

A Model for Reverse-Mentoring in Education

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Abstract—As the term indicates, reverse-mentoring flips the classical roles of mentoring: In school, students take over the role of mentors for adults, i.e. teachers or parents. Originally reverse-mentoring stems from US enterprises, which implemented this innovative method in order to benefit from the resources of skilled younger employees for the enhancement of IT competences of senior colleagues. However, reverse-mentoring in schools worldwide is rare. Based on empirical studies and theoretical approaches, in this article an implementation model for reverse-mentoring is developed in order to bring the significant potential reverse-mentoring has for education into practice.

Keywords—School education, reverse-mentoring, implementation model, innovation in education.

I. INTRODUCTION

REVERSE mentoring is a specific form of classical mentoring. Scientific work on the concept of mentoring began in the 1980s. Specifically, the publication of Kathy Kram's [1] "Phases of Mentor Relationship" has to be mentioned as a significant starting point of discussion and still is one of the most influential publications in this field [2]. Over the years, mentoring became an established method for personnel development in organizations and a myriad of different definitions of mentoring was developed, reflecting the significant number of the different contexts (e.g. enterprises, universities, medical institutions) where the concept is utilized. Therefore, a standard definition of mentoring is not easy to establish, rather it is possible to analyze fundamental elements characterizing the process of mentoring. Haggard et al. [3] dealt with this issue and analyzed the mentoring-definitions used by researchers in 124 scientific studies and determine the following elements:

1. Reciprocity of the social relation between the mentor and the mentee.
2. Developmental benefits related to the mentee's work and/or career, as well as benefits for mentors profiting by the learning partnership.
3. Regular/consistent interaction between the mentor and the mentee.

Ziegler [2] also regards it beyond the means of developing a standard definition for mentoring, as it is not only the different contexts where this approach is used, but also the various types of mentoring like formal/informal mentoring [3], peer mentoring [4], cascade mentoring [5], group-mentoring, mentoring in networks [6], e-mentoring [7]-[9] or as in our case, the relatively new concept of reverse-mentoring. Even so, the author drafts an ideal type of definition intended to

convey the nucleus of mentoring: "Mentoring is a temporally stable dyadic relation between an experienced mentor and a less experienced mentee. The relation is characterized by mutual trust and courtesy; it aims at facilitating learning and development of the mentee" [2, p.11].

As for the classical forms of mentoring, approaches for reverse-mentoring are mainly used in organizational contexts. The term indicates that generally spoken, in reverse-mentoring the roles of mentoring are reversed: A less experienced person serves as mentor for a more experienced person, taking over the role of the mentee. Just this simple description indicates, that in reverse-mentoring an understanding of interpersonal relations being characterized by a shape of apprenticeship or hierarchy no longer fits. Instead, it turns to reciprocity as both mentor and mentee take advantage of the mentoring relation. One, for example, getting advice from a senior colleague with regard to organizational culture or networking, and the other often in obtaining up-to-date knowledge of IT (Information Technology) [10], [3], [11]. The concept of reverse-mentoring is an innovative way to encourage learning for "both sides" and it further has a high potential in strengthening cross-generational relationships in terms of facilitating understanding and respect [12]. In fact, it is mainly in the field of IT where reverse-mentoring is implemented in organizations, as the young generation, being digital natives [13], bring with them the latest in technological knowledge. Though, other topics for reverse-mentoring may also include the latest economic theories, language skills, innovative ideas, perspectives or concepts [12]. This entails the author to propose an extension of the above mentioned definition: "Reverse-mentoring is a specific form of mentoring and refers to a reciprocal and temporally stable relationship between a less experienced mentor providing specific expert knowledge and a more experienced mentee who wants to gain this knowledge. The relation is characterized by mutual trust and courtesy, it aims at facilitating learning and development of both, the mentor and the mentee."

The positive effects of mentoring on mentors and mentees are well documented [14]-[17]: Mentoring positively influences mentees' careers, enhances job satisfaction and raises well-being. Mentors learn to establish relations, improve their social and leadership competences, and for example, gain recognition as mentors, enhancing their social status in the organization.

There may be a great deal of reverse-mentoring in schools worldwide, but it has to be stated an immense absence of scientific studies in this field. The databases ERIC or PubPsych, focusing on pedagogical and psychological resources, do not even deliver a single entry, and only some isolated projects can be found on Scholar Google. According to Chuang and Thompson [18], it is mainly the GenYes

(Generation Yes, www.genyes.org) mission, which for years has been relying on the potential of the youth, and although, they do not use the term reverse-mentoring, the organization adopts this approach on a large scale: The project provides the online resources to prepare a team of “Student Technology Leaders” with the skills necessary to support the technology integration efforts of teachers, IT staff, and other adults working at the school. Christie [19] also builds on a resources and solution oriented approach and analyzes the learning experiences of students. She found the reverse-mentors on the one hand to be highly accepted by their teacher-mentees and on the other hand to steadily enhance their own IT-knowledge and competences. Further, Peterson [20] implemented and analyzed two case-studies in New Zealand. Student mentors were directly offering IT support in classes, when requested by teachers. The mentors were beforehand instructed by IT-teachers who also took over the role of coordinators. The teacher’s positive evaluation especially was related to the immediacy of support, all teachers accepted the student-mentors and evaluated their own IT-competences as to have improved.

As demonstrated above, literature on reverse-mentoring in schools is far from being evidence based and practical implementations are just at the beginning. When considering the positive effects of reverse-mentoring in organizations, the author regards reverse-mentoring to be an innovative and valuable way of learning, as well as a resources-oriented method for personal and social development of both “sides” - the students and the teachers. Therefore, bearing in mind the IT-skills of the today’s digital natives, this article aims at the research and theory-based development of a reverse-mentoring model for school education.

II. QUALITY ISSUES IN MENTORING

Reverse-mentoring, as being a specific form of classical mentoring, enables us to build upon the studies and findings in the mentoring field. Hence, in a first step, quality issues need to be considered.

A. Quality Criteria for Mentoring

According to Ziegler et al. [21], an effective mentoring program has to be adapted to the specific *context*. Whereas in the economy or industry, mentoring is often used for career development or for the enhancement of job satisfaction, while in public institutions mentoring is employed for knowledge transfer and in the medical sector it is utilized to support the socialization of young colleagues into the profession. Not at least, it is used for the empowerment of women in order to achieve higher hierarchical positions [22]. This means that cultural conditions, the specific contexts and aims must be decisive for the development of a mentoring model. According to Schmid and Haasen [5] therefore, in a first step it is essential to clearly define the mentoring aims and to recruit the target group as related to this definition.

Secondly, the *matching* of mentors and mentees is to be regarded as an important quality issue. Matching can be self-organized or organized externally. The latter is established by

the program management according to general criteria, self-organized matching can reduce diversity, as mentees may select their mentees according to similarities. External matching also refrains the mentee from rejection and if the tandem does not fit together, this issue can be transferred to the project management. Be it one or the other way, a short meeting of the tandem before the official kick-off is important in order to find out, if both of them find it interesting to enter a mentoring relationship over a longer time period [5]. In line with this Ziegler [2], Schmid and Haasen [5] add the importance of a good relationship between mentors and mentees, and suggest measures to promote the quality of relations.

Training of the mentors, as well as the exchange of experiences and networking, is one further criterion in order to enhance the efficiency of mentoring programs. This can be offered in the preparation phase of a program, but also can be a continuous offer throughout the life of the project. Be it (group)-coaching, be it workshops, be it classical trainings or supervision, an offer like this is supportive and facilitates personal development through theories and tools helpful for the reflection of the mentoring role, respectively, the individual’s own mentoring-personality [5].

The fourth main issue is the *duration* of the mentoring process. Frequency of mentoring contacts is to be adapted to the aims of the program. This indicates, that no general recommendations can be given, though it can be stated that at least one meeting per month over a time span of half a years should continuously be given [5].

B. Organizational Factors and Issues of Implementation

In order to effectively develop a formal mentoring approach, Jones [15] in a longitudinal study, analyzed the following main issues:

- Ø The mentoring program has to fit to the organizational strategies.
- Ø It needs to be supported on a high organizational level.
- Ø It is necessary to embed the program into the organizational process.
- Ø The mentors should be flexible with regard to time and their availability.
- Ø The matching strategy needs to be considered carefully.
- Ø The mentoring-process should be documented, such as in a mentoring diary.
- Ø The mentoring program should be promoted within the organization.

The latter aspect of promotion is confirmed by other authors [17], [5]. The form of presenting the mentoring project in the organization and value given to mentors are decisive for their decision to take part. Mentors generally participate voluntarily, therefore, it is of high importance to recognize and value their engagement.

Generally, when starting a program, kick-off meetings are planned in order to bring together all participants and to transmit the process-specific information to mentors and mentees. Further, a mentoring agreement is officially signed by the mentor and the mentee.

III. THEORETICAL BACKGROUND

Apart from respecting the quality factors, as described above, mentoring-projects are successful, when an empirical basis is given [2], [23], [24]. This denotes research methodology, as well as the theoretical foundations. In analyzing the theoretical frames, Dominguez and Hager [25] identify three main theoretical threads mentoring builds upon: (1) developmental theories, (2) learning theories and (3) socialization theories.

A. Developmental Theories

In the context of mentoring, Levinson's "Career Stage of Life Theory" is one of the most cited developmental theories [26]. It acts on the assumption that in growing up, phases of stability are alternated with phases of instability. Whereas stability is connected to important life-decisions, instability relates to changes in values and beliefs. According to this approach, mentoring is regarded to be supportive along these developmental, academic or occupational transitions.

In the beginning of her scientific work on mentoring, Kram [1], [27] also related to Levinson. In particular, she highlighted the importance of the matching between mentors and mentees in terms of the individual career-status, the competences and the potential of the mentee. For mentees at the beginning of their career, she therefore depicted other mentoring topics than for mentees with a long occupational career. Especially in higher education, Kram's theory of developmental phases was adopted by researchers in order to develop interventions in different mentoring-relations (peer to peer, faculty to PhD, senior to junior faculty members), later the focus turned to the development of distinct developmental stages regarding adulthood [25].

Developmental theories therefore, organize the mentoring process within succeeding phases of individual development. Though, the inherent view of a superior mentor and an inferior and subordinate mentee has to be mentioned critically: Within this theory, a core component of the relations between mentors and mentees is defined along a complementary and dyadic view of mentoring, this by itself promoting a hierarchic understanding of the relationship between mentor and mentee.

Developmental theories are also criticized in terms of mainly relying on white, male samples in their research and neglecting issues of gender and diversity [24]. Though, to be effective in mentoring, the consideration of the resources and possibilities provided by variety and cultural diversity in contemporary implementations of mentoring in education is to be regarded as a basic and essential prerequisite [25].

B. Learning Theories

The perception of mentoring as a learning partnership is the second theoretical frame frequently used by researchers for mentoring. Just to mention the most important learning theories with regard to mentoring ranging from the classical behaviorist, cognitivist and constructivist theories to andragogy, transformative learning or action learning explicates the broad variety of mentoring-models. Though learning theories will overlap in mentoring, it is clear, that a

model, for example based upon behaviorism, will lead to different implementations than mentoring based on constructivist theory or action learning.

Behaviorist theories conceptualize learning as a change in behavior triggered by different modes of reinforcement [28]. This theory is assigned to classical forms of mentoring following an apprenticeship model. The main function of a mentor in this case is to support the mentee in the development of desirable behavior and to reach predefined goals, whereas mentees are perceived as passively reacting to the environment [25].

Cognitivist theories put an emphasis on intra-individual cognitive processes, i.e. information processing and thinking operations [29]. Mentoring models following cognitivism are individually determined and focus on the adaptation of the learning processes to the learner. Mentees in this view take over active thinking and metacognition, the mentors' role is a kind of teacher or tutor providing learning outcomes through knowledge transfer [25].

Constructivist learning theories stand for psychological, philosophical and epistemological approaches assuming that individual views of the world are actively constructed in interactions with the environment. The developmental psychologist Jean Piaget carried out pioneering work in this context when describing the interplay of "accommodation" and "adaption": When a child interacts with the environment, it creates experiences, which in the form of patterns/schemes, combine perception and behavior, and as such learning occurs. These patterns/schemes in further interactions with the environment are either confirmed, and thus assimilated, or have to be adapted, and therefore, accommodated [30]. The metaphor of a map is often used to describe constructivist learning: This internal map consists of numerous well-proven streets and pathways but is also open to draw new ways. In this sense constructivist learning is an adaptation of the environment to the inner cognitive schemes as well as an adaptation of the inner patterns to the environment [31]. Therefore, learning occurs, when real-world experience is compared to the inner schemes and in the case of being unsuitable, knowledge is actively reconstructed.

The constructivist perspective in mentoring places emphasis on the social construction of knowledge, on questions, sense and reflection [32]. In this effect, the mentor takes over the role of a facilitator or guide for the mentee [8], [25]. Crow [32] adds that constructivist learning "involves the social construction of knowledge, in which knowledge is co-constructed through the social negotiation process of relationship". Thus rather than identifying and transmitting a set of facts, skills, and practices, mentoring involves a creative process in which a mentor, together with the mentee, construct knowledge [34, p. 233].

Knowles' adult learning theory [33] focusses on the prerequisites and demands of adult learners. Andragogy considers the adult learner to generally bring along a magnitude of experiences and to be internally motivated. Learning is regarded to be self-directed, reflexive, in time and makes sense to the learner. Knowledge about adult learning

lead to a paradigmatic shift in mentoring from the mentor's traditional authoritarian role to a facilitator role, where mentor and mentee engage in a mutual learning process [25]. It further means an understanding of mentoring as enabling the mentees' self-directed learning.

The theory of transformative learning was drafted by Mezirov in the 1970s and presents another distinct body of research in adult learning. The transformative learning process is characterized by critical reflection of the own pre-assumptions. This is facilitated in discourses with others, when meaning schemes are reassessed and perspectives that are not viable are transformed. Thus, transformative learning is defined as using experiences in order to develop new interpretations of these experiences [34]. Like in constructivist learning, in this approach mentors take over the role of facilitators or guides and the mentees' role is that of active critical thinking. Mentors and mentees find themselves in a process of facilitating critical reflection being important for the analysis and/or change of perspectives [25].

Action learning theory also relies on mentors facilitating learning, respectively taking over the role of a coach for the mentees. It proposes that learning by doing and frequent dialogue lead to individual and organizational learning. In a preferably heterogeneous community of learners, mutual exchange takes place. The point is that in solving problems together, the group members learn from each other - there are no all-knowing authorities [35]. Action learning is used in newer forms of mentoring like group mentoring, team mentoring and implementations that include new forms of digital media and networks [25].

C. Social Theories

Also in this final category of theories on which mentoring is based, several approaches can be identified. As will be demonstrated, together with learning theories, social theories shift "our attention from ancient, traditional dyadic mentoring to the myriad of benefits that multiple developmental relationships bring to mentees, mentors and organizations" [25]. Social theories regard mentors as being role-models who provide information for mentees actively taking the responsibility for their own development. Especially, the networking perspective is regarded to have valuable impacts on both mentee and mentor.

Whereas in socialisation theory mentors are seen as role models and mentees take over the role of an active apprentice, in human capital theory the individual competences acquired when investing in education or job training with the aim of a higher potential income are highlighted. A higher potential income or a more successful position in social capital theory is determined by the accumulation of social networks and valuable connections [25].

Theoretical approaches of gender studies discussing mentoring in the context of the concept of male "homosociability" [36] further, is to be assigned here. According to this approach, in male dominated structures it is not competences or aptitude being decisive in career advancement, but relations and similarities. This explains the

lack of women in science and research, as the transfer of knowledge mainly occurs in "old boys' networks" between established and younger men. Mentoring is regarded to be a means to counteract these processes [37], [38]. Though in the academic sector, dyadic mentoring is still mainly employed, the application of networked models may have a high potential for the advancement of women's scientific careers.

Communities of practice, as drafted by Wenger [39], can be regarded as knowledge networks in providing information exchange, maintaining information and promoting competence development of their members. These functions are well suited for mentoring, respectively developmental-networks, and challenge the traditional role of mentors and mentees. This means that, for example, one person may be a novice in one network while taking over the role of an experienced mentor in another network. This is the case in reverse-mentoring, when a novice - an unexperienced person - brings in recent knowledge, respectively state-of-the-art expertise, and takes over the role of a mentor for more experienced colleagues. The understanding of mentoring as occurring in networks, essentially affects the relations between mentors and mentees, as it turns away from an understanding of mentors and mentees as a teachers and apprentices model, to a model characterized by partnership.

In line with communities of practice, a network-model of high interest for schools was drafted by Higgins and Kram [6]. They build upon Krams' former work on mentoring [27], [1] and introduce the "Developmental Network Theory" which is based upon the value of multiple relations in mentoring networks. The authors state that in times of steady technological innovation, internationalisation, multiculturalism or increasing diversity, traditional mentoring models no longer match up. Still, the two essential functions of mentoring - personal and career development - are of the highest interest, but Higgins and Kram raise the discussion from whom and how mentoring is offered. They define four essential elements of a mentoring developmental network:

1. Developmental network: "The developmental network consists of those relationships the protégé names at a particular point in time being important to his or her career development, they are simultaneously held relationships, as opposed to a sequence of developmental relations" [6, p. 268].
2. Developmental relations: The mentees' network consists of so-called "developers" being mentors as well, and who provide a high amount of both career and psychosocial support and sponsors, who provide a high amount of career support but low amount of psychosocial support.
3. Developmental network diversity: The less similar, respectively redundant information in a network, the greater the value for the mentees. Diversity in networks is defined to the number of different social systems (e.g. schools, community, organizations) where the relationships come from and the extent to which the developers provide expertise and are connected to each other. Hence, developmental diversity is rather attributed to the relations in the network than being individual

characteristics of the developers.

- Relationship strength is defined as the level of emotional affect, reciprocity and frequency of communication. Higgins and Kram relate to studies on relationships in learning and identity formation, as well as clinical studies on adult development when issuing the fact that individuals strongly tied to each other tend to be highly motivated to help each other.

IV. REVERSE-MENTORING MODEL FOR SCHOOLS

A. Defining Reverse-Mentoring

Summarizing the previous chapter, the main issues are a clear statement for reciprocity of the relation between mentor and mentee and for a networked perspective on mentoring. Hierarchic views of apprenticeship models, as displayed in developmental theories, are dismissed in favor of heterogeneous knowledge derived within networks. This is especially true for reverse-mentoring, as the idea of changing roles per se breaks open hierarchy. Though dyadic views still remain of value for the role-modelling function of mentoring-tandems, the relations within networks tend to become the core elements of personal and occupational development. Yet this is valuable, particularly for reverse-mentoring, when considering youth as digital natives being connected to each other via social media [13], [40].

Social theory therefore finds itself closely connected to constructivist learning theory, action learning and adult learning, respectively, transformative learning: In each of these theories mentors are regarded as facilitators of learning

and development, while mentees take over an active and reflective role for their own learning and development. Taken together, this leads to the further extension of the reverse-mentoring definition as described before:

“Reverse-mentoring is a specific form of mentoring and refers to a reciprocal and timely stable developmental partnership between one or more less experienced mentor/s providing specific expertise and one or more experienced mentee/s who want/s to gain this knowledge. The partnership is characterized by reciprocity and mutual respect and it aims at both, the development of the mentors and the mentees. In applying a networked perspective, it may take advantage of digital technology.”

B. Reverse-Mentoring Concept

The concept takes orientation in constructivist and action learning, as well as in adult learning and transformative learning. The common core element of the theories is to take over responsibility for one’s own learning and development process, which also accounts for the mentors and the mentees. Learning in reverse-mentoring is regarded as a self-directed, active process occurring in interaction and communication. Quite consistent to transformative theory, critical reflection in constructivism allows for the construction of new meaning which is integrated into earlier experiences (schemes) and there also find its origins. Regarding the interplay between mentors and mentees, knowledge is co-constructed by both parties.

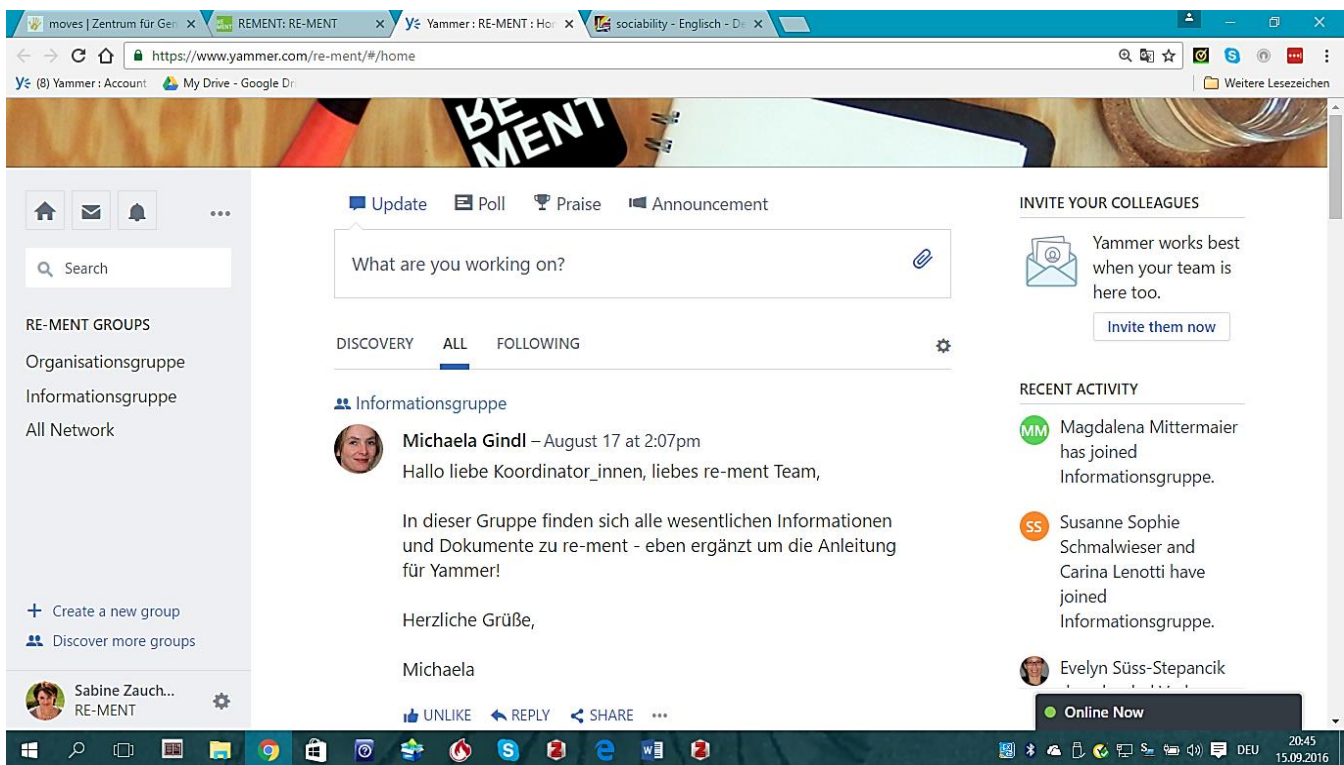


Fig. 1 Yammer for reverse-mentoring

The structure for reverse-mentoring in schools orients itself on the developmental network of Kram [6]. The concept is related towards reciprocity and takes advantage of the multiple connections possible within a network, moreover, being close to the environment and daily lives of young people. The network is technologically supported by the Social Network Enterprise Yammer (www.yammer.com), which is similar to Facebook, though being closed for the mentors and the mentees, who by themselves can create open or closed groups to be used by two or more persons (see Fig. 1). For student mentors, this means that, for example, they can work together in mentoring one mentee, and that they continue mentoring with a colleague's mentee in a specific topic or that they can take advantage of a community of practice dealing with the same topic as they themselves, even those from other schools.

C. Organizational Factors

With regard to organisational factors, the context of the specific schools needs to be considered. This means that besides a clear statement from the school principal with regard to the effectiveness of this innovative approach for learning and development of both sides – the student mentors and the teachers or other adults – there is to be installed a local management which has to be informed and trained beforehand. It will help all persons involved (mentors, mentees, managers, coaches) to obtain detailed information about their tasks in the program. This is, for example, for mentors and mentees, the development of the mentoring aims or keeping contact with each other. For the program managers, it is to provide infrastructure or to organize the pre-meeting of mentors and mentees before the kick-off, whereas the coaches are responsible for the mentors' preparation to their roles.

Besides the organisational issues, one main task of program managers is the promotion of the mentoring program inside and outside school. This can be through the use of flyers, as shown in Fig. 2, presentations for the colleagues and in class, articles for newsletters and blogs or texts in newspapers. Also the official events of the program, the kick-off and the closing event (see below), can be used for the promotion of the reverse-mentoring program.



Fig. 2 Reverse-mentoring postcard; German text: "Mentoring turned on its head!"

The selection/acquisition of mentors, for example when planning IT mentoring for teachers or parents - apart from IT

and social skills - in each case, should be based on the interest and willingness of the young people. Before the start of the mentoring-process, the participants need to be trained for their specific task as mentors. Systemic-constructivist coaching is an efficient method focusing on resources and solutions in order to prepare mentors for their role, be it in group coaching or in one-on-one sessions. Coaching facilitates reflection of one's own competences and aims at preparing a mentoring profile. This profile is subsequently used by the program management for the matching process with the mentees.

The kick-off is most essential in providing the relevant information to those participating. A core element of the kick-off is the signature of the mentoring agreements between the mentor and the mentee containing the contacts planned, as well as the mentoring aims and the steps to be taken in the first run. Further supporting material for the documentation of the mentoring activities, as well as the program schedule, should be provided.

After the start of the mentoring program, the mentors and mentees take over control and act independently. They decide for the specific content and decide the frequency of contacts within the given frame of about one meeting per month. Further, they determine the form of the meeting, be it face to face at school or online. Mentoring in groups is the option provided by the Yammer network, which is also the exchange platform for participants, and a useful tool to connect with mentors and mentees in other schools in order to exchange experiences. Nevertheless, the manager and the coach still remain available for the mentors and mentees.

The program ends with a closing event, where the school principal, and other teachers and students, as well as family members are invited. Mentors, as well as mentees, are evaluated and receive award certificates for their participation and work.

D. Quality Control and Evaluation

It is clear from the previous chapters that there is an immense absence of studies dealing with reverse-mentoring. In order to further develop the topic, it is essential to carefully evaluate the programs. Often evaluations of mentoring programs are criticized because of methodological shortcomings [2]. Allen, Eby and Lentz [23] state in their analysis of 200 studies on mentoring that mentoring research mainly uses quantitative and cross-sectional design, and that it is only the mentees who are included in the analysis. Further, the projects even do not fulfil conceptual minimum-requirements. Therefore, based on an elaborated model, the involvement of all participants, the use of age-appropriate qualitative methodology and longitudinal research design is recommended for the evaluation of reverse-mentoring programs.

V. CONCLUSION

Though reverse-mentoring in schools may be a great challenge, as it suggests, a totally different relation between students and teachers, it is an innovative way for individual development and the enhancement of skills and competences

of both the student and the teacher. It regards students as competent in teaching their own teachers, focuses on resources and not - as so often in education - on deficiencies. Also, new ideas and expertise can be built in the mentoring network and the experience of reverse-mentoring brings mentors and mentees closer to each other, as intergenerational exchange is facilitated and the understanding for the respect of the other rises. This indicates that reverse-mentoring has a high potential for the deconstruction of attitudes and beliefs. Young girls providing Java or HTML skills, respectively teach their teachers how to simply design a website in WordPress or introduce their mentees into the world of social media, and allows for an understanding of girls and technology distinct from the well-known, disadvantageous stereotypes. However, the reverse-mentoring model as proposed here, needs to be implemented and evaluated in different educational contexts. Most of the findings in the above article were derived from mentoring literature in other contexts than schools. Therefore, especially context sensitivity (e.g. in the form of a local program manager) needs to be carefully considered when implementing reverse-mentoring in school systems.

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REFERENCES

- [1] K. E. Kram, "Phases of the mentor relationship," *Acad. Manage. J.*, vol. 26, no. 4, pp. 608–625, 1983.
- [2] A. Ziegler, "Mentoring: Konzeptionelle Grundlagen und Wirksamkeitsanalyse," in *Mentoring: Theoretische Hintergründe, empirische Befunde und praktische Anwendungen*, Lengerich: Papst Science Publishers, 2009, pp. 7–30.
- [3] D. L. Haggard, T. W. Dougherty, D. P. Turban, and J. E. Wilbanks, "Who Is aMentor? A Review of Evolving Definitions and Implications for Research," *J. Manag.*, vol. 37, pp. 280–304, 2011.
- [4] D. Gillman and J. Kleist, "The Power of Peer Mentoring," University of Wisconsin Madison, Wisconsin, 2007.
- [5] B. Schmid and N. Haasen, *Einführung in das systemische Mentoring*. Heidelberg: Carl-Auer, 2011.
- [6] M. C. Higgins and K. E. Kram, "Reconceptualizing mentoring at work: a developmental network perspective," *Acad. Manage. Rev.*, vol. 26, no. 2, pp. 264–288, 2001.
- [7] H. Stöger, "E-Mentoring: eine spezielle Form des Mentorings," in *Mentoring: Theoretische Hintergründe, empirische Befunde und praktische Anwendungen*, Stöger, Heidrun, Ziegler, Albert, and D. Schimke, Eds. Lengerich: Papst Science Publishers, 2009, pp. 227–243.
- [8] A. J. Butler, R. S. Whiteman, and G. M. Crow, "Technology's role in fostering transformational educator mentoring," *Int. J. Mentor. Coach. Educ.*, vol. 2, no. 3, pp. 233–248, 2013.
- [9] S. Williams, J. Sunderman, and J. Kim, "E-mentoring in an Online Course: Benefits and Challenges to E-mentors," *Int. J. Evid. Based Coach. Mentor.*, vol. 10, no. 1, pp. 109–123, 2012.
- [10] A. K. Buahene and G. Kovary, "Reversing roles: Why Gen Ys can make great mentors," *Can. HR Report. Natl. J. Hum. Ressour. Manag.*, vol. 4, no. May, 2009.
- [11] J. C. Meister and K. Willyerd, "Mentoring Millennials," *Harv. Bus. Rev.*, vol. May, pp. 1–4, 2010.
- [12] D. Giddens and R. Phillips, "Reverse Mentoring: Finding a new way of working while discovering Web 2.0," Adelaide Convention Centre, Adelaide, SA, Australia, ALIA National Library and Information Technicians Conference, Sep. 2009.
- [13] M. Prensky, "Digital Natives, Digital Immigrants," *Horiz. MCB Univ. Press*, vol. 9, no. 5, 2001.
- [14] K. N. Rekha and M. P. Ganesh, "Do mentors learn by mentoring others?" *Int. J. Mentor. Coach. Educ.*, vol. 1, no. 3, pp. 205–217, 2012.
- [15] J. Jones, "An Analysis of Learning Outcomes within Formal Mentoring Relationships," *Int. J. Evid. Based Coach. Mentor.*, vol. 10, no. 1, pp. 57–72, 2012.
- [16] K. Crawford, D. Simoson, and I. Mathews, "Change, challenge and choice: Being a student mentor," *Int. J. Mentor. Coach. Educ.*, vol. 2, no. 2, pp. 137–148, 2013.
- [17] Q. Noufou, D. Rezanian, and M. Hossain, "Measuring and exploring factors affecting students willingness to engage in peer mentoring," *Internationa J. Mentor. Coach. Educ.*, vol. 3, no. 2, pp. 141–157, 2013.
- [18] H.-H. Chuang and A. Thompson, "Students Teaching Teachers," *Educ. Leadersh.*, vol. 63, no. 4, pp. 70–71, 2005.
- [19] A. A. Christie, "Scaffolding Graduate Student Learning Through the Use of Gen wwwY Students," in *Proceedings of Society for Information Technology & Teacher Education International Conference*, D. Willis, J. Price, and N. Davis, Eds. Chesapeake V.A.: Association for the Advancement of Computing in Education (AACE), 2002, p. 789.
- [20] M. J. Peterson, "Switching roles: An investigation into the use of reverse-mentoring by students to encourage teachers' uptake of ICT in their pedagogical approach.," Curtin University, School of Education, Australia, 2012.
- [21] A. Ziegler, D. Schimke, and H. Stöger, "Wo steht die Mentoringforschung im Hype-Zyklus? Resultate eines Literaturüberblicks," in *Mentoring: Theoretische Hintergründe, empirische Befunde und praktische Anwendungen*, H. Stöger, A. Ziegler, and D. Schimke, Eds. Lengerich: Papst, 2009, pp. 317–329.
- [22] S. Brondyk and L. Searby, "Best practices in mentoring: Complexities and possibilities," *Int. J. Mentor. Coach. Educ.*, vol. 2, no. 3, pp. 1889–203, 2013.
- [23] T. D. Allen, L. Eby, and E. Lentz, "The state of mentoring research: A qualitative review of current research methods and future research implications," *J. Vocat. Behav.*, vol. 73, pp. 343–357, 2008.
- [24] R. Grassinger, "Zur Bedeutung von Mentoring für die Entwicklung von Expertise und Leistungsexzellenz," in *Potenziale intergenerationell entfallen und lebenslang entwickeln Tagungsband zum ÖZBF-Symposium zum Tag der Talente 2012*, ÖZBF (Österreichisches Zentrum für Begabtenförderung und Begabungsforschung, Ed. Salzburg: Eigenverlag: Österreichisches Zentrum für Begabtenförderung und Begabungsforschung, 2013, pp. 79–88.
- [25] N. Dominguez and M. Hager, "Mentoring frameworks: Synthesis an critique," *Int. J. Mentor. Coach. Educ.*, vol. 2, no. 3, pp. 171–189, 2013.
- [26] D. Levinson, *The Season of a Man's Life*. New York, NY: Random House, 1978.
- [27] K. E. Kram, *Mentoring at Work: Developmental Relationships in Organizational Life*. Glenview, IL: Scott Foresman, 1985.
- [28] P. G. Zimbardo, "Lernen," in *Psychologie*, Berlin: Springer-Verlag, 1992, pp. 227–267.
- [29] R. M. Gagné, L. G. Briggs, and W. W. Wager, *Principles of Instructional Design*. Fort Worth, Philadelphia, San Diego, New York, Orlando, Austin, San Antonio, Toronto, Montreal, London, Sydney, Tokyo: Harcourt Brace College Publishers, 1992.
- [30] L. Montada, "Die geistige Entwicklung aus der Sicht Jean Piagets," in *Entwicklungspsychologie*, 5th ed., R. Oerter and L. Montada, Eds. München: Urban & Schwarzenberg, 2002, pp. 418–442.
- [31] F. B. Simon, *Einführung in Systemtheorie und Konstruktivismus*. Heidelberg: Carl Auer, 2006.
- [32] G. M. Crow, "A critical-constructivist perspective on mentoring and coaching for leadership," in *The Sage Handbook of Mentoring and Coaching in Education*, C. Fletcher and C. Mullen, Eds. Thousand Oaks, CA: Sage, 2012, pp. 228–242.
- [33] M. S. Knowles, Elwood F. Holton III, and R. A. Swanson, *The Adult Learner: The definitive classic in adult education and human resource development*, 5th ed. Woburn, MA: Butterworth-Heinemann, 1998.
- [34] J. Mezirow, E. W. Taylor, and Associates, *Transformative Learning in Practice: Insights from Community, Workplace, and Higher Education*. San Francisco, CA: John Wiley and Sons, 2009.
- [35] J. Markowitsch, K. Messerer, and M. Prokopp, *Handbuch praxisorientierter Hochschulbildung*. Wien: Facultas, 2004.
- [36] A. Witz and M. Savage, *Gender and Bureaucracy*. Oxford: Blackwell, 1992.
- [37] E. Genetti, H. Schlögl, and W. Schlögl, "move on ... Ergebnisse und Empfehlungen aus dem Wiener Mentoring-Projekt für

Nachwuchswissenschaftlerinnen, Wien.,” Projektzentrum Frauenförderung der Universität Wien, Wien, 2003.

- [38] E. Schiesselberger and S. Strasser, “In den Fußstapfen der Pallas Athene. Möglichkeiten und Grenzen des Mentoring von unterrepräsentierten Gruppen im universitären Feld.,” Bundesministerium für Wissenschaft und Verkehr., Wien, 1998.
- [39] E. Wenger, *Communities of Practice. Learning, Meaning, and Identity*. Cambridge, MA: Cambridge University Press, 1998.
- [40] MPFS, “JIM-Studie 2013. Jugend, Information (Multi)media. Basisstudie zum Medienumgang 12 bis 19jähriger.,” mpfs, Stuttgart, 2015.

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