Validity, which is considered the most important quality criterion of tests, is concerned with the degree of correlation in social settings, to which the test is actually measuring what it is supposed to measure and can be subdivided into a threefold typology of validity: content (also face) validity, criterion validity, and construct validity (Schnell, Hill, & Esser, 2013).

(1) Content validity is assumed when the test sub-questions evaluate the construct to be measured in its most important aspects, which is the case if the test measures the characteristics interested in (Bortz & Döring, 2006). Content validity must be considered in the test construction and cannot be numerically determined, but the overall test sub-questions should represent the topic under investigation (Bortz & Döring, 2006). This can typically be determined by independent experts, who agree on their ratings of content validity (Schuhmann, 2011).

(2) Criterion validity is defined as the correlation between the empirically measured test values of the instrument and another externally measured criterion of a sample (Bortz & Döring, 2006). Typically, criterion validity is subdivided into predictive and concurrent validity, where the determination of the kind of criterion validity is made based on the point in time, during which the external criterion is measured (Schuhmann, 2011). Here, concurrent criterion validity occurs, if the external criterion is measured at the same time as the values of the test to be validated (i.e. a special form using the ‘known-group’ validity, which assumes for example that members of a human rights group will achieve higher scores on a test to be validated concerning the abolishment of the death penalty), while predictive criterion validity exists, when a test at the time of administration is able to forecast the extent of the external criterion at a later point (i.e. forecast of school grades based on admission tests) (Schuhmann, 2011).

(3) While it appears that content and criterion validity are hardly meaningful or only rarely employable in behavioral sciences, construct validity has a higher importance (Schnell, Hill, & Esser, 2013). The term ‘construct’ is understood to entail

theoretical dimensions of characteristics (latent variables, which are not directly observable), which then form the basis for construct validity existing, providing the construct can be found true in an empirical study about the theoretical assumptions and their relationships between theoretical dimensions (Schnell, Hill, & Esser, 2013). For this research project, it meant that the assumptions derived from theory and represented in the functional model of mentoring are validated if the empirical study supports it. Namely, the latent variables were evaluated through the questionnaires, and then indicated if the manifest variable was truly a result from them. According to Bortz and Döring (2006), three steps are required to validate a construct: first, the theoretical relationships need to be determined (in Chapter 2 of this project), then the empirical relationships between the operationalization of constructs need to be determined (in Chapter 4 of this project), and lastly the empirically determined correlations must be examined (also Chapter 4), whether they support the research question of validity of constructs or not.

Furthermore, construct validity is judged based on two criteria, the ‘convergent validity,’ of a construct, which is the case, if different operationalization of the construct are similar and therefore exchangeable, and the ‘discriminant validity,’ which exists if it can be empirically proven that the instrument is measuring other circumstances of the case than other instruments (Bortz & Döring, 2006).

Chapter 4: Data Collection, Description and Analysis

Upon approval of the IRB for the online surveys, on 14 Nov. 2016, the recruitment letter along with the links to all four surveys were sent to the seventeen program managers administering the mentoring programs at the Bavarian UASs. The attachment consisted of the support letter by the Bavarian Speaker of the State Conference of Women's Representatives. Additionally, the author was asked by the Bavarian Speaker of the State Conference of Women's Representatives to take the opportunity to introduce the topic of her dissertation and concurrent evaluation of the mentoring programs at the State Conference of Women's Representatives in Regensburg on 25 Nov. 2016 to raise awareness amongst women's representatives. Two reminders were sent out in December 2016. Despite these efforts, the return rate for each one of the surveys was very low and remained well below the minimum expected level. For this reason, the level of analysis that can be performed on the data, especially in terms of analysis based on the four types of participants is limited.

To describe the participants and to test the respective research questions, the statistical procedures and methods were determined according to methodological texts and are listed in the following table. Subsequently, where possible despite the poor return rate, these tests were performed and the results are discussed for the respective research questions.

Description of Population and Survey Respondents

This was a population survey for the 17 Bavarian UAS's that had MINT mentoring programs. All 17 program managers received survey invitations and were

also the key for getting the surveys to the mentors and mentees. The office for the State Conference of Women's Representatives reported that there was a total of 423 mentors (without further identification of specific numbers for university or organizational mentors) and 456 mentees in Bavarian MINT mentoring program. With these total population numbers in mind, the amount of surveys answered was extremely low, with 48 industry mentors, 43 university (UAS) mentors (21.5% for both kinds of mentors), 51 mentees (11.2%), and 13 program managers (76%). Since none of the answers in any of the surveys were enforced, some questions have varying numbers of answers, since participants that occasionally might have chosen to skip a question.

Demographics of Mentors

The sample of $n = 42$ UASs mentors and $n=47$ industry mentors participating in the MINT mentoring programs at Bavarian UASs consists of all females except for four individuals. The birth years, where provided, range from 1954 to 1996. The industry mentors overall are older than the University mentors, which might have an impact on how they perceive the mentoring process. While only one industry mentor was born 1990 or later, 27 of the university mentors are in this young age group.

The majority of University mentors possess a high school degree and are in the 5th semester of their studies with a range from 3rd semester bachelor studies to 3rd semester master programs. The industry mentors have at least completed their bachelor degree, with 31 possessing the old-fashioned university diploma, 11 of them holding a master's degree, and one of them a doctoral degree. Considering the completion of the last degree, the University mentors indicated that 14 of them just completed it a year

ago, while another 24 of them completed it more than 2 years ago. On the other hand, with only the exception of four of the industry mentors, who had completed their degree a year ago, all of the industry mentors completed their last degree more than 2 years ago, going as far back as 1978.

Demographics of Mentees

The sample of $n = 50$ mentees participating in the MINT mentoring programs at Bavarian UASs consists of all females except for one individual. The birth years range from 1974 to 1998, with a median of 1994. When classifying into birth year 1990 or younger, 38 of the mentees fall into this category, while only 8 state to be born 1989 or before. The majority of mentees possess a high school degree and are in the 3rd semester of their studies, with a range from 1st semester bachelor studies to 3rd semester master programs.

Demographics of Program Managers

All of the 12 program managers who responded responsible for organizing the MINT mentoring programs at Bavarian UASs are females anywhere within the birth year range from 1963 to 1993, with only 2 of them born 1990 or later, and the other 10 before 1990. When considering the program managers' education level, only two of them do not hold university degrees, while another two possess a Bachelor degree and two a Master degree, with the remaining six holding the old-fashioned German Diploma. Only one of the program managers was working full-time, while the others worked between 5 to 30 hours per week on the mentoring programs. Only $\frac{1}{4}$ hold of the

12 program managers hold an indefinite employment contract, with the other $\frac{3}{4}$ on temporary appointments. Their employment time ranged anywhere from 1-5 years.

Evaluation of the MINT Mentoring programs based on the Research Questions

To allow a logical approach to test the author's functional model of program mentoring from the context and inputs through the Activities/Processes and to the outputs, the data were examined based on their meaning and application towards the individual research questions and their corresponding research questions RQ₁ through RQ₅. The results are initially reported based on the groups of either industry or university mentors, mentees or project managers. Then, where possible based on the response rate, comparisons are made between the different types of survey respondents.

INPUTS: Communication, Understanding and Support of Program Goals (RQ₁)

The first research question asks "Are the program goals communicated properly, understood by the mentors and mentees and supported by the institution. Research question 1, with its sub-sub-questions RQ_{1a} through RQ_{1c}, examined the communications about and the respective subgroup's understanding of the program goals as well as the support that was perceived from executives, faculty and the university itself.

Communication

RQ_{1a} evaluates how effectively program managers communicate the MINT mentoring program goals. When considering the effectiveness of the communication of programs as perceived by all mentors ($\bar{x} = 1.74$), industry mentors rated it slightly better

($\bar{x} = 1.81$) than University mentors ($\bar{x} = 1.65$), with significant differences in the indexed means for sub-question 1 (display on university homepage) with $t = -1.819^*$, $df = 57$, and sub-question 9 (communication through flyers) with $t = -1.793^*$, $df = 38$.

Mentees consider the communication of the programs to be better than mentors, with $\bar{x} = 1.87$, while program managers regard their communication efforts to be far more effective ($\bar{x} = 2.03$) than any of the other groups deem it to be.

To provide an overview of how well the program goals are communicated, Table 12 is included. Here it can be seen that in most areas program managers, the ones primarily responsible to run the programs and communicate them at their respective universities, perceive themselves to communicate these programs with high scores. In particular, when it comes to activities program managers actually perform, like writing articles for the homepage, feeding the university news ticker, and providing flyers and showcase content, program managers are the ones who have the highest perception of their own good goal communication. Potentially, this is an overestimate of the effectiveness of their own activities, especially since the other groups do not perceive communication to take place to the same extent. One area especially would need improvement: Goals known to university mentors. With the mean of less than 'two' for all four groups of participants, it indicates that the goals are not perceived to be known most of the time. Here, a more precise address of target groups through program managers as well as a clear understanding of what the programs actually can help with and where the limits may be could assist in exact goal understanding and expectations. Additionally, program managers should attempt to review their activities systematically and see, how successful they are in their communication within the individual areas. A

methodical and steady controlling and tracking would help and provide a basis for good analysis.

Table 12: Comparison of Means for Communication of Program Goals

Source: (own depiction)

Comm Pgm Goals	University Mentors	Industry Mentors \bar{x}	Total Index Mentors \bar{x}	Mentees \bar{x}	Program Managers
1_Display on Homepage	1.85	2.19	2.02	1.88	2.83
2_Solicitation of Content	2.04	1.80	1.93	2.04	2.55
3_Female Inquiries	1.67	1.71	1.69	1.86	2.09
4_Male Inquiries	1.44	1.08	1.28	1.13	1.09
5_University News Ticker	1.47	1.73	1.59	1.93	2.08
6_Newsletter	1.29	1.50	1.39	2.04	1.42
7_Goals known to university members	1.82	1.88	1.85	1.74	1.92
8_Posters and Showcases	2.00	1.79	1.92	1.90	2.42
9_Flyers	1.62	2.10	1.85	2.09	2.42
10_solicited through University mentors	1.71	1.62	1.68	1.25	1.89
11_solicited through Mentees	1.75	2.18	1.97	1.80	2.11
12_solicited through Industry Mentors	0.92	1.29	1.17	0.89	1.55
Total	1.65	1.81	1.74	1.87	1.59
Cronbach's Alpha	0.833/ 32	0.734/ 41	.797/ 73	0.942/ 42	0.708/ 3
Combined Cronbach's Alpha	0.851/ 45 excluded cases				

Comparison of Mentor's Understanding of Program Goals

To better understand differences in perceptions of the mentoring programs, the indexed means for the mentors' program goal understanding were compared. Table 13 reports the results for each group by sub-question as well as the overall means for the industry mentors ($\bar{x} = 2.33$), university mentors ($\bar{x} = 2.13$), the mentors as a group ($\bar{x} = 2.24$), the mentees ($\bar{x} = 2.24$), and the program managers ($\bar{x} = 2.19$).

While a solid understanding of the program goals seemed present, means differed significantly for 3 sub-questions using the t-test for equality of means for the

two mentor types. For sub-question 4 (time to be invested) a significant difference of opinion exists with $t = -2.242^*$, $df = 59$. Similarly, for sub-question 7 (networking support through the mentor), $t = -1.702^*$, $df = 56$. Also, sub-question 8 (mental support through the mentor) is significant with $t = -2.274^*$, $df = 58$ and sub-question 10 (insights into MINT-corporate world) with $t = -3.732^*$, $df = 59$. The negative sign for the t-values here indicates that the values were higher on the industry mentors' side compared to the university mentors.

Overall, with the exception of program understanding, the three levels of mentoring, and the subject-matter support, the index for industry mentors is always higher. When looking at the averages overall, the mentors feel they do not know enough about the three levels of mentoring, but are very confident about the goals. Furthermore, it indicates that university mentors – even though they are not very aware of all the support they might offer – better understand the goals of the programs and the three levels of mentoring than their industry counterparts, probably because they themselves typically come into the mentoring as mentee and then become a mentor themselves.

Mentees estimated their mentors' knowledge of program goals equally high ($\bar{x} = 2.24$) as the mentors themselves (all ranging between 2.05 to 2.52 of the recoded values with 3 = very well), again with the exception of the 3-level mentoring programs with a score of only 1.58.

The free-text fields of all four groups reflect a common understanding according to the actual program purposes, including having a focus mainly on networking, support through mental and subject-matter advice as well as insights and experience exchange.

Table 13: Mentor's Understanding of Programs

Source: (own depiction)

Mentor Understands	University Mentors ($\bar{x} = 2.13$)	Industry Mentors ($\bar{x} = 2.33$)	Total Mentors ($\bar{x} = 2.24$)	Mentees ($\bar{x} = 2.24$)	Program Managers ($\bar{x} = 2.19$)
1_Goal	2.78	2.57	2.66	2.46	2.40
2_Frequency	2.31	2.51	2.42	2.52	2.22
3_Expectations	2.26	2.45	2.37	2.46	2.03
4_Time invested	2.00	2.45	2.25	2.18	2.11
5_Multi-faceted offers	2.24	2.37	2.31	2.27	2.10
6_3 levels of mentoring	2.00	1.53	1.74	1.58	1.67
7_Networking support	2.12	2.47	2.51	2.05	2.20
8_Mental support	2.30	2.64	2.48	2.48	2.20
9_subject-matter support	2.33	2.18	2.25	2.14	2.22
10_insights into MINT-corporate world	1.38	2.34	1.93	2.29	2.44
Cronbach's Alpha	0.805/19	0.883/ 21	.841/ 40	0.876/31	0.972/ 6
Combined Cronbach's Alpha	0.860 and 52 excluded cases				

When the mentors were asked to assess their mentees' understanding of the mentoring programs ($\bar{x} = 1.93$), industry mentors ($\bar{x} = 1.96$) overall estimated their mentees' understanding higher than the university mentors ($\bar{x} = 1.89$), with the exception of the 3-level mentoring. In particular, the t-test shows that the indexed means for sub-question 5 (multi-faceted offers) with $t = -1.690^*$, $df = 61$ and sub-question 10 (insights into the MINT-corporate world) with $t = -2.695^{**}$, $df = 58$ are statistically significant.

When self-assessing their own program goal understanding, mentees evaluated themselves overall slightly higher than their mentors' ratings, with an indexed mean of $\bar{x} = 2.44$ (all goals ranging between 1.33 and 2.70), with two exceptions (3-level cascades at 1.33 and insights into MINT-corporate world at 1.96) (see Table 14). Again,

here as well as with the mentors' understanding of the program goals, the weakest perception of understanding is concerned with the three levels of cascading mentoring.

Table 14: Comparison of Mentees' Understanding of Program Goals

Source: (own depiction)

Mentee Understands	University Mentor Index \bar{x}	Industry Mentor Index \bar{x}	Total Mentor Index \bar{x}	Mentees	Program Managers
1_Goal	1.97	2.11	2.05	2.45	2.10
2_Frequency	1.96	2.14	2.06	2.11	2.11
3_Expectations	2.04	1.88	1.95	2.12	1.80
4_Time invested	1.63	1.83	1.74	2.04	1.80
5_Multi-faceted offers	1.67	2.03	1.87	2.07	2.00
6_3 levels of mentoring	1.71	1.61	1.66	1.33	1.60
7_Networking support	1.88	2.11	1.99	2.17	2.09
8_Mental support	2.04	2.00	2.02	2.23	2.00
9_subject-matter support	2.29	2.03	2.15	2.04	2.36
10_insights into MINT-corporate world	1.40	2.09	1.75	1.96	2.10
Total	1.89	1.96	1.93	2.44	1.83
Cronbach's Alpha	0.890/ 20	0.884/20	0.884/ 40	0.909/29	0.866/ 4
Combined Cronbach's Alpha	0.858 and 46 excluded cases				

Similarly, when asked about the mentees' understanding of the program goals, the other groups all reflected in the free-text fields the presence of a common understanding according to the actual program purposes and expectations, including having a focus mainly on networking, support through mental and subject-matter advice as well as insights and experience exchange.

Program managers felt that industry mentors (RQ_{1a}) understand the program goals ($\bar{x} = 2.19$) ranging between 1.67 and 2.44 for the individual sub-questions, with

1.67 being the 3-level cascades. The overall university mentors were deemed equally knowledgeable (RQ_{1b}), with the same range and indexed mean. In their evaluation of goal understanding amongst mentees (RQ_{1c}), program managers felt slightly less positive ($\bar{x} = 1.986$), but none-the-less still scored the individual sub-questions within a range of 1.60 to 2.36, again with the 3-levels of mentoring scoring the lowest.

Comparisons of Perceived Levels of Support

When considering perceptions of Executive Support, there are significant differences according to the Chi Square (χ^2) value of $\chi^2=60.587***$. This value must be taken with care, since 58.3% of the cells have a count of less than 5 values. The Gamma statistic of $3.959***$ suggests a very strong positive correlation between the type of survey respondent and the perceptions of executive support.

The perceptions of Faculty Support at the university were not significantly different as suggested by these statistical tests: $\chi^2=17.504$ and $\text{gamma} = .628$. Yet, there is a concern with the distribution of the responses since the 62.5% of the table had thin cells. Though, it is noted that the perceptions of support for the program managers were higher than those of the three other groups, continuing a pattern evident in the Executive Support variable.

When asked about the general level of University Support, the χ^2 value of: $\chi^2=16.973$ is not significant and there were 57.1% thin cells. Nevertheless, the gamma statistic was $-2.504*$ suggesting that the results of a comparison between the four types of respondents should be interpreted cautiously for the three questions measuring perceptions of Executive, University and Faculty support.

Overall, it could be concluded that there is mixed support for the mentoring programs by executives, faculty and the organization are perceived by the respondents. While some statistics are statistically significant, skewed distributions of the data lead to thin cells and call the significance into question. The findings for RQ_{1c} are mixed, but they do suggest that program managers have a more positive view than the other three participant types. Still, these results need to be interpreted cautiously since the number of non-respondents and the unacceptably high percentage of thin cells threatens the validity of these findings.

To summarize the input variables, it could be concluded that there is low support for research question RQ_{1a}, due to divergent estimates of the groups asked in the triangulation of the issue of sufficient program communication. Here it can be noted that based on some of the individual information provided by participants, some were not even aware of the programs being communicated via several media at the universities, making stronger communication necessary and imperative for improvements. Additionally, based on personal observation, many university students do not even know about the programs nor that they might be eligible for enrollment in them. Mentors and mentees do seem to understand the mentoring program goals, lending support for RQ_{1b}. The perceived levels of executive, faculty and university support for the mentoring program vary dramatically between and within the respondent groups leading to a mixed conclusion regarding RQ_{1c}.

ACTIVITIES/PROCESSES (RQ₂):

Activities, Robust Matching, Similarities and Appropriate Processes

The second research question asks “What are the participants’ perceptions of the processes and relationships developed in the MINT mentoring programs?” Research Question 2, with its sub-sub-questions RQ_{2a} through RQ_{2d}, established the prior and current mentoring activities of the participants, then examined the robustness of the matching process, the similarities within mentoring tandems, and the appropriateness of the matching process.

Prior and Current Mentoring Activities (RQ_{2a})

The prior and current mentoring activities in which participants may have engaged could help to understand how they perceive the MINT mentoring program processes as well as how they report the relationships they have with their mentoring partner. The surveys asked four questions to establish the number of hours per week spent on mentoring, mentor status, the number of semesters spent mentoring and prior mentor/mentee experience. The results by the types of participants are presented in this sub-section.

Mentors’ Prior and Current Mentoring Activities

From Table 15, it appears that the university mentors are spending almost the same amount of time mentoring as their industry counterparts. The weekly mentoring time commitment is generally one or two hours, with a few reporting higher amounts of time spent mentoring. The industry mentors do tend to devote more time.

Table 15: Hours Spent Mentoring per Week

Source: (own depiction)

Hours spent mentoring per week	Total	University mentors	Industry Mentors
1	49	27	22
2	29	7	22
3	7	4	3
4	2	2	0

While 24 of the university mentors function as such within their first year so far, the remaining 16 are more experienced with 2 or more years. The industry mentors seem to be more experienced than the university mentors, since only 24 of them are in their first year of providing mentoring, and 26 have been with it for 2 or more years. With a count of 25, the university mentors indicated that they either were or still are mentees themselves compared to only 15 of the industry mentors. The responses suggest that individuals are more likely to mentor when they had benefited from mentoring programs themselves at one point. Only 15 of the university mentors specified that they did not have the opportunity to participate in mentoring, either because no program existed or no slots were available, while 32 industry mentors do so. Even though this difference might appear significant at first glance ($\chi^2 = 8.138^{**}$), it can easily be explained with the mentoring programs still being rather new (just being introduced since 2005/2006), so many of the industry mentors never were able to enjoy benefits of formal mentoring during their own university time.

Mentees' Prior and Current Mentoring Activities

All of the mentees spend between 0 to 2 hours per week in mentoring activities as mentees, even though the majority (28) claimed to only utilize less than 1 hour of their time, while 12 estimated one hour, and only 3 spent 2 hours. While only a few

mentees have been enrolled for the duration of their studies, the majority of mentees are relatively new to the program (16 within their 1st year of studies, 16 in their second year, and 12 in higher semesters, of whom 3 are already enrolled in master's degrees). Five mentees have been or still are mentors themselves for mentees in lower semesters, the remaining mentees indicated either no interest in mentoring others due to their young age or report of a lack of mentoring opportunities.

A total of 41 mentees indicate that they receive access to coaching events free of charge, with another 6 of them stating that they additionally receive valuable subject matter support and advice from either more experienced university mentors or industry mentees. Of the respondents, 39 are participating in the mentoring program for the first year, with only 4 more experienced mentees. Of the responding mentees, 38 were involved in mentoring at lower levels, and only 5 did not receive this opportunity.

Overall, it appears that mentors and mentees both invest a moderate amount of time of one to two hours per week in the mentoring activities. A good half of the industry mentors are on their second or more year of mentoring, while only about 40% of university mentors are experienced. This can be explained due to them not being able to become university mentors unless they are at least in their second year, and the standard bachelor degree takes only 3.5 years. While no clear support for RQ_{2a} is found, it appears intuitive that the more mentors were involved in the mentoring programs as mentees themselves, the better they can function as mentors and the better they understand the programs.

Perceived Robustness of the Matching Process (RQ_{2b})

In order to gain an impression of the perceived robustness of the matching process, the surveys asked all groups about their experience. Industry mentors reported that in almost $\frac{3}{4}$ of the instances (72.5%) mentor and mentee were matched through program managers, whereas 17.5% matched themselves after an initial kick-off meeting. It is indicated that matching takes place according to required skills and needs (50%) half the time, even though one mentor was working with several mentees in $\frac{1}{6}$ of the cases (17.5%).

Similarly, university mentors reported matching through program managers (83.3%) and/or after a short kick-off event where mentor and mentee found themselves (40%) based on skills and needs (56.7%), while here also in 60% of the cases one mentor worked with several mentees. Only one person (3.3%) reported that a random process was used to match mentor and mentee.

As far as the matching process was concerned, mentees confirmed the observations of both types of mentors by indicating that mentee and mentor were matched based on the required skills and needs (66.7%) through either program managers (60.6%), finding themselves after a brief kick-off (18.2%), or being matched randomly (9.1%). Also, they reported that mentors work with several mentees (33.3%).

Program managers reported to perform the matching in 91.7% of the cases, often based on the required skills and needs (50%) and supported through a first kick-off meeting of mentor and mentee (16.7%). Also, in $\frac{1}{3}$ of the cases, one mentor is working with more than one mentee.

An overview of the count of answers provided is displayed in the following Table 16 for all four groups. While the program managers only answer from the multiple-choice options between one to three times, close to 30% of the mentees did not chose to answer this question concerning the methods used to match mentor and mentee at all. Here it appears that no remembrance of any particular matching process could be recalled or participants were not motivated to answer – despite not dropping out of the survey. Also, mentors ($\bar{x} = 1.62$) seem to have made more observations of different matches made between mentor and mentee compared to mentees ($\bar{x} = 1.30$), which can be explained through them often having been mentees themselves before becoming mentors, or staying with mentoring for a long time, resulting in them having seen more methods of matching in their times.

Table 16: Count of Sub-question responses related to Robust Matching
Source: (own depiction)

# of answers provided	University Mentors	Industry Mentors	Mentor Total	Mentees	Program Managers	Total
0	10	7	17	14	0	31
1	5	20	25	9	4	38
2	11	15	26	18	4	48
3	10	4	14	5	4	23
4	2	1	3	0	0	3
5	2	0	2	0	0	2
<i>N</i>	40	47	87	46	12	145
\bar{x}	1.88	1.40	1.62	1.30	2.00	

Based on the above review of survey questions concerning the matching process, the findings for RQ_{2b} are mixed. This is determined by looking at the majority of answers ranging between one and three answers provided. When comparing the count of answers for the different groups, they are relatively similar in frequency, but none-the-less, differences exist, also in the higher counts.

Similarity Matching (RQ_{2c})

Concerning the identification of observable similarities in matching, it appeared industry mentors perceived the degree program to be the foremost important factor in matching with 89.5% finding it very distinct or present, followed by the degree of engagement concerning the mentoring relationship with 64.9% also very distinct or present. While geographic vicinity and branch of industry in which a career is desired reach a medium score, age and culture can be entirely neglected.

As far as observable similarities are concerned, university mentors agreed with industry mentors that foremost importance is the degree program (100% as very distinct or present), followed by 59.3% in the branch of industry where a career is desired. All other criteria (engagement, age, culture, etc.) were rated with 59% or higher as hardly noticeable to not important.

When evaluating the observable similarities, mentees indicated that the most important criteria were degree program with 97% (very distinct to present) and branch, where career was desired with 82.76%. All other criteria seemed to be perceived more important than for the mentors, with engagement (63%), age (43.3%), regional membership (40%), culture (39.3%), or residence (33%).

Program managers indicated that the matching is influenced through the degree program (very distinct or present 100%) as well as the branch of industry sought for a future career (100%), whereas only residence also seemed to have importance (54.5%), and age and culture could be neglected according to the program managers.

An overview of the data collected and the differences between the groups is displayed in the following Table 17.

Table 17: Comparison of Means for Similarity Matching

Source: (own depiction)

Similarities	University Mentors \bar{x}	Industry Mentors \bar{x}	Total Index Mentors \bar{x}	Mentees \bar{x}	Program Managers
1_Age	0.96	0.25	0.58	1.18	0.30
2_Culture (i.e. ethnicity, same migration background)	0.48	0.35	0.41	1.08	0.38
3_Degree program / area of emphasis	2.69	2.21	2.42	2.47	2.67
4_engagement in respect to the mentoring relationship	1.23	2.03	1.67	1.84	2.00
5_Regional membership (i.e. Upper Franconia, from Bavaria, etc.)	1.04	0.63	0.81	1.42	0.82
6_Residence or vicinity	1.17	1.00	1.07	1.17	1.30
7_Branch that is intended for the professional career	1.68	1.99	1.85	2.29	2.50
Total	1.38	1.30	1.33	1.74	1.59
Cronbach's Alpha/ Excluded cases	0.688/ 20	0.403/ 22	0.530/ 42	0.451/28	0.708/ 3
Combined Cronbach's Alpha	0.655 and 51 excluded cases				

Similarities were measured with seven sub-questions with four categories on a Likert scale, where the means represent the average of respondents and range between 0 – 3, with 3 meaning very distinct similarity between mentor and mentee. As noted in the literature review, when mentor and mentee share more of these attributes, the mentoring relationship is more likely to encourage development and growth in mentee and mentor alike. Here it seems, that both groups of mentors agreed on the importance of degree program / career field, while age and culture did not matter at all. Contrary to all other groups, mentees thought that age, culture, regional membership and residence all mattered in addition to degree program. This can be explained through younger and less mature individuals realizing and accounting for age or other differences more than individuals with more maturity and standing and experience in society or at university.

However, the index variables by category and overall are mostly below the Cronbach's alpha threshold (except for Program managers, which has too few responses to be reliable) so these results have very high threat to the validity and should be taken with caution.

Even though it appears that most criteria are considered not to be important, means differed significantly for 3 sub-questions using the ANOVA test for equality of means. For sub-question 1 (age) a significant difference is perceived with the statistic of 3.368^{**} , $df = 58$; this difference can be explained through the industry mentors valuing a tandem that is closer to their own age than the other three groups. These findings are quite contrary to the literature. Perhaps the difference in experience and career phase that an industry mentor has is important for this function to be held compared to university mentors who are still students themselves and much younger, as was also confirmed in the comparison of demographic data.

For sub-question 3 (degree program / area of emphasis $ANOVA = 2.933^{**}$, $df = 65$), and for sub-question 4 (engagement in respect to the mentoring relationship $ANOVA = -3.437^{**}$, $df = 56$). Both values are surprising when compared to expectations from the scholarly literatures, since they suggest that university mentors place much higher importance on the similarity of these attributes than do the others. Literature assumes similarity to be of importance, also in the area of professional field and engagement. No assumptions can be made for these differences with the exception that the data set was very thin due to many participants providing the answer 'do not know,' resulting in non-support of RQ_{2c} .

Appropriate Matching Process (RQ_{2d})

Additional support concerning the matching process is gained through a question asking about the appropriateness of the process. Almost 2/3 of the mentors deemed the matching process optimal (66%), whereas another 1/3 found it needs improvement (32%), with merely one person indicating it to be extremely poor (2%). Parallel to what industry mentors found, university mentors evaluated the matching process as robust in 58% of the cases, where 39% felt it needs improvement, and 1 person (3%) deemed it very poor. Overall, mentees seemed to be even more content than mentors with the matching process, with 82% deeming it optimal, 15% considering it worth improving, and only 1 person (3%) evaluating it very poor. Program managers' perception of the matching process is to be optimal (50%) compared to another 50%, who deem the process in need of improvement. In sum, the majority of participants (n=77) deem the process appropriate, with only 1/3 (n=36) of the participants feeling it needs improvement, and only 4 participants describing the process as inappropriate.

Overall, the descriptive statistics (see Table 18) provide the impression that the matching process of mentoring is perceived to be effective according to the estimates of the groups involved and – at least based on the descriptive statistics – RQ_{2d} seems to be acceptable, with the following \bar{x} , indicating 2 = optimal / appropriate and 0 = inappropriate, and the program managers appearing to be the most skeptical group at 1.50, which is between the responses of optimal and needing improvement.

Table 18: Comparison of Means for Appropriateness of Matching Process

Source: (own depiction)

Appropriate Process	University Mentors \bar{x}	Industry Mentors \bar{x}	Total Index Mentors \bar{x}	Mentees \bar{x}	Program Managers
Optimal	18	27	45	26	6
Needs Improvement	12	13	25	5	6
Inappropriate	1	1	3	1	0
\bar{x}	1.55	1.63	1.57	1.78	1.50

To sum up the findings on the second research question concerning activities and processes, overall it can be stated that the activities, the robustness of matching, similarities between mentors and mentees, and the appropriateness of matching process only partially can be confirmed. While RQ_{2a} cannot clearly be answered, it makes sense that prior and current mentoring activities lead to a better understanding of the programs and results in better functioning as mentors. The process for matching mentors and mentees appears to be mostly robust, lending mixed support to RQ_{2b}. Similarity matching RQ_{2c} - contrary to literature – is not supported in respect to culture and age, while at least the group of mentees deemed it important to some degree. Here, no assumptions can be made due to the very thin data set. The appropriateness of the matching process (RQ_{2d}) is confirmed due to 2/3 of participants perceiving the process as optimal.

OUTPUTS: Perceived Development and Growth (RQ₃)

The third research question asks: “Are the development and growth expectations of the mentoring programs met?” Research Question 3, with its sub-sub-questions RQ_{3a} through RQ_{3c}, examined the perceived development and growth of the mentors, the mentees, and the organization’s.

Development and Growth of Mentors (RQ_{3a})

Industry mentors' self-assessment of their development and growth indicated a distinguishable or small increase in knowledge of human relations (23.5% / 38.2%), their self-assurance (17.1% / 31.4%), their understanding of mentee (24.2% / 42.4%), their trust in mentee (26.5% / 35.3%), and their ability to listen (9.1% / 45.5%) and passing on knowledge (15.2% / 54.6%). Most participants deemed the other skills to remain stable or even decrease over time, such as patience with mentee, subject matter knowledge, self-organization, and presence in the company. This can be explained potentially through mentors' realizations that their subject matter knowledge is either not quite current or is tested by mentees, possibly resulting in their patience decreasing also.

Similarly, university mentors claimed to have improved - with a distinguishable or small increase – their self-assurance (21.4% / 42.9%), their patience for (19.2% / 34.6%) and understanding of mentee (15.4 / 38.5%), their ability to pass on knowledge (11.1% / 55.6%) and to listen (15.4% / 30.8%) to their mentees, and their knowledge of human relations (19.2% / 38.5%). On the other hand, university mentors indicated that their subject-matter knowledge did remain the same (57.7%) as well as their ability to self-organize (50%).

A significant difference of means was observable for sub-question 5, where the recognition within the mentoring network was asked. Here, the ANOVA statistic is equal to -2.643**, df 47, which indicates that industry mentors perceive that their own mentoring efforts are recognized within the mentoring network at a significantly higher level than what is perceived by the other three groups. This might be due to the fact that

gaining external support and mentors from industry requires harder acquisition; similarly, they volunteer outside of their own organization and might give up some of their valuable time to assist students through mentoring for merely altruistic reasons to make a difference in some young woman's life.

The mentees considered their mentors – both industry and university mentors – to have gained self-assurance (20.8% / 29.2%) and understanding of mentee (28% / 36%), while they also felt an improvement in their subject-matter knowledge (13% / 26.1%), their ability to pass on knowledge (17.4% / 26.1%), and their knowledge of human relations (8.7% / 39.1%). In the area of ability to listen and self-organization the results were non-conclusive.

Program managers considered the mentors to have gained to 50% or more in the following areas: self-assurance (33.3% / 16.7%), patience with mentee (8.3% / 50%), understanding for mentee (33.3% / 33.3%), trust in mentee (41.7% / 8.3%), and responsibility for mentee (25% / 33.3%), while the majority of the program managers did not dare to estimate changes in the following areas and rather answered as 'not known': ability to pass on knowledge (58.3%) and to listen (58.3%), knowledge of human relations (50%), and self-organization (58.3%).

When comparing the indexed means of the different groups (see Table 19), it becomes apparent that at least a moderate increase of skills across all areas took place in reference to the mentors, as can be seen in the following table, since a value above '1' indicates an increase, '2' a small increase, and '3' a distinguishable increase. However, it needs to be noted that project managers' perception index is not valid since it is below the Cronbach's threshold.

Table 19: Perception of Development and Growth of Mentors

Source: (own depiction)

MENTOR	Self-observed, University Mentors \bar{x}	Self-observed, Industry Mentors \bar{x}	Total Index Mentors \bar{x}	Mentees' \bar{x}	Program Managers'
1_Self-assurance	1.89	1.7	1.78	1.89	2.43
2_Patience with mentee	1.67	1.31	1.46	1.58	2.14
3_Understanding for mentee	1.71	1.88	1.81	2.15	2.33
4_Trust in mentee	1.57	1.88	1.75	2.26	2.57
5_Recognition within mentoring network	1.38	2.00	1.73	1.77	2.50
6_Subject-matter knowledge	1.52	1.47	1.49	1.69	2.00
7_Responsibility for mentee	1.63	1.74	1.69	1.47	2.43
8_Ability to pass on knowledge	1.80	1.85	1.83	1.72	2.40
9_Ability to listen	1.65	1.64	1.64	1.71	2.00
10_Gaining trust of the mentees	1.87	2.09	2.00	2.00	2.57
11_Knowledge of human relations	1.79	1.85	1.83	1.87	2.33
12_Self-organization	1.68	1.45	1.55	1.62	2.20
13_Better presence in company ¹		1.50	1.50		
14_Recognition through company ¹		1.33	1.33		
15_Belittling of the mentoring process within company ¹		0.94	0.94		
Total	1.69	1.68 / 1.78 ²	1.69 / 1.80 ¹	1.94	1.73
Cronbach's Alpha	0.914/ 21	0.903/ 25	0.903/ 46	0.866/42	0.509/ 8
Combined Cronbach's Alpha	0.895 and 55 excluded cases				

¹ questions only asked of industry mentors² indexed means that exclude sub-questions 13, 14 and 15¹

Overall, the development and growth of mentors in the respective areas was not strong, and it appeared that self-reported development and growth is expressed more reserved than the perception program managers and mentees, who see the development to a larger degree. Since the changes indicated are not all in the same areas nor are they to similar degrees, a careful estimation of development and growth can be assumed.

Especially when sub-questions 13-15 are removed, the adjusted means are higher and allow a better comparison, since these questions were only asked of industry mentors. Support of RQ_{3a} is given at least when considering both groups of mentors and the mentees' perceptions, while program managers do not offer conclusive answers, partially due to thin cases.

Development and Growth of Mentees (RQ_{3b})

In their perceived evaluation of development and growth in their mentees on a scale of 1 (distinguishable increase) to 4 (decrease), industry mentors clearly indicated improvements (of distinguishable increase / slight increase) in the area of understanding of the career field (29.4% / 61.8%), clarity of career goals (23.5% / 61.8%), self-assurance (19.4% / 63.9%), initiative (23.5% / 29.4%), study-motivation (5.9% / 58.8%), self-organization (11.8% / 41.2%), and problem-solving abilities (11.8% / 38.2%). Somewhat inconclusive results were attested in the area of subject-matter knowledge, ability to absorb knowledge and to listen.

The university mentors identified almost identical areas of development and growth in the area of the career field (12% / 48%), clarity of career goals (11.5% / 42.3%), self-assurance (17.9% / 42.9%), initiative (11.5% / 38.5%), study-motivation (18.5% / 40.7%), subject-matter knowledge (14.8% / 59.3%), and problem-solving abilities (7.7% / 50%). The inconclusive areas were almost identical and are ability to absorb knowledge, to listen, and to self-organize.

Significant differences became apparent for some of the sub-questions through the t-test: Clarity of career goals (sub-question 2) was significantly higher for industry

mentors ($t = -2.034^{**}$, $df 47$), which can be attributed to the industry mentors providing better and more precise insights into the career field. Related is also sub-question 5 (understanding for the professional field) with $t = -1.898^*$, $df 48$ for the same reasons. On the other hand, when it comes to attributing increase of subject-matter knowledge (sub-question 7), university mentors see themselves as more effective with $t = 3.581^{**}$, $df 47$. In the area of motivation for studies (sub-question 15), university mentors similarly see themselves far more effective than their industry counterparts with $t = 3.707^{**}$, $df 37$; the significant difference may be attributable to their closer knowledge of what to focus on for individual courses and exams, and their potential providing of hints and advice for meeting of requirements. When looking at the drop-out rate (sub-question 16), industry mentors are significantly more confident with $t = -4.834^{**}$, $df 39$; no explanation can be offered for this difference except thin cells since it appears, both types of mentors should be equally informed about the study progress of their mentees.

Program managers were not so certain in their identification of development and growth areas, since the only fields they indicated with a majority are self-assurance (33.3% / 25%), clarity of career goals (25% / 33.3%), and understanding of the career field (36.4% / 18.2%). In all other areas, the majority always answered that they do not know, which is why their answers concerning this question are not evaluated any further. The few participants in this survey and their indication of not knowing does offer no basis for statistical evaluation. Surprisingly, 100% indicated not to know about examination results and degree-completion rates of the mentees, which indicated a lack of program controlling, as can also be seen in the evaluation of the next section of their questionnaire.

Examining the results reported in Table 20, it becomes apparent that the group of mentees as well as university mentors takes turns in having the highest score of the perceived development and growth of mentees. In only two areas industry mentors score highest: Clarity of career goals as well as recognition within mentoring network.

Table 20: Perception of Development and Growth of Mentees

Source: (own depiction)

Mentee	University Mentors \bar{x}	Industry Mentors \bar{x}	Total Index Mentors \bar{x}	Self-observed Mentees' Perception \bar{x}
1_Self-assurance	1.92	2.12	2.05	2.25
2_Clarity of career goals	1.89	2.23	2.10	2.05
3_Understanding for mentor	1.70	1.84	1.78	2.05
4_Trust in mentor	1.91	2.19	2.08	2.30
5_Understanding for the professional field	1.94	2.28	2.16	2.44
6_Recognition with the mentoring network	1.59	1.86	1.74	1.69
7_Subject-matter knowledge	2.09	1.52	1.78	1.79
8_Responsibility for mentoring process (commitment)	1.40	1.45	1.43	1.83
09_Ability to absorb information	1.65	1.45	1.53	1.78
10_Ability to listen	1.68	1.55	1.60	1.55
11_Problem solving abilities	1.89	1.75	1.81	1.74
12_Self-organization	1.83	1.73	1.77	1.76
13_Self-initiative	1.57	1.77	1.69	1.95
14_Success in exams	1.83	1.82	1.83	1.50
15_Motivation for studies	2.00	1.28	1.07	1.80
16_Drop-out rate of students (females)	0.86	1.89	1.54	0.80
Total	1.67	1.79		1.99
Cronbach's Alpha	0.862/ 27	0.793/ 34	0.824/ 61	0.919/6
Combined Cronbach's Alpha	0.904 and 54 excluded cases			

Here it might be noted that industry mentors are possibly not that close to mentees to observe their development and growth in one to two hours of contact per week, while university mentors still are students themselves, might see mentees on

campus frequently, and often times have been mentees before becoming mentor themselves. Mentees and university mentors might be able to identify their own areas of development better, or on the other hand prefer their self-perception to include a greater development and growth. The Cronbach Alpha is above the threshold of acceptable values of 0.7 for all three categories, so the dataset can be considered reliable.

In order to provide more insights into the learning taking place, it is recommended to have self-assessments concerning development and growth and an exchange of the resulting information done between the respective mentoring tandems. In this manner, a better overview, self-efficacy and learning achieved could be picked out as a central theme during mentor-mentee meetings.

As far as the mentees themselves were concerned, their self-assessment of these criteria even is considerably more positive than that of their mentors. All sub-questions were evaluated with at least 50% agreement or more in the category of distinguishable increase or some increase with the exception of the ability to listen, examination passing and degree-completion rates of mentees. Therefore, research question RQ_{3b} can be confirmed.

Perceived Organizational Development and Benefit (RQ_{3c})

This research question is evaluated based on the data collected from both groups of mentors, mentees, and program managers. The majority of industry mentors indicated through the choice of ‘don’t know’ that they were unable to assess organizational development in just about all areas except the establishment of the

mentoring programs, which they felt was either improved (25.7%) or remained the same (25.7%).

The university mentors seemed to sense a slightly better development of the organization, since they indicated an increase with a majority (18.5% distinctive increase / 40.7% slight increase) in the area of the establishment of mentoring programs. For other areas, the majority observed about the same level as before or a slight increase, not really hinting at a development: willingness to help, support of the programs, and establishment of informal or professional networks. When it comes to the establishment of similar programs for other groups of students, the failure-rate at exams, and the drop-out rate of female students, most of the answers provided 'don't know.'

Mentees are similarly unknowing, but testified to informal communication networks being established with a majority, while otherwise indicating same levels. In particular, they stated not to know the demand for similar programs, the failure-rate, and the drop-out rate of female students with 60% or higher.

Program managers only indicated positive support (9.1% distinct increase / 45.4% slight increase) for the programs and their establishment (0% / 54.6%) as well as for the establishment of professional networks (0% / 45.5%). The other areas covered reflected that the majority of program managers 'do not know' about increased willingness to help (54.6%), introduction of similar programs (54.6%), establishment of informal communication networks (54.6%), failure-rate (90%), and drop-out rate of female students (100%), again indicating that no type of controlling for the mentoring programs is conducted.

As can be seen in Table 22, it appeared that if anything, only slight organizational development can be observed based on the vague answers provided by all four groups surveyed.

Table 21: Organizational Development in MINT-Mentoring-Programs

Source: (own depiction)

ORGANIZATION	University Mentors \bar{x}	Industry Mentors \bar{x}	Total Index Mentors \bar{x}	Mentees \bar{x}	Program Managers
1_Willingness to help at university in general	1.09	1.09	1.09	1.00	1.20
2_Support of the programs	1.10	1.06	1.08	1.06	1.11
3_Establishment of the programs	1.23	1.21	1.22	1.18	1.00
4_Deamnd of similar programs for other groups of students (i.e. migration background, disability, men in social professions)	1.36	1.20	1.29	1.29	1.17
5_Introduction of similar programs for other groups for students (i.e. migration background, disability, men in social professions)	1.27	1.43	1.33	1.11	1.40
6_Development of informal communication networks	1.07	1.21	1.14	1.12	1.80
7_Development of professional networks	1.00	1.21	1.11	1.29	1.00
8r_Failure-rate in exams				1.70	1.00
9r_Drop-out rate of students (female)				1.75	°
Total	1.05	1.03	1.09	1.32	1.08
Cronbach's Alpha	0.178/ 31	0.911/ 40	0.455/ 71	0.598/41	**
Combined Cronbach's Alpha	0.873 without 8 and 9 and 53 excluded cases				

° The only answers provided were 'do not know'

** Cannot be computed due to excluded cases

It is astonishing that in many areas non-conclusive statements were made. This observation is confirmed when evaluating organizational development for the program managers, who stated that they conduct cost controlling in only 27.3% of the cases, and

63.6% conduct satisfaction surveys concerning the mentoring programs. Only 9.1% of the program managers conducted drop-out studies of mentees compared to non-mentees, while no other type of controlling is conducted, which unfortunately leads to wasted chances of organizational development and does not offer support for RQ_{3c}.

To sum up the findings for Outputs, the perception of mentors' development and growth was supported despite the fact that mentors evaluated themselves more reserved than the other groups involved, lending support for RQ_{3a}. The perception of mentees development and growth can be confirmed (RQ_{3b}), and no support is offered for organizational growth and development (RQ_{3c}).

CONTEXT: Gender Matched Mentors (RQ₄)

The fourth research question asks: "How important is it to have gender matched mentors?" Research Question 4 expects that mentoring by females offers the only valuable mentoring.

When asked about the option to utilize male mentors for female students, industry mentors indicated with a clear majority (70.37%) that they could not imagine that mentees, nor that the other mentors (48.2%) would like it. It appeared that at least 7.4% of the industry mentors thought about it and are still in the testing phase, while 3.7% reported that they conduct mentoring with male mentors and it has been working out well. Another 11.1% state they would only consider it in exceptional cases.

For university mentors, the results were not as stringent, since only 27.3% assumed that mentees might not like it, while 18.2% thought other mentors would not agree to it. Of the university mentors, 31.2% reported to have considered mentoring

through males, with 4.6% still in the testing phase and another 27.3% indicated it to be a success. Another 27.3% stated they would only consider it in exceptional cases.

Mentees were slightly more reserved than the university mentors, since almost half of them (47.6%) stated that other mentees would not like it, while also 23.8% assumed the mentors would not like it. While 9.5% clearly indicated that mentoring through males for female students would be unthinkable at their university, 23.8% stated that they thought about it already, with 4.8% in the testing phase. Another 38.1% stated mentoring through males would only be an option in exceptional cases when not enough females could be gained for the mentoring tandems.

Program managers stated that mentoring through males for female MINT students is unthinkable at their university (33.3%), with 22.2% indicating it not to be tolerated by mentees, whereas 11.1% stated mentors would not like it. Of the program managers, 22.2% stated they considered male mentoring already, with 11.1% in the testing phase. Another 11.1% stated that they would only consider male mentoring in an exceptional case, if no female mentors would be available. Summary information on potentially using male mentors can be seen in Table 23.

Table 22: Count of Answers about Using Male Mentors

Source: (own depiction)

Numbers of answers provided to Male Mentor	Total Mentors	University Mentors	Industry Mentors	Mentees	Program Managers	Total
0	38	18	20	26	3	67
1	28	14	14	13	8	49
2	21	8	13	6	1	28
3	0	0	0	1	0	1
Totals	87	40	47	46	12	145

Overall, it appeared that for most part all groups had reservations and were not willing to give male mentoring a try, even though the argument could be provided that

male mentoring is still better than no mentoring at all, and workplace reality might also include close working relationships with males. At least through the surveys conducted for this paper, it appears that those involved in the mentoring programs want to hold on to exclusive use of female mentors for the MINT-mentoring, resulting in RQ₄ being supported.

LOGIC MODEL TESTING (RQ₅)

The final research question asks: “To what extent are the development and growth expectations of the mentoring programs met?” Research Question 5, with its sub-sub-questions RQ_{5a} through RQ_{5d}, looks at the relationships between the inputs, process/relationships and outputs.

Correlations

To test the logic model, first the correlations between controls to outputs are determined, then between the different other groups. Controls came not out as expected, however, these results are not statistically significant, and while they are interesting, they do not have explanatory value due to being controls. As can be seen in Table 24, D&G goes down when Age goes up (not s.s.), which can be explained through less incremental development in older individuals. Also, a higher degree leads to lower D&G of mentor and organization (not s.s.).

Table 23: Controls to Outputs

Source: (own depiction)

	Gender	Age	Degree	SemPostDegree
D&G_Mentor	.087	-.058	.041	-.137
D&G_Mentee	-.060	-.016	-.107	.015
D&G_Org	.167	-.029	-.008	-.088
**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).				

When evaluating the correlation of Inputs to Activities, one result is statistically significant (see Table 25). The higher the number of mentoring semester, the lower the perceived level of University Support. This is a finding that is contradictory to what was predicted in the literature. It is noted that the negative relationship between mentoring semesters persists across all the activities with the exception of Executive Support. There are also several negative, but not statistically significant, correlations between being a prior mentee and the activities. This is a finding that would not be predicted in the literature either.

Table 24: Correlation of Inputs to Activities

Source: (own depiction)

	Pgm Goals	Comm To Mentor	Comm To Mentee	Exec Support	Faculty Support	Univ Support
Hours Week	.172	.109	.142	.080	.067	-.033
Mentoring Semesters	-.198	-.008	-.138	.036	-.032	-.198*
Prior Mentee	-.025	.020	-.106	.023	.002	-.058*
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

The correlation between Inputs and Processes provides several highly significant values. Especially the robustness of matching is positively correlated to the support from all three levels – executive, faculty, and overall - at university, which indicates that individuals feel strong support if they feel the matching process is robust (see Table 26).

Table 25: Correlation of Inputs to Processes

Source: (own depiction)

	Pgm Goals	Comm To Mentor	Comm To Mentee	Exec Support	Faculty Support	Univ Support
Robust Matching	.012	-.087	-.176	.403**	.254**	.482**
Similarities	.123	-.027	.099	.116	.109	.072
Approp Process	.219*	.439**	.499**	.049	.100	.122
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

Correspondingly, the appropriateness of the matching process is positively correlated to the program goals and the communication with mentors and mentees.

Correlations of Inputs to Outputs are statistically significant in many areas as can be seen in Table 27. While D&G_Mentor is correlated to all input variables except University Support, it is extremely surprising that D&G_Mentee is not significantly correlated to any input variables and in four instances even is negative. The D & G_Org variable has significantly positive relationships with program goals, communication to mentor and mentee and university support. Surprisingly it is negatively correlated with faculty support. This result stands in contrast to what is expected by the literature. In the future, additional research could investigate the negative correlations for the D&G_Mentee variable.

Table 26: Correlation of Inputs to Outputs

Source: (own depiction)

	Pgm Goals	Comm To Mentor	Comm To Mentee	Exec Support	Faculty Support	Univ Support
D&G_Mentor	.400**	.328**	.323**	.216*	.258**	.101
D&G_Mentee	.037	-.040	-.143	.011	-.052	-.076
D&G_Org	.328**	.291*	.338**	.021	-.034	.225*
** . Correlation is significant at the 0.01 level (2-tailed).						
* . Correlation is significant at the 0.05 level (2-tailed).						

Correlations of Activities to Outputs are non-existent, as can be seen in Table 28. Nonetheless, it appears surprising that the amount of time spent in the mentoring relationship or the longevity of the mentoring relationship is not correlated to the D&G_Mentor or D&G_Mentee. Here again, a confirmation of these results needs to be considered in future research; even though results are not statistically significant, these results were not expected.

Potential explanations could be that the higher semester students have either a reduced incremental output, or on the other hand they might feel that the mentoring takes up too much time, possibly also away from them progressing towards their degree and their academic advancement. Whether from a networking perspective or simply for the usefulness of a relationship, it could be assumed that the longevity of the relationship would make a difference; these findings are interesting and might be specific to Germany.

Table 27: Correlation of Activities to Outputs

Source: (own depiction)

	Hours per Week	Mentoring Semesters	Prior Mentee
D&G_Mentor	.125	-.028	.182
D&G_Mentee	.102	-.051	-.031
D&G_Org	.134	-.082	.045
**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).			

Correlations of Processes to Outputs provide nothing but questions for future research. As can be seen in Table 29, robustness of matching is negatively related to all of the development and growth variables, which cannot be explained. If the process is deemed robust, why would growth and development be negative, even if not statistically significant. This finding poses a big problem, which needs to be considered in future research.

Additionally, Similarities have to be dropped from the regression model since the Cronbach Alpha for the entire index is too low (.485), and even for subsets of the question on Similarity is not improving much. Considering this question, it is realized that it asked a spectrum too broad to cluster in this variable and should rather be asked in separate questions in future research, splitting it in location, culture, profession, and

personality. Also, Robust Matching needs additional future research, since it appears that the more robust the process of matching is, the less development and growth is taking place for all three categories. Furthermore, while it is good to see that the appropriateness of the process is statistically significant for the development and growth of the mentor, it could be assumed that in reality, the appropriateness would more so guarantee development and growth for the mentee, just as much as similarities would rather provide a highly significant outcome for mentees, instead of just focusing on mentors. Here additional research is needed.

Table 28: Correlations of Processes to Outputs

Source: (own depiction)

	Robust Matching	Similarities	Approp Process
D&G_Mentor	-.096	.267**	.310**
D&G_Mentee	-.011	.094	.076
D&G_Org	-.129	.126	.151
**. Correlation is significant at the 0.01 level (2-tailed).			
*. Correlation is significant at the 0.05 level (2-tailed).			

Regression

In order to develop a model for the mentoring programs, significant variables are evaluated and combined to use them in a regression. Different sections of the correlations were reviewed to collapse some of the variables that are highly interrelated into one variable. In particular, the purpose is to work with fewer variables in the regression, since the response rate was so low.

Two of the Input variables were consolidated. Instead of the two questions about communication to the mentors and communication to the mentees, these two variables were consolidated into one variable that measures communication (COMM) and has a

reliability estimate of .728. Second, the three variables that were measuring the support of the executives, faculty and organization were consolidated into one index variable called SUPPORT with a reliability estimated of .822:

Cronbach – Pgm Goals (.851/ 45)

Cronbach – Comm to Mentor, Mentee (.728/ 40) NOW: COMM

Cronbach – Support Executive, Faculty, Org (.811/ 0) NOW: SUPPORT

The index variable for Similarities had a Cronbach Alpha of .649, which is too low for the index variable to be used reliably. Therefore, the Similarities variable also has to be dropped from the regression equation.

The following three regression models are tested for each of the different dependent variables (D&G_Mentor, D&G_Mentee, and D&G_Org):

Regression Model #1: Controls, Inputs

Regression Model #2: Controls, Inputs, Activities

Regression Model #3: Controls, Inputs, Activities, Processes

For the dependent variable, D&G_Mentor, the first regression model indicates that controls and inputs provide two predictive variables (Pgm Goals and COMM) at the $p < .10$ standard. R^2 is providing the goodness of fit of the regression. The higher the value, the better, but we can start working with it starting at 0.1. This value provided information on what percent of the dispersion of the dependent variable can be explained through the independent variables. The r^2 at .170 is acceptable and indicates that 17% of D&G_Mentors variation can be explained through the model. So according to the model, COMM and Pgm Goals are good predictors for the development and growth of mentors.

This learning is even increased, when adding three activity and process variables to the model. The R^2 increases to 21.7%, with two variables (COMM and Prior Mentee)

at statistically significant levels of $p < .05$ and Pgm Goals at a significance level of $p < .10$.

The third model, testing a total of ten variables, predicts the dependent variable of D&G_Mentor with 25.8%. Here it seems particularly surprising that COMM, which seemed to matter for the prior two models, is not of significant importance any longer. However, Prior Mentee status as well as Pgm Goals are still significant at levels of $p < .05$, and Robust Matching also serves to predict at a lower significance level (see Table 30).

Table 29: ANOVA #1-#3 for D&G_Mentor⁶

Source: (own depiction)

D&G_Mentor	Control + Inputs		+ Activities		+ Processes	
	Unstandardized Coefficients					
	B	Std Error	B	Std Error	B	Std Error
(Constant)	.687	.277	.444	.304	.521	.383
Age	-.173	.193	-.232	.196	-.161	.193
Degree	.024	.084	.048	.082	.000	.084
Pgm Goals	.262	.136 [^]	.257 [^]	.134	.315*	.133
COMM	.279	.140 [^]	.318*	.138	.139	.159
SUPPORT	.012	.020	.013	.020	.012	.019
Hours Week			-.003	.122	.002	.121
Mentoring Semesters			.110	.136	.174	.135
Prior Mentee			.289*	.122	.324*	.125
Robust Matching					-.140 [^]	.074
Appropriate Process					.186	.128
F (df)		4.202* 5		3.700** 8		3.710** 10
Adj r ²	.170		.217		.258	
Std Error	.516		.502		.488	

[^] $p = .10$, * $p = .05$, ** $p = .01$, *** $p = .001$

While the models seem to be a decent predictor for the dependent variable D&G_Mentor, they do not serve as well for the other dependent variable D&G_Mentee. As can be told by looking at r^2 , the predictive value of the variables is ranging around

⁶ The stability of the model was confirmed after removal of the responses from the program coordinators to determine if their statistically significantly higher rankings of the program and the institution's support were artificially influencing the testing of the model.

13% for all three models. Degree is a highly significant negative predictor, which appears logical since students who have not obtained a first degree yet might have more need and are more invested in the mentoring process to help them cope with the particulars of MINT programs. Same holds true for age, since an increase in age would also imply that progress is made in studying if the students still remain in the programs.

Even though COMM does not matter as a predictor in Model 1, communication of the programs is getting increasingly important in Model 2 and 3. It is not quite understandable that COMM should not matter as an input, but for the activities and processes it contributes to prediction and needs to be researched further (see Table 31).

Table 30: ANOVA #1-#3, D&G_Mentee⁷

Source: (own depiction)

D&G_Mentee	Control + Inputs		+ Activities		+ Processes	
	Unstandardized Coefficients					
	B	Std Error	B	Std Error	B	Std Error
(Constant)	2.231	.292	2.276	.330	2.135	.426
Age	.496*	.198	.555**	.210	.596**	.211
Degree	-.313***	.086	-.323***	.087	-.341***	.091
Pgm Goals	.247^	.145	.220	.148	.252^	.150
COMM	-.238	.150	-.273^	.152	-.426*	.179
SUPPORT	-.013	.022	-.016	.022	-.019	.022
Hours Week			.120	.134	.101	.136
Mentoring Semesters			-.164	.149	-.119	.151
Prior Mentee			-.080	.134	-.091	.141
Robust Matching					-.055	.084
Appropriate Process					.209	.145
F (df)		3.453** 5		2.44 9* 8		2.227* 10
Adj r ²	.136		.129		.136	
Std Error	.551		.553		.551	

^ p = .10, * p=.05, ** p=.01, *** p=.001

It strikes as extremely surprising that the relationship between COMM and D&G_Mentee was negative, because this actually means that the more communication is taking place, the less of development and growth of mentees is occurring. Future

⁷ As noted above, program coordinators' responses were removed; the model's results remained stable.

research would need to double-check with other groups if COMM truly is having a negative impact on outcomes, or if this is something particular to the German MINT Mentoring.

According to the regression models, the model for the dependent variable D&G_Org seems to have no predictive power (with r^2 of 8.6% for the first model, r^2 of 6.6% for model two, and r^2 of 4.1% for the third model). While COMM seems to play a changing significant role for the other two dependent variables, here it hardly plays any role at all with any of the models. Also, it is stunning that the SUPPORT variable, even though not significant, is actually negative for all three models in Table 32.

Table 31: ANOVA #1-#3: D&G_Org⁸
Source: (own depiction)

D&G_Org	Control + Inputs		+ Activities		+ Processes	
	Unstandardized Coefficients					
	B	Std Error	B	Std Error	B	Std Error
(Constant)	.687	.159	.565	.185	.675	.251
Age	-.136	.112	-.164	.121	-.157	.123
Degree	.059	.048	.062	.049	.047	.053
Pgm Goals	.040	.082	.029	.084	.048	.089
COMM	.163	.083	.163	.084	.148	.098
SUPPORT	-.002	.011	-.002	.012	-.001	.012
Hours Week			.077	.075	.080	.077
Mentoring Semesters			.033	.089	.048	.094
Prior Mentee			.062	.077	.075	.080
Robust Matching					-.043	.052
Appropriate Process					-.007	.077
F (df)		2.107 [^] 5		1.519 8		1.253 10
Adj r^2	.086		.066		.041	
Std Error	.270		.273		.277	

[^] p = .10, * p=.05, ** p=.01, *** p=.001

The inconsistent results across the three output variables suggests that more investigation needs to be done.⁹

⁸ As noted above, program coordinators' responses were removed; the model's results remained stable.

For regressions #1-#3 that test the entire functional model of mentoring, the following observations can be made with the conclusion to cautiously accept parts of RQ_{5d} in regard to D&G_Mentor, where some variables serve to predict these outcomes. RQ_{5d} needs to be rejected for mentees because values are non-conclusive.

Overall, the model does not offer any predictive value for D&G_Org, and it appears most striking that – even though not statistically significant – SUPPORT negatively influences organizational development and growth. Similarly, Robust Matching and Appropriate Processes seem to negatively influence organizational outcomes. Does this really mean that support and appropriately chosen processes for matching should have a negative impact on organizational learning? These relationships need further investigation.

Even though two further regressions could potentially be presented here, they are omitted on purpose. Because Activities and Processes had no statistically significant outputs, or like in the case of Processes, only Similarities, but with a bad Cronbach Alpha, it appears pointless to conduct an ANOVA for:

Regression #4: Inputs, Processes

Regression #5: Inputs, Processes, Activities

Findings

The logical testing of the model through correlations for RQ_{5a-c} and regressions for RQ_{5d} provided the following findings: Several variables prove to be highly significant when it comes to Inputs positively influencing activities and processes, leading to support for RQ_{5a}. Activities and processes are not found to positively

⁹ Two additional regression models were tested for each of the three dependent variables. The first looked only at Inputs and Processes and the Second looked at Inputs, Processes, and Activities. There were no noticeable differences in the adjusted r² values nor in the variables that had statistical significance.

influence the quality of the mentoring program outputs, resulting in no support for RQ_{5b}. Partial support is rendered for RQ_{5c}, with Inputs positively influencing the quality of mentoring program outputs. The model is supported for mentors and program managers, while non-conclusive for mentees, indicating partial support for RQ_{5d}.

Threats to Validity

In general, threats to validity in this study are two-fold. First, the low response rate with only few participants per type threaten the validity. However, despite the low response rate, scholars argue that low response rates in web-based (7%) and e-mail surveys (6%) are typical (Schonlau, Fricker Jr., & Elliott, 2001; Wigley & Meirick, 2008). Moved this around. Furthermore, it needs to be considered that even though the invites for participation in the survey went out to 17 UASs, the data set revealed that responses were provided by mentors, mentees and/or program managers affiliated with only 12 UASs. UAS program managers were responsible for forwarding the survey links to those participating in the mentoring tandems at their organizations. Since five UAS program managers did not participate themselves, it appears that they did not pass on the survey questions to their mentors or mentees. This reduces the total number of persons from our total population who were recruited to take the survey from $N = 1079$ to $N = 831$. When considering recent scholarship on the low response rates for online surveys mentioned above, having received responses from $N_{\text{Mentors_invited}}$ (Univ. & Industry) = 314, and $n = 89$ mentors altogether, equates to a sample size of 28% of the population. Unfortunately, the response rate (9.9%) for mentees is considerably lower, at $N_{\text{mentees_invited}} = 505$ and a sample of $n = 50$. While the low

response rates are surprising since a professional organization endorsed the survey on its letterhead and two follow up invitations were sent, there is no reason to suspect that there is a systematic bias related to the non-respondents.

A second challenge related to response rates is that there was a total population of 17 program managers in Bavarian UASs. Had every one of these individuals completed the survey, it is likely that, as a group, they would make data analysis challenging by causing thin cells and also having inflated perceptions of program outputs since this is the program they are tasked with implementing. To assess the sensitivity of the empirical results to this threat, the program managers' responses were not considered for some of the statistical testing, so that their particularly low case rate (12/17) could be mitigated. In addition, to manage the low response rate overall, some of the variables were collapsed (COMM and SUPPORT) to work with the ANOVA; since these individual variables had an acceptable reliability in their Cronbach's Alpha, it could be concluded that participant types perceived the situation similar due to a very similar score.

Secondly, another threat to validity are the many missing cases, in particular when it came to the variables of D&G_Org, MentorStatus, and SemPostDegree, which all had 60 or more missing cases of a total of 145. Here the threat was managed by not utilizing the data set, or as with D&G_Org, leaving it in but pointing to the threat. It could be argued that less missing cases and a higher response rate would provide far more solid data that could be analyzed in a more meaningful manner. Sometimes, the threat to validity most likely has contributed to the inconclusive results or results, which

indicated that one variable is important in one ANOVA model, but then appears negligible in the next model or even appears with reversed signs.

Additionally, it appears particularly problematic that many data sets were missing data; furthermore, the numbers of answers provided determined that with about 80 cases total to work with, a maximum of 3 variables could be used for the regression. It did not appear advisable to manipulate the variables any further, especially due to the thin cells. Therefore, this paper is only suggestive, but certainly not conclusive due to data considerations and the low number of responses.

While descriptive statistics suggested support for the research questions, and correlations and reliability were high for many of the variables, it is surprising that results are inconclusive. It appears imperative to ensure more data sets are answered in the future, which could be safeguarded through curtailing some of the many answering options. Despite the lengths of the questionnaires, surprisingly few dropouts took place. Therefore, even though the open questions did hardly provide any insights since they were often left empty, the issue seemed to be another one: not very many universities (9 out of 17) even disbursed the questionnaire, and a disappointingly low number of participants answered per university. Therefore, a lack of motivation to participate could be concluded. Additionally, timing right before the Christmas holiday may have been problematic.

Chapter 5: Conclusions and Implications

This final chapter will serve to recapitulate each chapter with details on the research questions and testing of research questions. Contributions to literature and practice will be provided.

Chapter one provided an introduction to the need for mentoring programs at Bavarian universities within the MINT context. The aim was to develop a better understanding of the current mentoring programs, add insights through exploring issues, and at the same time expand knowledge while structuring the mentoring process in a logical and functional sequence.

The mentoring literature offered insights into the bases of mentoring and focused on inputs required for mentoring programs, processes and activities taking place, and outputs resulting from the mentoring programs. The reviewed literature was then used to develop a functional mentoring model. Within the larger context of the mentoring process, Inputs are used to feed into Activities and Processes, which then lead to the desired Outputs; this model, and its current context of utilizing females exclusively for mentoring, serves as a basis for the research questions following below.

In chapter three, the research questions and their respective research questions were introduced. Inputs were the topic of the first set of research questions RQ_{1a}-RQ_{1c}, followed by another cluster of research questions RQ_{2a}-RQ_{2d} concerned with processes and relationships. The third research question served as a basis for research questions concerned with outputs RQ_{3a}-RQ_{3c} to evaluate the current mentoring programs, and RQ₄ was reviewing the context of mentoring in form of potentially using male mentors. The

last set of research questions tested the logic of the model through another set of research questions RQ_{5a}-RQ_{5d}.

Online surveys were used to take a cross-sectional look at different groups of participants, mentors of universities and industry, mentees, and program managers. The data from the surveys were introduced and analyzed in chapter four with the following conclusions. The variable names are included in brackets at the end of each research question statement.

Inputs: How well are the MINT mentoring program goals communicated, understood, and supported?

RQ_{1a}: Do program managers communicate the mentoring program goals?

This research question RQ_{1a} is mostly supported through the data findings, but it became obvious that results are divergent amongst the groups and that program managers perceived their own communication efforts better in many areas than the other groups. This may be an overestimate of their own effectiveness.

RQ_{1b}: Do mentors and mentees understand the mentoring program goals?

In respect to this research question, mentors and mentees seemed equally knowledgeable and able to understand the program goals of the Bavarian MINT-mentoring; however, one aspect of the mentoring programs appears to be unclear, which is the 3-level cascades. Even though RQ_{1b} is supported, here, a clearer communication and presentation through program managers would result in less confusion.

RQ_{1c}: Do all involved perceive support from the mentoring program?

This research question of RQ_{1c} is supported, since all surveyed groups alike perceived strong support from executives, faculty and the overall organization. Results

need to be interpreted cautiously though, since the unacceptably high percentage of thin cells and the number of non-respondents pose a threat to validity.

Activities/Processes: What are the participants' perceptions of the processes and relationships developed in the MINT mentoring programs?

RQ_{2a}: Do prior and current mentoring activities of the participants improve the mentoring programs?

The data did not provide a clear support for RQ_{2a}, even though it appeared intuitive that mentors, who had been prior mentees themselves and therefore were familiar with mentoring activities, should be able to understand the programs and ultimately contribute to any improvements.

RQ_{2b}: Is the process for matching mentors and mentees robust?

The process of matching was counted based on the amount of sub-questions asked from participants. Here, the robustness was determined based on the clusters of answers provided; therefore, RQ_{2b} can be supported.

RQ_{2c}: Do mentors and mentees identify similarities within the mentoring tandems?

The question surveying participants on perceived similarities posed a problem since answers differed not only from literature, but also provided different answers from the respective groups. No assumptions can be made for this research question, especially since the data set was very thin and many participants provided the answer 'do not know.'

RQ_{2d}: Is the process for matching mentors with mentees appropriate?

The process used to match mentors with mentees is deemed appropriate and optimal by 2/3 of participants, which results in a confirmation of RQ_{2d}.

Outputs: How well are the development and growth expectations of the MINT mentoring programs met?

RQ_{3a}: What are the perceptions of mentors' development and growth?

According to the survey results, the mentors' development and growth is supported in RQ_{3a}, because all groups determined that they perceived at least a moderate increase of the indexed. However, the results of program managers need to be excluded because they are below the Cronbach's threshold.

RQ_{3b}: What are the perceptions of mentees' development and growth?

Research question RQ_{3b} can be confirmed, since the groups of mentors and mentees perceive the mentees' development as having increased in most areas, with mentees perceiving their own development and growth even higher than their mentors do. The group of program managers needs to be excluded because it is below the Cronbach's threshold, while all other groups result in a solid Cronbach's Alpha.

RQ_{3c}: Do all involved perceive the mentoring program's contribution to organizational development and growth?

This research question cannot clearly be supported, since two groups, program managers and industry mentors, answer many items with 'do not know.' It appears that chances to contribute to organizational learning are neglected, because no type of drop-out study is performed or any type of controlling of the programs is conducted.

Context: How important is it to have gender-matched mentors?

RQ₄: What are the perceptions of mentoring by females only?

In regard to the use of male mentors to supplement and support the female mentors, participants of this survey felt it imperative to hold on the mentoring exclusively through females. Even though it appears not logical, especially since

mentoring through males still would provide benefits versus not having any mentoring at all, RQ₄ is supported.

Logic Model Testing: What are the influences of the inputs and Processes / Relationships on the MINT program mentoring outputs?

RQ_{5a}: Do Inputs positively influence the quality of Activities / Processes?

The correlation of Inputs to Activities is statistically significant for university support with hours per week and prior mentoring status, while Inputs to Processes provide several statistically significant correlations, in particular with support perceived from all three levels of the university and Robust Matching as well as the appropriateness of the process with Pgm Goals and the communication to both groups, mentors and mentees alike. Therefore, RQ_{5a} can be supported with the findings of this paper, which reflects what is found in literature also.

RQ_{5b}: Do Activities / Processes positively influence the quality of mentoring program Outputs?

Surprisingly, this research question, despite being based on literature, cannot be supported, since – even though statistically not significant - data indicated no correlation of activities (amount of time spent in the mentoring relationship or the longevity of the mentoring relationship) to the development and growth of neither mentor nor mentee. This area needs confirmation of results and needs to be subject of further research, especially since the correlation of Mentoring Semesters to development and growth is slightly negative.

Similarly, correlations of Processes to Outputs pose just as many questions; especially the indication that the robustness of process (even though not statistically significant) is negatively correlated to development and growth in all three categories

causes concern. Similarities as a variable for processes had to be excluded due to their low Cronbach's Alpha with the conclusion to break down this cluster of question in future research. The Appropriateness of Process provided a significant result for the development and growth of mentors, even though it was more so expected to be an indicator for mentees, but here data indicated it did not matter.

RQ_{5c}: Do Inputs positively influence the quality of mentoring program Outputs?

This research question could be supported for the correlations of development and growth for mentors and organization in regard to the inputs; however, development and growth of mentees is not significantly correlated to the inputs except for Faculty Support, and interestingly enough even are providing two negative figures. Future research needs to look at this effect closely, even though the reason in this paper might be based on the overall threats to validity and the low response rate.

Additionally, ANOVA #1 was conducted to test the positive influence of inputs on outputs of mentoring programs. For development and growth of mentors, Inputs provide a predictive value of 17% with two weak significances for Pgm Goals and the collapsed variable COMM. While for mentees the prediction is reduced to 13.6% of the development and growth, Degree is the only (highly) significant, but negative value, which appears logical; similarly, the older a mentee is, the more learning takes place. For ANOVA #1, the lowest predictive value is obtained ($r^2=.086$) for development and growth of the organization, even though only the collapsed COMM variable is significant at $p = .10$. Surprisingly, Age and Pgm Goals are negative; overall, RQ_{5c} cannot be supported. Further investigation needs to be concerned with the fact that the

correlations found significant between Inputs and D&G_Org were all reduced to COMM in this model.

RQ_{5d}: Do Inputs and Activities / Processes positively influence the quality of mentoring program Outputs?

To validate this research question, ANOVA #3 was used. For the development and growth of mentors, the model has a predictive value of 25.8%, even though only Pgm Goals and Prior Mentee matter significantly along with Robust Matching at a lower level, while the collapsed value of COMM surprisingly does not matter. Development and growth of mentees is not that well predictable (only 13.6%), even though age and degree are highly significant variables. The collapsed value for COMM is significant for mentees' development and growth at $p=.05$. When predicting development and growth for the organization (at 4.1%), COMM again does not matter, and the collapsed variable SUPPORT is even negative along with the Robust Matching, even though neither one is statistically significant. The changing role of COMM and the lack of significance in SUPPORT in this regression needs to be examined further; overall, RQ_{5d} cannot be supported due to the predictive values of the ANOVA.

Contribution to Literature

This paper tested existing literature on mentoring based on the practical model of MINT mentoring at Bavarian universities, which lead to a better understanding not only of the respective mentoring programs, but also provided several interesting findings to elaborate on in the future.

One of the major findings of this paper is the estimation by all four participant types that the organization did not learn from the mentoring programs, as was also

shown in Figure 9. While literature indicated learning of the organization, in particular in regard to professional and communication networks, it is not perceived as such at the universities. Even though many cases were missing, it would have been expected to find a tight network spanning from university into organizations. This might be a particular problem to Germany, which often times is not seen as being good in networking, but needs to be elaborated on in the future, potentially in its cultural context.

Another important finding is the outcome that correlations between Inputs and Outputs showed significance for development and growth of mentors and the organization for all variables tested, but did not provide significance except for one variable in the category of development and growth for mentees. Two of the correlations are even negative, which is all the more surprising, indicating that an increased communication to mentors and mentees is causing less development and growth in mentees.

Contribution to Practice

For practitioners at Bavarian universities, the major finding is the lack of organizational learning taking place due to the mentoring programs. Universities should be able to clearly track contributions of the mentoring programs to their development, whether it is through a solid communication concept established or through increases in their networking ability and exchanges of best practice as part of the organizational learning.

To ensure this, the process of communication and network exchanges should be formalized and documented through a set of activities prescribed throughout the year and that could be initiated by the respective program managers.

Furthermore, another major implication for practice is the non-existing controlling of the mentoring programs, as was indicated by the program managers in a special question as part of their survey. Not only were program participants able to clearly identify an increased success rate in exams or a decrease in drop-out-rates of students enrolled in the mentoring programs, but program managers lacked evaluative items for the programs. The only thing conducted on a regular basis by the program managers asked were satisfaction surveys after completion of workshops or completion of a mentoring year.

Three of the 12 universities participating in the program manager survey indicated they also conducted cost controlling, but no specifications were provided. However, obvious comparisons in terms of mentoring effectiveness and cost controlling, such as comparison of drop-out rates of participants and non-participants or the comparison of female exam-failure rates of participants and non-participants were not conducted at all. Similarly, comparisons of degree completion rate of female mentees and non-mentees as well as job-placement rates of female mentees and non-mentees are not made.

All the above-mentioned measures to control effectiveness of the programs and expenses are highly recommendable and should be conducted by the respective program managers to evaluate the programs. Simple satisfaction surveys might provide a spontaneous impression concerning the overall perception of the mentoring programs,

but by far do not provide the detailed information needed to initiate changes to the programs and improve the evaluation of their effectiveness. Additionally, it might need to be considered that many of the program managers might have a social studies educational background rather than a business or economics background. This may make it more likely that they would not place a high importance on the need to have evaluation metrics – quantitative or qualitative – for the mentoring program. Here, a concerted effort through the collection of Key Performance Indicators (KPIs) for the programs could be initiated with the help and input by the Bavarian Speaker of the State Conference of Women’s Representatives.

In conclusion, this research might offer the chance to make the Bavarian UAS MINT mentoring programs far more effective through controlling and best-practice exchanges taking place amongst the program managers. Similarly, other structured mentoring programs taking place in an overarching manner like the ones researched here might benefit in the same manner.

Additional opportunities for practitioners to improve mentoring programs might occur by developing relationships with the Bavarian STEM industry, because it appears that despite the car industries’ push for MINT mentoring programs and their confirmation that they are in dire need of engineers and IT specialists, it is this author’s first hand observation that there still seems to be a distinct workforce bias when it comes to hiring females into male-dominated fields. Part of this bias might stem from the German type of family leave act, which prohibits females from working 6 weeks prior to giving birth, and then not start working earlier than 8 weeks afterwards. However, the German system allows for parents (men and women alike) to use up to 3

years of unpaid parental leave to stay at home with their newborns – something most employers fear due to the parents' right to return into their job- and in most cases, females take the majority of the parental leave. A reduced workload of up to 30 hours also counts as parental leave, but many young women will not use most of their entitlements due to fear of obsolescence in job skills. Especially through cross-gender mentoring taking place, the existing stereotypes on both sides could be counteracted and reduced.

In general, it might need to be considered that the German / European systems seem to lag behind the US in many respects, whether it is management education, formalization of evaluations, quantitative metrics on degree completion rate, and also the measuring of Key Performance Indicators. So, it appears a trend is going into more formalization of the program evaluation also in Germany/Europe.

Future Research

As disappointing as this research project proved to be concerning the return of questionnaires and the missing data in the answer sets provided, as important will it be to take a more solid approach to operationalize the variables that are not providing conclusive information. Since it is astonishing that Activity and Process variables, in particular Similarities, do not prove to be statistically significant on Outputs or otherwise cannot be used due to poor Cronbach's Alpha, either this lengthy section of questions, even though it should have mattered according to the literature review, might be neglected in future research to allow a better focus on other sections. On the other

hand, it might be advisable to conduct further research in respect to Similarities, especially with more cases.

Then, the Similarity variable could be further investigated, especially if the questions were reworded into different subsections to precisely distinguish between different types of similarities. Here a closer match with previous research could be aimed for. Correspondingly, it might be important to determine in future investigations what factors actually predict the perceptions of appropriateness of matching.

An extension of this research would be concerned with one of the identifiers for Similarity (gender), especially since the author is convinced that mentoring can also successfully take place in cross-gender relationships and provide learning for the mentees, which participants of this research project did not perceive. Overall, especially due to the small amount of available female mentors in MINT mentoring, it should be investigated, if cross-gender mentoring would not provide similar benefits for mentors.

Another avenue for future research should focus on the relation of processes to Outcomes. Surprisingly, it does not seem to matter who is matched with whom or how they are matched. Research should mainly be concerned with the robustness of matching processes and the appropriateness of the process in relationship to the development and growth of mentors, mentees, and organizations.

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Appendix

Support Letter - German



OTH Regensburg • LaKoF Bayern / HAWs • PF 12 03 27 • 93025 Regensburg

Hochschulen für angewandte Wissenschaften
Koordinatorinnen BayernMentoring

LaKoF Bayern / HAWs
Prof. Dr. Christine Süß-Gebhard
Sprecherin
Tel.: 0941/943-9729
frauenbeauftragte@oth-r.de

Regensburg, 19.10.2016

Brief der Sprecherin der Landeskonferenz der Frauenbeauftragten an bayerischen HAWs (Original Dokument)

Liebe Projekt-KoordinatorInnen der MINT-Mentoring-Programme des BayernMentoring,

im Rahmen unserer vielzähligen Mentoring-Programme bitte ich Sie um Ihre Unterstützung bei einer Erhebung zu den vorhandenen Programmen, Ihren Tätigkeiten darin sowie Ihrer Betreuung und Unterstützung der Mentorinnen und Mentees. Die Befragung unterstützt das Promotionsvorhaben von Gabriele M. Murry, der stellvertretenden Frauenbeauftragten der OTH Amberg-Weiden und findet im Wintersemester 2016/17 statt. Die Daten werden nur für Sie zur Verfügung gestellt und in anonymisierter Form und ohne persönliche Identifikationsmerkmale in zusammengefasster Form genutzt.

Diese Erhebung umfasst vier verschiedene Fragebögen: für ProjektkoordinatorInnen der HAWs, für Mentees und für Mentorinnen entweder der HAWs oder aus Unternehmen. Bitte leiten Sie die jeweiligen Umfragen-Links und PDF Dokumente über den E-Mail Verteiler an die jeweiligen Gruppen weiter. Weiterhin bitte ich Sie, Ihre Veranstaltungen zu nutzen um auf die Wichtigkeit dieser Umfrage hinzuweisen und ggf. Fragebögen dort zu verteilen und wieder an sich zu nehmen.

Obwohl die Online-Teilnahme bevorzugt wird, können auch ausgedruckte oder gescannte Bögen an Gabriele M. Murry geschickt werden.

g.murry@oth-aw.de oder
OTH Amberg-Weiden, Gabriele M. Murry, Hetzenrichter Weg 15, 92637 Weiden

Auf einer der nächsten LaKoF-Sitzungen werden die Ergebnisse in zusammengefasster und anonymisierter Form von Frau Murry vorgestellt.

Ich danke für Ihre Bereitschaft und aktive Mitarbeit bei der Erhebung.

Mit freundlichen Grüßen

Prof. Dr. Christine Süß-Gebhard

LaKoF Bayern
Sprecherinnen
www.lakof-bayern.de

Universitäten
Akad. Dir. Dr. Margit Weber
Ludwig-Maximilians-Universität München
Tel.: 089/2180-3644
frauenbeauftragte@lmu.de

Hochschulen für angewandte Wissenschaften (HAWs)
Prof. Dr. Christine Süß-Gebhard
Ostbayerische Technische Hochschule Regensburg
Tel.: 0941/943-9729
frauenbeauftragte@oth-r.de

Beirat der Gleichstellungsbeauftragten
Adelgunde Wolpert
Universität Würzburg
Tel.: 0931/31-82005
gleichstellung@uni-wuerzburg.de

Support Letter – English



OTH Regensburg • LaKoF Bayern / HAWs • PF 12 03 27 • 93025 Regensburg

University of Applied Sciences
Coordinators of STEM-Mentoring-Programs

LaKoF Bayern / HAWs
Prof. Dr. Christine Süß-Gebhard
Sprecherin
Tel.: 0941/943-9729
frauenbeauftragte@oth-r.de

Regensburg, 19.10.2016

Letter of the Bavarian Speaker of the State Conference of Women's Representatives (Courtesy Translation)

Dear Project Coordinators of STEM-Mentoring-Programs within the BayernMentoring,

in respect to our many mentoring programs I request your support in the assessment of our current programs, your participation in them, as well as the deployment of mentors and mentees. The assessment supports the dissertation project of Gabriele M. Murry, the deputy Women's Representatives of the East-Bavarian Technical University of Applied Sciences Amberg-Weiden and is taking place in WS 2016/17. Data will only be provided to her, and use and reports will only entail aggregate and anonymous data without individual identifiers.

This assessment entails four different questionnaires: for project coordinators of the respective UASs, for Mentees and for Mentors either from your university or from external organizations. Please forward the respective survey link and PDF questionnaires to the groups concerned through the e-mail distribution of your university. Furthermore, I would like for you to use your events to stress the importance of the assessment, and if needed, potentially distribute the forms right there, and collect them afterwards again.

While the online-participation is preferred, printed or scanned surveys can be mailed to Gabriele M. Murry of the East-Bavarian Technical University of Applied Sciences Amberg-Weiden.

g.murry@oth-aw.de or
OTH Amberg-Weiden, Gabriele M. Murry, Hetzenrichter Weg 15; 92637 Weiden

She will present the aggregated and anonymized results during one of the next LaKoF Conferences.

Thank you very much for your willingness and active support of this assessment.

All the best,

Prof. Dr. Christine Süß-Gebhard

LaKoF Bayern
Sprecherinnen
www.lakof-bayern.de

Universitäten
Akad. Dir. Dr. Margit Weber
Ludwig-Maximilians-Universität München
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Hochschulen für angewandte Wissenschaften (HAWs)
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IRB – Approval



Institutional Review Board for the Protection of Human Subjects
Approval of Initial Submission – Exempt from IRB Review – AP01

Date: November 14, 2016

IRB#: 7450

Principal Investigator: Gabriele M Murry

Approval Date: 11/14/2016

Exempt Category: 2

Study Title: STEM MENTORING IN BAVARIA: AN EFFECTIVE PATH TOWARDS EQUAL OPORTUNITY?A CASE STUDY TO EVALUATE AND ELABORATE ON THE CONCEPT OF MENTORING UTILIZING A FUNCTIONAL MODEL OF MENTORING

On behalf of the Institutional Review Board (IRB), I have reviewed the above-referenced research study and determined that it meets the criteria for exemption from IRB review. To view the documents approved for this submission, open this study from the *My Studies* option, go to *Submission History*, go to *Completed Submissions* tab and then click the *Details* icon.

As principal investigator of this research study, you are responsible to:

- Conduct the research study in a manner consistent with the requirements of the IRB and federal regulations 45 CFR 46.
- Request approval from the IRB prior to implementing any/all modifications as changes could affect the exempt status determination.
- Maintain accurate and complete study records for evaluation by the HRPP Quality Improvement Program and, if applicable, inspection by regulatory agencies and/or the study sponsor.
- Notify the IRB at the completion of the project.

If you have questions about this notification or using iRIS, contact the IRB @ 405-325-8110 or irb@ou.edu.

Cordially,

A handwritten signature in black ink that reads 'Lara Mayeux'.

Lara Mayeux, Ph.D.
Chair, Institutional Review Board

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Erhebung - ProjektkoordinatorInnen

Zustimmung zu dieser Erhebung

Online Zustimmung an dieser Erhebung teilzunehmen

Wollen sie an dieser Erhebung durch die University of Oklahoma (OU) teilnehmen?

Mein Name ist Gabriele M. Murry vom PhD Programm der Universität von Oklahoma, USA, im Bereich Organisationsführung, und ich bitte Sie um Ihre Teilnahme an meinem Forschungsvorhaben mit dem Titel: *MINT-Mentoring in Bayern: Ein effektiver Pfad zur Chancengleichheit? Eine Fallstudie zur Bewertung und Optimierung des Mentoring-Konzepts anhand des funktionalen Mentoring-Modells*. Dieses Forschungsvorhaben wird an den Hochschulen Bayerns durchgeführt. Sie wurden als potentielle(r) TeilnehmerIn ausgesucht, da Sie entweder Projekt-KoordinatorIn, Mentorin oder Mentee in den MINT-Programmen des Bayern Mentorings sind. Sie müssen mindestens 18 Jahre alt sein um an dieser Studie teilzunehmen.

Bitte lesen Sie dieses Dokument und kontaktieren mich um jegliche Fragen aus dem Weg zu räumen BEVOR Sie zustimmen an dieser Studie teilzunehmen.

Was ist der Zweck dieser Studie? Diese Studie wird durchgeführt um ein Mentoring Modell zu testen, welches die Bewertung der Mentoring-Programme unterstützt. Insbesondere interessieren MentorIn- und Mentee-Eigenschaften und deren Entwicklung, die Kommunikation und das Verständnis der Mentoring Programme und letztendlich die Weiterentwicklung der gesamten Organisation.

Wie viele Personen werden an der Studie teilnehmen? Es werden ca. 177 Personen an der Studie teilnehmen: 17 Projekt-KoordinatorInnen der staatlichen Bayerischen Hochschulen, und jeweils ca. 80 MentorInnen und 80 Mentees.

Was wird von mir erwartet? Falls Sie zustimmen, an dieser Umfrage teilzunehmen, so werden Sie gebeten, die folgenden Fragen bzgl. demographischer Daten sowie auch Fragen zu Ihrem Verständnis und Ihren Erfahrungen zu den Mentoring Programmen zu beantworten.

Wie lange wird dies dauern? Ihre Teilnahme an der Umfrage sollte nicht mehr als 10 Minuten in Anspruch nehmen.

Was sind die Risiken oder Vorteile meiner Teilnahme? Es gibt weder Risiken noch Vorteile durch eine Teilnahme.

Werde ich für die Teilnahme vergütet? Nein, Sie werden weder für Ihre Zeit noch Ihre Teilnahme an dieser Studie vergütet.



IRB NUMBER: 7450
IRB APPROVAL DATE: 11/14/2016

Wer wird meine Informationen erhalten? In den Studienberichten wird keinerlei Information verwendet, welche Rückschlüsse auf Sie zulässt. Die Forschungsunterlagen werden sicher gespeichert und nur zugelassene Forschende sowie die Ethik-Kommission der University of Oklahoma (Institutional Review Board der OU) werden Zugang zu den Unterlagen haben.

Außerdem ist dies ein nicht auf Gewinn ausgerichtetes wissenschaftliches Forschungsprojekt. Daten werden via SurveyMonkey.com gesammelt, einem web-basierten Online-Umfragesystem, welches seine eigenen Privats- und Sicherheitsvorschriften zu Datenschutzzwecken hat. Bitte nehmen Sie zur Kenntnis, dass keine Zusicherung bzgl. der uns überlassenen Daten gemacht werden kann, welche über die Nutzung zu Forschungszwecken hinausgehen.

Muss ich teilnehmen? Nein. Falls Sie nicht teilnehmen, so werden keine negativen Konsequenzen für Sie entstehen, weder durch eine Bestrafung noch durch den Verlust von Vergünstigungen, welche in keinem Zusammenhang mit dieser Forschung stehen. Falls Sie teilnehmen, so müssen sie nicht auf Fragen antworten und können zu jeder Zeit Ihre Teilnahme abbrechen.

Wen kann ich im Falle von Fragen, Bedenken oder Beschwerden kontaktieren? Falls Sie Fragen, Bedenken oder Beschwerden bzgl. dieser Studie haben oder sich eine forschungs-basierte Verletzung zugezogen haben, so können Sie mich direkt unter +49-170-540-4202 oder g.murry@oth-aw.de kontaktieren. We

Sie können ebenfalls die Universität von Oklahoma – Norman Campus Institutional Review Board (OU-NC IRB) unter 001-405-325-8110 oder irb@ou.edu kontaktieren, falls Sie Fragen zu Ihren Rechten als StudienteilnehmerIn haben. Dies gilt auch im Falle von Bedenken oder Beschwerden über die Forschenden und wenn sie mit einer anderen Ansprechperson als den Forschenden selbst sprechen wollen oder falls Sie die Forschenden nicht erreichen können.

Bitte drücken Sie dieses Dokument für Ihre Unterlagen. Durch Ihre Angaben in der Umfrage stimmen Sie der Teilnahme an dieser Studie zu.

Diese Forschung ist genehmigt durch die University of Oklahoma, Norman Campus IRB.

IRB Nummer: _____ Genehmigungsdatum: _____

(NOTE: The Principal Investigator is responsible for the input of the IRB number and approval date, BEFORE the document is implemented online.)

1. Wollen sie an dieser Erhebung durch die University of Oklahoma (OU) teilnehmen?

- Ich stimme der Teilnahme zu
- Ich möchte nicht teilnehmen

Erhebung - ProjektkoordinatorInnen

Einleitung - Zu Ihnen



IRB NUMBER: 7450
IRB APPROVAL DATE: 11/24/2016

2. Sind Sie männlich oder weiblich?

- Männlich
 Weiblich

3. Wann wurden Sie geboren? (Geben Sie ein vierstelliges Geburtsjahr ein, z. B. 1976.)

4. Was ist der höchste Bildungsgrad, den Sie bisher erlangt haben?

- Hauptschulabschluss
 Realschulabschluss bzw. Mittlere Reife
 Fachhochschulreife bzw. Abitur
 Bachelor
 Diplom
 Master bzw. Magister
 Promotion / PhD

5. An welcher der bayerischen Hochschulen arbeiten Sie im Rahmen der Mentoring-Programme?

6. Meine Wochenarbeitsstunden als Projektkoordinatorin der MINT-Programme beträgt.....Stunden pro Woche.

- 1-5
 6-10
 11-15
 16-20
 21-25
 26-30
 31-35
 36-40
 40+



IRB NUMBER: 7450
IRB APPROVAL DATE: 11/30/2016

7. Welche der folgenden Kategorien beschreibt am besten Ihren Beschäftigungsstatus?

- zeitlich befristet
- fest angestellt
- verbeamtet

8. Seit wie vielen Jahren sind Sie für die Projektkoordination der MINT-Mentoring-Programme zuständig?

- weniger als 1 Jahr
- 1-2 Jahre
- 3-4 Jahre
- 5+ Jahre

Erhebung - ProjektkoordinatorInnen

Inputs der Organisation

9. Bitte nennen Sie Ihrer Ansicht nach in 3-5 Stichpunkten das Ziel der MINT-Mentoring-Programme.

1.
2.
3.
4.
5.

10. Bitte nennen Sie Ihrer Ansicht nach in 3-5 Stichpunkten die Erwartungen der Mentees an die MINT-Mentoring-Programme.

1.
2.
3.
4.
5.



IRB NUMBER: 7450
IRB APPROVAL DATE: 11/24/2016

11. In Bezug auf unsere Mentoring-Programme ist den Mentorinnen aus anderen Unternehmen.....bekannt.

	sehr gut	meist	seiten	nie	k. A.
...das Ziel...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die Häufigkeit der Treffen...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die Erwartung an das Programm...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die einzubringende Zeit...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die Vielseitigkeit der Angebote...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...das mehrschichtige Programm auf 3 Ebenen (Kaskadenmentoring)...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die Netzwerkunterstützung durch die Mentorin...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die mentale Unterstützung durch die Mentorin...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die fachliche Unterstützung durch die Mentorin...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...der Einblick in die MINT-Unternehmenswelt...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



IRB NUMBER: 7450
IRB APPROVAL DATE: 11/5/2016

12. In Bezug auf unsere Mentoring-Programme ist den hochschulischen Mentorinnenbekannt.

	sehr gut	meist	selten	nie	k. A.
...das Ziel...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die Häufigkeit der Treffen...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die Erwartung an das Programm...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die einzubringende Zeit...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die Vielseitigkeit der Angebote...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...das mehrschichtige Programm auf 3 Ebenen (Kaskadenmentoring)...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die Netzwerkunterstützung durch die Mentorin....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die mentale Unterstützung durch die Mentorin...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die fachliche Unterstützung durch die Mentorin....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...der Einblick in die MINT-Unternehmenswelt...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



IRB NUMBER: 7450
IRB APPROVAL DATE: 11/01/2016

13. In Bezug auf unsere Mentoring-Programme ist den Menteesbekannt.

	sehr gut	meist	selten	nie	k. A.
...das Ziel...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die Häufigkeit der Treffen...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die Erwartung an das Programm...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die einzubringende Zeit...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die Vielseitigkeit der Angebote...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...das mehrschichtige Programm auf 3 Ebenen (Kaskadenmentoring)...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die Netzwerkunterstützung durch die Mentorin...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die mentale Unterstützung durch die Mentorin...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...die fachliche Unterstützung durch die Mentorin...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...der Einblick in die MINT-Unternehmenswelt...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



IRB NUMBER: 7450
IRB APPROVAL DATE: 11/7/2016

14. Unsere MINT-Mentoring-Programme.....

	sehr gut	gut	kaum	nie	k. A.
...sind auf der HS-Homepage zu finden	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...und deren Inhalte werden beworben (z.B. Vorstellung in Vorlesungen, Einführungstag bei Erstsemestern)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...werden von Studentinnen (weiblich) nachgefragt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...von Studenten (männlichen) auch nachgefragt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...erscheinen in den Hochschulnachrichten / Newsticker	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...werden in einem separaten Newsletter verbreitet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...und deren Zielsetzungen sind bei Hochschulangehörigen (Lehrende, Verwaltung und Studierende) bekannt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...werden durch Schaukästen und/oder Poster kommuniziert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...werden durch Flyer kommuniziert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...werden durch unsere <u>Mentorinnen</u> bei ihren Kommilitoninnen beworben	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...werden durch unsere <u>Mentees</u> bei ihren Kommilitoninnen beworben	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...werden durch unsere <u>Mentorinnen aus Unternehmen</u> im Unternehmen beworben	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



IRB NUMBER: 7450
IRB APPROVAL DATE: 11/8/2016

15. Welches Verhalten würden Sie Ihrer Hochschulleitung in Bezug auf die Mentoring Programme zuordnen? Mehrfachantworten sind möglich.

- begeistert
- ablehnend
- unterstützend
- wertschätzend
- nicht wünschend
- anerkennend
- dulddend
- Sonstiges (bitte angeben)

16. Welches Verhalten würden Sie Ihren Lehrenden in Bezug auf die Mentoring Programme zuordnen? Mehrfachantworten sind möglich.

- begeistert
- ablehnend
- unterstützend
- wertschätzend
- nicht wünschend
- anerkennend
- dulden
- Sonstiges (bitte angeben)



IRB NUMBER: 7450
IRB APPROVAL DATE: 11/01/2016

17. Welches Verhalten beobachten Sie an Ihrer Hochschule in Bezug auf die Mentoring Programme?
Mehrfachantworten sind möglich.

- studentischen Mentorinnen sind begeistert
- Mentorinnen werden von HS unterstützt
- Mentorinnen werden von HS anerkannt (z.B. durch Auszeichnungen, Zertifikate, etc.)
- studentischen Mentorinnen sind schwer zu gewinnen
- Montorinnen nehmen gerne über mehrere Semester teil
- studentischen Mentorinnen werden als Studentische Hilfskraft (SHK) vergütet
- HS schafft Anreize* für studentischen Mentorinnen, damit sie teilnehmen
- HS bietet einführendes Training für neue studentischen Mentorinnen
- HS bietet einführendes Training für neue unternehmensseitige Mentorinnen
- Mentorinnen aus Unternehmen sind schwer zu gewinnen

*Welche Anreize, falls überhaupt, bietet Ihre Hochschule den Studentinnen?

Erhebung - Projektkoordinatorinnen

Prozesse der Organisation

18. Wie bringt Ihre Hochschule im Regelfall Mentorin und Mentee zusammen?

- Die Mentee wird der Mentorin durch die Projektkoordinatorin zugeteilt
- Bei einer Auftaktveranstaltung finden sich Mentorin und Mentee selbst nach dem ersten Kennenlernen
- Das Los (oder ähnliches Zufallsverfahren) entscheidet
- Eine Mentorin betreut mehrere Mentees, die zugeordnet werden
- Mentorin und Mentee werden nach den jeweilig erforderlichen Fähigkeiten und Bedürfnissen zugeordnet
- Persönlichkeitstests
- Sonstiges (bitte angeben)



IRB NUMBER: 7450
IRB APPROVAL DATE: 11/01/2016

19. Bei den Mentoring-Tandems aus MentorIn und Mentee(s) stelle ich folgende Ähnlichkeiten fest:

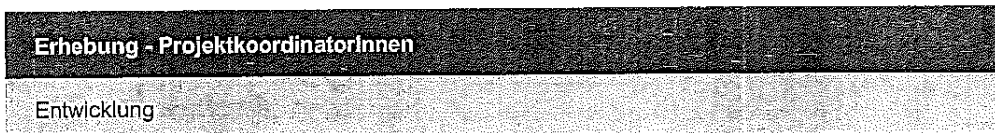
	stark ausgeprägt	vorhanden	Kaum merkbar	unwichtig	k. A.
Alter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kultur (z.B. Ethnie/ gleicher Migrationshintergrund)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Studiengang / Vertiefung	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engagement bzgl. der Mentoring-Beziehung	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regionale Zugehörigkeit (z.B. Oberfranken, aus Bayern, aus den neuen Bundesländern, aus den anderen alten Bundesländern, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wohnort oder nähere Umgebung	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Branche, die für die Karriere angestrebt wird	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Sonstiges (bitte angeben)

20. Den Prozess, in dem sich Mentorin und Mentee finden, erachte ich als.....:

- optimal
- verbesserungswürdig
- ganz schlecht

Falls nicht 'optimal', erläutern Sie bitte wieso.



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21. In Bezug auf die Mentorinnen kann ich im Laufe der Zeit folgendes beobachten:

	nimmt deutlich zu	nimmt etwas zu	bleibt gleich	nimmt ab	k. A.
Selbstsicherheit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Geduld mit Mentee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Verständnis für Mentee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vertrauen zur Mentee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Anerkennung im Mentoring-Netzwerk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fachwissen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Verantwortung für Mentee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fähigkeit Inhalte zu vermitteln	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fähigkeit zuhören zu können	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vertrauen, welches von der Mentee entgegengebracht wird	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Menschenkenntnis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Selbstorganisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Sonstiges (bitte angeben)



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22. In Bezug auf die Mentees kann ich im Laufe der Zeit folgendes beobachten:

	nimmt deutlich zu	nimmt etwas zu	bleibt gleich	nimmt ab	k. A.
Selbstsicherheit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Klarheit der Karriereziele	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Verständnis für Mentorin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vertrauen zur Mentorin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Verständnis für das Berufsbild	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Anerkennung im Mentoring-Netzwerk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fachwissen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Verantwortung für den Mentoring-Prozess (Commitment)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fähigkeit Inhalte aufzunehmen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fähigkeit zuhören zu können	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Problemlösungsfähigkeit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Selbstorganisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eigeninitiative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prüfungserfolge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Studien-Motivation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Studien-Abschluss-Quote	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Sonstiges (bitte angeben)



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23. An unserer Hochschule konnte ich folgendes - vermutlich aufgrund der Mentoring-Programme - beobachten:

	hat stark zugenommen	hat leicht zugenommen	ist in etwa gleich geblieben	hat abgenommen	k. A.
Hilfsbereitschaft an der Hochschule allgemein	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unterstützung der Programme	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Etablierung der Programme	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nachfrage ähnlicher Programme für andere Gruppen Studierender (z.B. Migrationshintergrund, Behinderung, Männer in sozialen Berufen, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Einführung ähnlicher Programme für andere Gruppen Studierender (z.B. Migrationshintergrund, Behinderung, Männer in sozialen Berufen, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entstehung informeller Kommunikationsnetzwerke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entstehung professioneller Netzwerke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bestehens-Quote bei Prüfungen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Studien-Abschluss-Quote	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Erhebung - ProjektkoordinatorInnen

Frauen, oder auch Männer?



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24. Wie stehen Sie zur Nutzung männlicher Mentoren? Mehrfachantworten sind möglich.

- kann mir nicht vorstellen, dass unsere Mentees das wollen
- kann mir nicht vorstellen, dass unsere Mentorinnen das wollen
- ist an unserer Hochschule undenkbar
- haben wir schon angedacht
- haben wir schon eingeführt und sind noch in der Versuchsphase
- haben wir schon eingeführt und es läuft gut
- haben wir schon eingeführt, aber dann wieder abgebrochen, da es nicht gut lief
- nur im Ausnahmefall, wenn wir keine Mentorinnen gewinnen können

Weitere Anmerkungen:

25. Führen Sie an Ihrer Hochschule bzgl. MINT-Mentoring folgendes durch: Mehrfachantworten sind möglich.

- Kosten-Controlling
- Studien-AbbrecherInnen-Quoten von Mentees im Vergleich zu Nicht-Mentees
- Prüfungs-Durchfall-Quoten von Mentees im Vergleich zu Nicht-Mentees
- Zufriedenheitsumfragen
- Studienerfolge von Mentees im Vergleich zu Nicht-Mentees
- Berufseinstiegsfolge von Mentees im Vergleich zu Nicht-Mentees
- Keine der hier angegebenen Massnahmen
- Sonstiges (bitte angeben)

26. Gibt es weitere Anmerkungen oder Hinweise zu den Mentoring-Programmen, die Sie machen wollen?

Erhebung - ProjektkoordinatorInnen

Interviewbereitschaft? Besten Dank



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Liebe ProgrammkoordinatorInnen,

herzlichen Dank, dass Sie (eine Teilnahme in Erwägung gezogen haben) mich mit Ihrer Bereitschaft, an der Erhebung mitzuwirken, dazu beitragen unsere Programme zu evaluieren und damit auch mein Promotionsvorhaben zu ermöglichen.

Vielen Dank für Ihre wichtige und wertvolle Mitarbeit als Projektkoordinatorin.



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Engl. - Project Coordinators

Online Consent to Participate in Research

My name is Gabriele M. Murry from the Organizational Leadership Ph.D. Program at the University of Oklahoma and I invite you to participate in my research project entitled *STEM Mentoring in Bavaria: An effective path towards equal opportunity? A case study to evaluate and elaborate on the concept of mentoring utilizing a functional model of mentoring*. This research is being conducted at Bavarian universities of applied sciences. You were selected as a possible participant because you are either a program manager, a mentor, or a mentee of the STEM mentoring programs in Bavaria. You must be at least 18 years of age to participate in this study.

Please read this document and contact me to ask any questions that you may have BEFORE agreeing to take part in my research.

What is the purpose of this research? The purpose of this research is to test a model of mentoring which will help to evaluate the STEM mentoring programs in terms of mentor and mentee characteristics and their development as well as the communication and understanding of the mentoring program, and lastly the organizational learning.

How many participants will be in this research? About a total of 177 will take part in this research: 17 program managers of the public Bavarian universities of applied sciences, and approximately 80 mentors and another 80 mentees.

What will I be asked to do? If you agree to be in this research, you will be asked to answer a survey with some demographic questions as well as questions about your understanding and experience with the STEM mentoring.

How long will this take? Your participation will take a maximum of 10 minutes to complete the survey.

What are the risks and/or benefits if I participate? There are no risks and no benefits from being in this research.

Will I be compensated for participating? You will not be reimbursed for your time and participation in this research.

Who will see my information? In research reports, there will be no information that will make it possible to identify you. Research records will be stored securely and only approved researchers and the OU Institutional Review Board will have access to the records.

In addition, this is an academic not-for-profit research project. Data are collected via survey monkey.com, an online survey system that has its own privacy and security policies for keeping



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your information confidential. Please note no assurance can be made as to the use of the data you provide for purposes other than this research.

Do I have to participate? No. If you do not participate, you will not be penalized or lose benefits or services unrelated to the research. If you decide to participate, you don't have to answer any question and can stop participating at any time.

Who do I contact with questions, concerns or complaints? If you have questions, concerns or complaints about the research or have experienced a research-related injury, contact me at +49-170-540-4202 or at g.murry@oth-aw.de or my research advisor, Prof. Aimee L. Franklin, PhD of the Political Science Department of the University of Oklahoma, USA, either at 001-405-325-2061 or alfranklin@ou.edu.

You can also contact the University of Oklahoma – Norman Campus Institutional Review Board (OU-NC IRB) at 405-325-8110 or irb@ou.edu if you have questions about your rights as a research participant, concerns, or complaints about the research and wish to talk to someone other than the researcher or if you cannot reach the researcher.

1. Online Consent to Participate in Research

Would you like to be involved in research at the University of Oklahoma?

Please print this document for your records.

The University of Oklahoma is an Equal Opportunity Employer.

This research has been approved by the University of Oklahoma, Norman Campus IRB.

IRB Number: ___XXXX___

Approval date: ___XXXX___

- I agree to participate
 I do not want to participate

Engl. - Project Coordinators

1. Introduction - About You

2. Are you male or female?

- male
 female



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3. When were you born? (Please enter a 4-digit birth year, i.e. 1976.)

4. Which is the highest degree you achieved so far?

- Hauptschulabschluss
- Realschulabschluss bzw. Mittlere Reife
- Fachhochschulreife bzw. Abitur
- Bachelor
- Master bzw. Magister
- Diplom
- Promotion/PhD

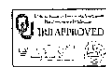
5. At which Bavarian university of applied sciences do you work as a project coordinator for the STEM-mentoring programs?

6. Which of the following categories describes your work hours per week best as a project coordinator for the STEM-Programs?

- I work 1-5 hours per week
- I work 6-10 hours per week
- I work 11-15 hours per week
- I work 16-20 hours per week
- I work 21-25 hours per week
- I work 26-30 hours per week
- I work 31-35 hours per week
- I work 36-40 hours per week
- I work 40+ hours per week

7. Which of the following categories describes your employment status best?

- I have a temporary work contract
- I have an indefinite work contract
- I am a tenured civil servant



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8. Since when are you working as a project coordinator of the STEM-Mentoring-Programs?

- less than 1 year
- 1-2 years
- 3-4 years
- 5+ years

Engl. - Project Coordinators

II Inputs

9. According to your understanding, please name the goals of the STEM-Mentoring-Programs in 3-5 bullet points. (Communication and clarity of program goals - H1d)

- 1.
- 2.
- 3.
- 4.
- 5.

10. According to your understanding, please name the expectations of the mentees towards the STEM-Mentoring-Programs in 3-5 bullet points. (Communication and clarity of program goals - H1c)

- 1.
- 2.
- 3.
- 4.
- 5.



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11. In reference to our STEM-Mentoring-Programs, the mentors from enterprises are familiar with....
 (Communication and clarity of program goals - H1a)

	almost always	often	rarely	never	don't know
...the goal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the frequency of the meetings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the expectations towards the programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the time to be invested	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the multi-faceted offers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the 3 levels of mentoring (cascades)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the networking support through the mentor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the mental support through the mentor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the subject-matter support through the mentor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...insights into the STEM-corporate world	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



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12. In reference to our STEM-Mentoring-Programs, the student mentors know..... (Communication and clarity of program goals - H1b)

	almost always	often	rarely	never	don't know
...the goal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the frequency of the meetings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the expectations towards the programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the time to be invested	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the multi-faceted offers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the 3 levels of mentoring (cascades)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the networking support through the mentor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the mental support through the mentor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the subject-matter support through the mentor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...insights into the STEM-corporate world	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



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13. In reference to our STEM-Mentoring-Programs the mentees know..... (Communication and clarity of program goals - H1c)

	almost always	often	rarely	never	don't know
...the goal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the frequency of the meetings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the expectations towards the programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the time to be invested	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the multi-faceted offers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the 3 levels of mentoring (cascades)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the networking support through the mentor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the mental support through the mentor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...the subject-matter support through the mentor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...insights into the STEM-corporate world	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



IRB NUMBER: 7460
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14. Our STEM-Mentoring-Programs..... (Communication through program managers - H1d)

	always	often	rarely	never	don't know
...are displayed on the university homepage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...and their content are solicited (i.e. brief information STEM lectures, introduction day for first semester students)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...are inquired about by female students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...are also inquired about by male students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...appear in the university news reports / news ticker	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...are disbursed in a separate newsletter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...and their goals are known to members of the university (faculty, administration and students)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...are communicated through posters and/or showcases	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...are communicated through flyers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...are solicited through our <u>mentors</u> with their co-students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...are solicited through our <u>mentees</u> with their co-students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...are solicited through our <u>mentors from enterprises</u> in their organizations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



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15. Which behavior would best describe the top executives of the university in reference to the STEM-Mentoring Programs? Multiple answers are possible. (Perceived support through UAS top executives - H2)

- our top executives are enthusiastic
- our top executives are depreciative
- our top executives are supportive
- our top executives are appreciative
- our top executives provide the impression that the programs are undesirable
- our top executives are approving
- our top executives are tolerating the programs
- is not known to me
- Other (please insert)

16. Which behavior would best describe the faculty of your university in reference to the STEM-Mentoring-Programs? Multiple answers are possible. (Perceived support through faculty - H2)

- our faculty are enthusiastic
- our faculty are depreciative
- our faculty are supportive
- our faculty are appreciative
- our faculty provide the impression that the programs are undesirable
- our faculty are approving
- our faculty are tolerating the programs
- is not known to me
- Other (please insert)



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17. What behavior do you observe at your university in general in reference to the STEM-Mentoring-Programs? Multiple answers are possible. (Perceived support at university in general - H2)

- our university mentors are enthusiastically involved
- our mentors are supported by the university
- our mentors are recognized by the university (i.e. public acknowledgement, certificates, etc.)
- our student mentors are hard to gain for the programs
- our mentors willingly participate for several semesters
- our student mentors are paid as student assistants for their participation
- our university provides incentives* for student mentors so they participate
- our university assures that the new student mentors undergo an introductory training
- our university assures that the new mentors from enterprises undergo an introductory training
- our mentors from enterprises are hard to gain for the programs

*What incentives, if any, are offered to student mentors by the university?

Engl. - Project Coordinators

III: Processes and Relationships

18. How does your university match the mentor and mentee regularly? (Process of Matching - H3)

- Mentee and mentor are matched by the project coordinator (you)
- During a kick-off meeting mentor and mentee find themselves after getting to know each other briefly
- A draw (or similar random method) determines the match
- One mentor is responsible for several mentees that are assigned
- Mentor and mentee are matched according to their respective abilities and needs
- Personality Tests
- Other (please explain)



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19. I can determine following similarities with the mentoring tandems consisting of mentor and mentee(s):
(Similarity Matching - H3)

	very distinct	present	hardly noticeable	not important	don't know
Age	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Culture (i.e. ethnicity / same migration background)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Degree program / area of emphasis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engagement in respect to the mentoring relationship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regional membership (i.e. Upper Franconia, from Bavaria, from the new states, from the old states, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Residence or vicinity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Branch that is intended for the professional career	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please insert).

20. I regard the process that matches mentor and mentee(s) as..... (Matching - H3)

- optimal / appropriate
- needing improvement
- inappropriate

In case you answered anything else than optimal, please explain why.

Engl. - Project Coordinators

IV Growth & Development



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21. In reference to mentors, I am able to observe the following over time: (Growth & Development - H4a)

	distinguishable increase	small increase	remains the same	decreases	don't know
Self-assurance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Patience with mentee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Understanding for mentee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trust in mentee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recognition within the mentoring-network	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Subject-matter knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Responsibility for mentee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to pass on knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to listen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gaining trust of the mentee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowledge of human relations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Self-organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please insert).



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22. In reference to the mentees, I am able to observe the following over time: (Growth & Development - H4b)

	distinguishable increase	small increase	remains the same	decreases	don't know
Self-assurance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clarity of career goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Understanding for mentor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trust in mentor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Understanding of the professional field	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recognition within the mentoring-network	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Subject-matter knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Responsibility for mentoring process (commitment)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to absorb information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ability to listen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Problem solving abilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Self-organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Self-initiative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Success in exams	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Motivation for studies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drop-out rate of students (females)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please insert).



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23. I could observe the following, possibly based on the STEM-Mentoring-Programs: (Org. Development - H5)

	distinguishable increase	small increase	remains the same	decreases	don't know
Willingness to help at the university in general	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Support of the programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Establishment of the programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Demand of similar programs for other groups of students (i.e. migration background, disability, men in social professions)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Introduction of similar programs for other groups of students (i.e. migration background, disability, men in social professions)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Development of informal communication networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Development of professional networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Failure-rate in exams	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drop-out rate of students (female)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Engl. - Project Coordinators

V Women only?



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24. How do you feel about the use of male mentors? Multiple answers are possible. (Females only? H6)

- can't imagine our mentees want this
- can't imagine our mentors want it
- is unthinkable at our university
- we considered this already
- we introduced this already, but are still in the testing phase
- we introduced this already, and it is a success
- we introduced this already, but then discontinued it because it was not successful
- only in exceptional cases, when no female mentors can be gained

Other remarks:

25. Do you perform the following concerning STEM-Mentoring at your university? Multiple answers are possible. (Organizational Learning - H5)

- Cost-controlling
- Comparison of drop-out rates of female mentees versus non-mentees
- Comparison of exam-failure rates of female mentees versus non-mentees
- Satisfaction surveys
- Comparison of degree completion rates of female mentees versus non-mentees
- Comparison of job-placement rates of female mentees versus non-mentees
- Other (please insert).

26. Are there any further remarks or insights about the STEM-Mentoring Programs you would like to make?

Engl. - Project Coordinators

Thank you

Dear Program Coordinators,



IRB NUMBER: 7450
IRB APPROVAL DATE: 11/5/2016

thank you so much for (considering) participating in this research.

Sincere thanks for your important and valuable work as a project coordinator.

Thank you!



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