Providing engineers with OARS and EARS

Effects of a skills-based vocational training in Motivational Interviewing for engineers in higher education

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Abstract

Purpose – Motivational Interviewing (MI) is a vocational communication skill from the helping professions. Verbal skills in MI are summarized under the acronyms OARS and EARS (open-ended questions/elaborating, affirmations, reflections, and summaries). The purpose of this paper is to outline how MI provides important skills for engineers, and demonstrate skill assessment by using an observation-based scientific approach.

Design/methodology/approach – Totally, 25 engineering students took part in a skill-based MI training. Quality assurance of the training was assessed by using a repeated measurement design with multiple measures: systematic observations from recorded interactions and self-reported and standardized performance measures. Two external observers reliably coded the recorded conversations using the MI skill code.

Findings – Trainees showed a significant increase of verbal skills in MI. Directive-confrontational behaviors decreased after training. Self-reported and performance measures indicated significant increases in MI post training. Conversational partners in the post-training condition showed significantly more motivation in comparison to partners before the training.

Research limitations/implications – The main limitation of the study is the small sample size. However, training effect sizes showed large effects on verbal skills.

Practical implications – Communication skills in MI can be taught effectively for a technical population. This study suggests that MI is effective within the higher education of technical professions who have to deal with motivational issues. Observational measures can be used for quality assurance purposes, but also serve as a feedback instrument for work-based learning purposes.

Originality/value – This is the first study to evaluate training in MI for engineers using a multi-method approach with observational measures.

Keywords Engineering education, Communication skill training, MI skill code, Motivational Interviewing, Reflective listening

Paper type Research paper

Introduction

The curriculum of technical professions and engineering education often is heavily focussed on technical knowledge (Darling and Dannels, 2003). More recently, scholars have argued that oral communication skills are increasingly important for engineers (Ford and Teare, 2006; Seat *et al.*, 2001). The rational for this argument is that communication skills are important for personal and professional development (Morreale and Pearson, 2008; Morreale *et al.*, 2000), are rated among the most requested

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skills by employers (The Cline, 2005; McEwen, 1997), and can facilitate career success (Morreale and Pearson, 2008). As engineers spend about 50 percent of their day communicating with others (Vest *et al.*, 1996) it is even more important for them to communicate effectively. However, it appears to be challenging to teach communication skills effectively to engineers (Dannels *et al.*, 2003; Ford and Teare, 2006). Given the importance of communication skills in the area of engineering (Darling and Dannels, 2003) and higher education (Morreale and Pearson, 2008), the evaluation of communication training in this domain is worth studying.

The present study sets out to evaluate how professional development in Motivational Interviewing (MI) – a person-centered and directive communication method – has measurable impact on engineers' communication skills. Overall, this study contributes the following. First, we will outline the basic features of MI. We will give definitions and examples of central verbal skills in MI and show how these can be assessed by using an observation-based scientific approach. Second, we will show how skills covered in MI are valuable within the work environments of engineers. Finally, we will illustrate how to use an observational instrument as a quality assurance measure in higher education. For this, we present results from a training study that we carried out in a university of technology.

MI

MI is a person-centered and directive communication method that aims to motivate a conversational partner to reach a change-related goal. The method is based on communicating and exchanging ideas with a conversational partner, with the aim of increasing their intrinsic motivation and helping them to resolve ambivalence (Miller and Rollnick, 2013). Whereas MI is usually taught to professionals in the helping professions (e.g. for therapist, nurses, or counselors), recent studies indicate that MI also seems suitable within business contexts, for example, for managers who work in change projects (Klonek *et al.*, 2014), during appraisal interviews (Campbell, 2005), during facilitation of team meetings (Klonek *et al.*, in press), or for career coachings (Passmore, 2007; Stoltz and Young, 2013). Besides theoretical arguments (e.g. Klonek and Kauffeld, 2012) that MI has added value outside the realm of helping professions, no study so far has evaluated its merit in higher education for the professional development of engineers. As engineering students are often insufficiently prepared for the workforce due to communication inadequacies (Katz, 1993), this study hopes to illustrate that MI has the potential to enhance communication skills of engineering students.

Elements of MI skill acquisition. The training program for the acquisition of MI is often summarized under the acronym OARS and EARS (Miller and Moyers, 2006). Open-ended questions/elaborating, affirmations, reflective listening, and summaries. The acronym conveys the idea that MI verbal skills are like the OARS of a skiff that trainees use as dynamic micro-tools within verbal interactions (cf. Figure 1).

The OARS of the skiff (i.e. the basic communication skills) are supposed to guide the trainee effectively through the river (i.e. interaction) in a person-centered fashion. The river represents the dynamic interactions with a conversational partner. The river may also contain parts that impede progress, for example, a rock (i.e. resistance). In order "to roll with resistance" (one of the four principles of MI), the trainee needs to ask the right questions and listen effectively. Open-ended questions may evoke self-motivational statements of the client and help the trainee to move forward, reflections and summaries help to understand these motivations in an empathic way, and affirmations serve to build rapport with the conversational partner.

Whereas these person-centered techniques are one part of MI skill acquisition, trainees also need to replace a directive-confrontational communication style with more autonomy-supportive behaviors (e.g. affirmations, support). The list below summaries the communication skills that are specific for MI. In the following section, we will further relate why MI skills are of particular significance within the higher education of engineering students.

Communication skills covered in the MI training

(1) Questions:

- Open question ("What is an advantage?").
- Closed question ("Do you think this is an advantage?").

(2) Listening skills:

- Simple reflection: a simple repetition, rephrase, or paraphrase of a previous statement ("I don't want to talk about this" – "You do not want to talk about this").
- Complex reflection: reflects a previous statement but adds substantial meaning to what the conversational partner has said ("I don't want to talk about this" – "Talking about this subject makes you feel uneasy").

(3) MI consistent (motivating behaviors):

- Advise with permission ("May I suggest something?"), affirm ("You have made good progress."), emphasize control ("This is your responsibility"), reframe (Changing the valence of a statement), support ("I understand that this is difficult").

(4) MI inconsistent (directive-confrontational behaviors):

- Advise without permission ("You should try […]"), confrontation (arguing, correcting, blaming, persuading, criticizing), direct (order, command or direction), raise concern (pointing out possible problems), warn (implying negative consequences).

Listening skills. Listening skills are usually differentiated into passive listening skills ("nodding the head and showing attention non-verbally," Jones, 2011) and active listening skills. Active listening is a form of empathic back-channeling by means of paraphrases and verbal repetitions of what the conversational partner has just said

Figure 1.
The metaphoric significance of OARS as micro-tools to guide through a dynamic interaction (i.e. river) with a conversational partner

(Rogers, 1951; Gordon, 1977). Rogers (1951) developed this technique (and termed it reflective listening) in his person-centered counseling approach as a form of verbal mirroring. Gordon (1977) labeled this behavior active listening and introduced it to business contexts (Rautalinko and Lisper, 2004). Whereas listening skills are important across a variety of professional settings, such as sales skills (Comer and Drollinger, 1999), crisis counseling (Mishara and Daigle, 1997), and management tasks (Gordon, 1977), it also has particular relevance in the work environment of engineers (Darling and Dannels, 2003). Jung *et al.* (2012; Jung 2011) investigated listening behavior in software engineering teams that developed software codes. The authors reported positive correlations of reflective listening behavior (i.e. back-channeling of information) with objective (performance of a software code, duration) and subjective performance measures (satisfaction with programming experience and the code). In other words, engineering teams who actively tried understand their peers (by reflecting and back-channeling information) during software development, showed higher satisfaction with the overall programming experience and developed better software programs. These results indicate that reflective listening behavior may positively affect engineering work as they develop a mutual understanding about technical problems and solutions.

Asking open-ended questions. While listening is important to convey mutual understanding, asking questions is crucial to gain information within work-related communication (Keyton *et al.*, 2013). Open-ended questions are a key element of person-centered communication (Rogers, 1951) and can have particular importance in professions that involve client communication (Brown *et al.*, 2010; Daff, 2012; Darling and Dannels, 2003). If clients have little technical knowledge, it is even more important to address knowledge gaps by asking open-ended questions. Otherwise, engineers may use technical language in costumer relations – without being aware that these clients do not follow their explanations. Therefore, engineering students should learn to formulate open-ended questions as a client-centered method of communication.

Reduction of directive-confrontational behavior. Directive-confrontational behaviors have been shown to harm effective conversations (Klonek *et al.*, 2014). This observation is substantiated by the study from Jung *et al.* (2012) in which the authors reported that behaviors such as condescension, domineering, or contempt were negatively related to subjective and objective performance measures of engineering teams. At the same time, studies in the field of education have shown that autonomy-supportive behaviors and verbal affirmations are particularly important for increasing intrinsic motivation, engagement, and well-being (Deci and Ryan, 1985; Noels *et al.*, 1999; Reeve, 2006, 2009; Reeve *et al.*, 1999, 2004). Overall, motivating other team members is an important task in an engineer's work environment, particularly when they work in teams (O'Connor *et al.*, 2008; Salas and Cannon-Bowers, 2000). In sustainability projects, for example, engineers also motivate employees to adopt energy-saving behaviors (Kauran, 2013; Visočnik, 2014). However, the task of motivating others to change behavioral routines is not easy if engineers have to deal with resistance to change from their conversational partners (Klonek *et al.*, 2014).

In sum, skill acquisition in MI seems to have added value for the engineering professions – it teaches specific verbal behaviors that help to motivate the conversational partner (Miller and Rollnick, 2013). Engineering students should be sensitized for set of verbal skills. Specifically, these verbal skills are to support their conversational partners' autonomy (i.e. emphasize control), to evoke ideas instead of providing their own solutions for a problem (e.g. asking permission before giving

advice), to appreciate past efforts (i.e. affirm), and to show support toward their conversational partner if he/she struggles with motivation (i.e. support).

In contrast, controlling-authoritarian behaviors (e.g. confrontation/arguing; directions/imperatives; unsolicited advice) are supposed to harm the intrinsic motivation of conversational partners (Miller and Rollnick, 2013). Gordon (1977) has termed this class of behaviors communication roadblocks because they tend to constrain personal freedom and arouse reactance (Brehm and Brehm, 1981). Professionals who are in charge of educating others (e.g. teachers) are very likely to show these communication behaviors (Reeve, 2009). There are several reasons that make the occurrence of these behaviors likely, for instance, if individuals occupy a powerful role or are responsible for the behavioral outcome of another person (for an overview, see Reeve, 2009). Within their professions, engineers are very likely to work in a leading position and are often accountable and/or responsible for the work of other people. Since MI training aim to reduce a directive-confrontational communication behavior, we believe MI has particular benefit for the employability of participating engineering students.

Assessment of verbal communication behaviors

Communication skills in MI are directly related to observable verbal behavior (Miller and Moyers, 2006). This does two things: it allows for the assessment of whether communication training in MI actually affects trainees communication skills and it provides quality assurance (Miller and Mount, 2001). Observational measures are not susceptible to response shifts or social desirability. Furthermore, observations also allow assessing verbal responses of the conversational partner. Previous studies in clinical settings have successfully used this in-session speech to classify the conversational partners' motivation to change (e.g. Amrhein *et al.*, 2003; Lombardi *et al.*, 2014). In a recent review by Madson *et al.* (2009), the authors concluded that future studies in MI need to evaluate the trainings' outcomes of the respective conversational partners. In order to close this research gap, we will test whether newly acquired verbal skills of MI trainees also positively affect the motivational responses of their conversational partners.

We have presented how verbal skill acquisitions in MI are favorable toward the employability of engineering students. We now present data from a pilot study in which we assessed how the MI training affected observable verbal skills of engineering trainees. Furthermore, we also assessed verbal behavior of their conversational partners, that is, their motivation to change. Our general hypotheses are that training positively affects both trainees' verbal behavior and their respective conversational partners' motivation. More specifically, we expect that: first, trainees' use of open-ended questions will increase after the training; second, training will positively affect trainees' reflective listening skills; and third, trainees' use of directive-authoritarian verbal behavior (i.e. advise without permission, confrontation, direct, raising concern, warn) will decrease after training. Finally, we assume that, fourth, conversational partners who talk to a trained participant will show higher motivation to change compared to those conversational partners who talk to a participant before the training. We applied a multi-measure approach using self-reports, performance, and observational measures.

Method

Sample

As part of their professional qualification development, 25 students took part in the MI training. They were 24-years-old on average (SD = 3.05, Min = 19, Max = 32). Nearly

two-thirds of participants were male (64 percent), and all studied an engineering subject (mostly mechanical, construction, or industrial engineering). About 12 percent ($n = 3$) had already finished a vocational training. Trainees were randomly allocated to one of two identical trainings in MI offered by the first author within a temporal timeframe of two weeks.

Design

We used a repeated measurement design in order to evaluate the effects of the MI training. We assessed participants' communication skills in MI with multiple measures (cf. Table I). First, we coded verbal behaviors in recorded interactions using an MI observational coding scheme. Second, we assessed their self-reported familiarity and competence in MI. Third, we used a standardized performance test to assess reflective listening (Helpful Response Questionnaire (HRQ)), that is, we used an additional measure to operationalize the construct of reflective listening. All measures were assessed before the training as well as two weeks after the training. Self-reported measures, demographic variables, and the HRQ were assessed via an online questionnaire. Finally, we transcribed parts of one pre- and post-conversation of one participant in order to illustrate the acquisition of MI skills in a more qualitative fashion (Appendix).

Procedure

Trainees were informed that the training outcomes would be evaluated for research purposes. In order to obtain pre-training measurement of trainees' communication skills, we used a procedure that has been applied in previous studies to assess person-centered communication skills, or skills in MI, before and after training (e.g. Brown *et al.*, 2010; Miller and Mount, 2001). Trainees were asked to provide a recorded sample of their communication behavior prior to training. Their task was to focus on a behavior that their conversational partner should change, but who had little readiness for it (for details of this procedure, see Klonek *et al.*, 2014). Each client signed a separate consent for the session to be audio taped, but did not participate in the study in any other way.

Two weeks after the training, participants were given the possibility to have a second conversation with a new and unacquainted conversational partner. The purpose of the second conversation was to motivate the conversational partner to show more sustainable behavior (e.g. saving energy, heating). Informed consent to record the interaction was given by all participants.

Pre-training	Two weeks post training
Observational measures	
Recorded dyadic conversation coded with the MI skill code	Recorded dyadic conversation coded with the MI skill code
Performance measures	
Helpful response questionnaire	Helpful response questionnaire
Self-reported measures	
Familiarity with MI	Familiarity with MI
Competency in MI	Competency in MI

Table I.
Assessment of MI communication skills

Training

The contents of the training followed the principles of MI (Miller and Rollnick, 2013) and were designed according to the eight stages of learning MI (Miller and Moyers, 2006). During the first day, participants learned person-centered communication skills (e.g. reflective listening, asking an open-ended instead of closed questions when gathering information from their conversational partners) and how to handle resistance in conversations. During the second day, participants were taught how to develop motivation to change, to support self-efficacy. They had the possibility to foster skills in role-playing and other exercises with their peers. Exercises originated from the Motivational Interviewing Network of Trainers (2008) manual. The MI skill training lasted two days in total (17 hours).

Assessment of communication skills in MI

Observational measures. All recordings before and after the training were coded by two external observers using the German version of the MI skill code (MISC; Klonek *et al.*, 2014; Miller *et al.*, 2008) implemented in INTERACT software (cf. Klonek *et al.*, 2014; Mangold, 2010). A sample transcript of a coded conversation before and after training is provided in Appendix. Both coders were kept blind about MI training conditions and did not know which recordings were used for estimating observer reliability. Observers did not recognize that recordings were part of a pre- /post-training design. In the first coding pass, observers listened to the entire tape. In the second coding pass, observers coded specific behavioral categories that are characteristic of MI. We used 80 percent ($n = 20$) of all conversations to estimate observer reliability. We calculated intra-class correlations (ICC) as a statistical index that is commonly used to estimate reliability for behavioral categories in MI (Moyers *et al.*, 2003). The ICC adjusts for chance agreement and systematic differences between observers (Fleiss and Shrout, 1978; McGraw and Wong, 1996) – it is therefore a more conservative estimate compared to the Pearson product moment correlation. All behavioral counts that were used for the following analyses had excellent reliabilities (ICC > 0.75, cf. Cicchetti, 1994).

We summarized trainees' communication behavior and the responses of their conversational partner using indices that are supposed to be crucial training outcomes (Miller and Mount, 2001). All code frequencies were standardized for a ten-minute interval (i.e. rate; cf. Bakeman and Quera, 2011) to compare conversations with different lengths:

- Percent of open-ended questions is the relative amount of open-ended questions to all questions (i.e. open-ended questions/(open-ended+closed-ended questions)). The training stressed the use of open-ended questions as a person-centered communication skill.
- Listening skills were assessed by counting the amount of simple and complex reflections. Reflective listening was also part of the person-centered communication taught in the training.
- Motivational behaviors (MI consistent) are behaviors that are considered to evoke intrinsic motivation (affirmation, emphasizing client control, reframe, and support; Miller *et al.*, 2008).
- Communication behaviors inconsistent with MI are behaviors that are considered to constrain participants' autonomy and decrease intrinsic motivation (e.g. giving advice without permission, confronting, directing, and warning).

Motivation of conversational partners. Motivation of the conversational partners (clients) was assessed by coding their verbal responses (Klonek *et al.*, 2014; Miller *et al.*, 2008). Utterances with a positive inclination toward change are called change talk, whereas utterances that have a negative inclination toward change are called sustain talk. As a single index of client response, we computed the percentage of change talk (i.e. change talk/(change talk+sustain talk)).

Self-reported measures

MI familiarity and proficiency. Two items were used to assess MI familiarity ("I am familiar with the communication style of MI") and proficiency ("I am proficient in using the communication style of MI"; cf. Byrne *et al.*, 2006; German version from Rahner, 2007). The items were preceded by the following explanation: "MI is a directive and person-centered communication method that was developed by William R. Miller and Stephen Rollnick." Respondents rated each item on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Performance measure

HRQ. Reflective listening skills were assessed with a German version of the HRQ from Rahner (2007; original version from Miller *et al.*, 1991). As reflective listening constitutes a central skill in MI, this instrument is frequently used in MI skill assessment (Madson *et al.*, 2009; Young and Hagedorn, 2012). The HRQ is a multiple-choice measure that asks participants "what would you say next?" in response to a set of ten hypothetical statements (e.g. "My colleagues systematically exclude me […] No one approaches me […]"). Each statement offers four standardized responses: one reflective listening statement (e.g. "This must be an oppressive atmosphere. You feel as if you were invisible to others") and three distractors (e.g. "Maybe you should take the first step and approach them"). The stimuli statements in the instrument cover a wide range of social situations (e.g. interpersonal conflicts, university problems, work-related problems, etc.). Trainees can choose only one of the four alternative responses. Correct answers (i.e. reflective listening) are added up, and final scores can vary between zero and ten: a low score indicates that the trainee never responded with reflective listening, whereas a high score indicates that the trainees dominantly chose reflective listening as a response.

Results

Observational measures

We calculated paired *t*-tests and standardized mean-difference effect sizes to compare effects of the MI training on repeated measures. Table II presents changes of summary indices of face-to-face communication skills before and after MI training. Trainees asked significantly more open-ended questions after the training. Their relative amount of open-ended questions actually increased from 28 percent to over 50 percent ($t(23) = -5.75$, $d = -2.3$, $p < 0.01$). Furthermore, trainees showed a large increase of simple ($M_{t1} = 1.33$, $M_{t2} = 4.38$; $t(23) = -5.56$, $d = -2.2$, $p < 0.01$) and complex reflections after the MI training ($M_{t1} = 2.92$, $M_{t2} = 6.08$; $t(23) = -4.64$, $d = -1.9$, $p < 0.01$) – both indicators of listening skills. The amount of MI inconsistent behaviors significantly decreased from about six statements within ten minutes before training to nearly zero statements ($M_{t2} = 0.13$) after the training ($t(23) = 7.15$, $d = 2.9$, $p < 0.01$). It is noteworthy that after training, participants used at least 50 percent open-ended questions and showed a rate of ten reflective listening statements (within a ten-minute

	Reliability ICC	Pre-post Mean (pre)	Mean (post)	*t*-value
Trainees' communication skills				
Questions				
Open question (o)	0.99**	2.04	6.63	$t(23) = -6.71$**
Closed question (c)	0.97**	5.75	5.71	$t(23) = 0.04$
% Open questions	0.96**	28%	56%	$t(23) = -5.75$**
Listening skills				
Simple reflection (e)	0.94**	1.33	4.38	$t(23) = -5.56$**
Complex reflection (k)	0.93**	2.92	6.08	$t(23) = -4.64$**
MI consistent				
(Advise with permission, affirm, emphasize control, reframe, support)	0.90**	2.71	3.08	$t(23) = -0.52$
MI inconsistent				
(Advise without permission, confrontation, direct, raise concern, warn)	0.90**	5.96	0.13	$t(23) = 7.15$**
Conversational partners' response				
% change talk	0.84**	47%	60%	$t(23) = -4.65$**

Notes: Observational data of one participant before training was not available. **$p < 0.01$

Table II. Comparison of trainees' and conversational partners' verbal behaviors before and after the MI training

interval). These values are in line with proficiency-level benchmarks that have been proposed for good levels of MI (Opheim *et al.*, 2009).

Motivation to change. Change talk of trainees' respective conversational partners were, as expected, significantly higher in conversations after the training ($M_{t2} = 60$ percent) in comparison to conversations before the training ($M_{t1} = 47$ percent, $t(23) = -4.65$, $d = -1.9$, $p < 0.01$).

Self-reported measures

Trainees showed increased familiarity with MI ($M_{t0} = 1.08$, $M_{t1} = 4.04$, $t(23) = -18.74$, $d = -7.5$, $p < 0.01$) and also indicated increased proficiency in MI after the training ($M_{t0} = 1.12$, $M_{t1} = 2.76$, $t(23) = -11.74$, $d = -4.7$, $p < 0.01$).

Performance measures

The increase in reflective listening skills measured by the standardized HRQ was also significant ($t(23) = -11.74$, $d = -4.7$, $p < 0.01$). Before the training, participants chose 2.4 reflective listening statements, on average, and after training, this measure increased to 7.1.

Overall, the performance (HRQ) and observational measures (i.e. from recorded interactions) indicated large increases in MI skill acquisition. Participants most notably showed a large increase in reflective listening.

Discussion

The aim of the present study was to evaluate the effects of communication training in MI on trainees' verbal communication skills. Repeated observations of participants' verbal behavior before and after the training showed training effects on trainees' communication skills in line with our hypotheses. Trainees showed increased rates of reflective listening, which was indicated by two different measures: The standardized performance measure (HRQ) and trainees' actual verbal behavior within face-to-face recorded conversations showed increases in reflective listening. Trainees asked significantly more open-ended questions, therewith adhering to techniques of MI.

In addition, they significantly reduced MI inconsistent behaviors (confrontations, arguing), which are considered to harm intrinsic motivation (Reeve, 2009). Trainees reported higher familiarity and proficiency in MI after the training. More importantly, conversational partners post training showed significantly more change talk, thereby expressing more motivation to change in comparison to those conversational partners before training. Overall, our results suggest that engineering students acquired new skills that are characteristic of MI and were better capable of motivating their conversational partners.

Theoretical implications

Our findings have important theoretical implications. Previous training studies in MI have been exclusively applied to individuals who work in the helping professions (cf. Madson *et al.*, 2009). Recently, scholars have asked whether MI also works in settings with non-addicted clients (Young *et al.*, 2013). We further discussed how MI has added value within the higher education of engineering studies. Previously, scholars have argued that effective verbal skill acquisition is highly important for engineers who enter the workforce (Darling and Dannels, 2003; Dannels *et al.*, 2003; Hunt and Cusella, 1983), and earlier observational studies have shown that reflective listening in software engineering teams is positively related to subjective and objective team performance measures (Jung *et al.*, 2012). This study has demonstrated that skills in MI can be taught successfully to participants with a technical background. Overall, MI covers skills that enhance graduate employability of engineers. The training helped trainees to use relatively more verbal behaviors that were consistent with MI, and additionally gave them a means to address the motivation of their conversational partner. The present study has shown how communication across the curriculum of engineering students can be enriched with a relatively short training in MI.

Furthermore, we observed trainees verbal behavior within a real conversation of change. Whereas there are many training studies of MI in the helping professions, this is the first study to provide strong behavioral effects on MI for a population with a technical background. As nurses, therapists, or social workers have a stronger educational background in communication, our study also indicates that the technical background of our participants did not impede skill acquisition in MI.

Practical implications

Overall, this study suggests that MI provides added value for the education of engineers who enter the workforce (e.g. Darling and Dannels, 2003). Engineers are often highly specialized in a specific technical field, which makes it particularly tempting for them to step into an expert role and to domineer over their conversational partner (Jung *et al.*, 2012). Well-intended engineering solutions may be undermined if the perspectives of those who are affected by it are not taken into consideration (Campbell and Campbell, 2013).

During the training, participants expressed that using MI made them realize how frequently they used the roadblocks to communication (Gordon, 1977), that is, argued for a solution that they had in mind instead of first actively listening to their conversational partners. Whereas the explicit expression of their conversational partners' statements (i.e. a simple or complex reflection) was odd to them at first, trainees felt more comfortable using reflective listening during the course of the training. This observation underlines that individuals with a technical background are used in arguing for their own solutions instead of taking a client perspective (cf. Appendix). Previous studies (Jung *et al.*, 2012) have indicated that reflective listening (back-channeling of information) is also advantageous for engineering teams who develop software programs.

Engineers also often have to work on projects that involve customer relations and with audiences that have only little technical knowledge (Darling and Dannels, 2003). As a result, engineers might find it particularly beneficial when applying person-centered communication. Asking more open-ended questions and using reflective listening can enhance the mutual understanding of a technical solution. In other words, individuals can rephrase their understanding of a technical problem, which in turn allows the non-technical client to check whether they have been understood correctly.

This study implies that MI skill training should not be restricted to the helping professions. We have offered our training as a pilot project for a small sample of engineering students. Policy makers (e.g. Engineering Council or HE Faculty) should consider offering MI as a professional development program within the field of engineering. Whereas our small-scale study does not justify offering MI training as a compulsory requirement, we would recommend offering these trainings as an optional work-based learning (WBL) opportunity. In fact, if more higher education faculties would offer MI training for engineering students, this would allow for the investigation of the benefits of MI on a larger scale.

Even though, this research covers only data from one German educational facility, the transfer of MI trainings appears to be transferable to other international institutions. In particular, the training material used in the present study originated from the MINT (2008) manual. The MINT is an international organization of MI trainers with the central interest to improve the quality and effectiveness of interactions using MI worldwide, representing 35 countries and more than 20 different languages, and providing training in numerous cultures and languages. Moreover, a recent meta-analysis about MI in the helping professions revealed that MI has greater impact with conversational partners from minority ethnic groups – especially those groups that "have experienced social rejection and societal pressure" (Lundahl *et al.*, 2010, p. 153). These clients may benefit from the humanistic approach conveyed in MI trainings. We conjecture that engineers who work in humanitarian projects in the developing countries, for example, "Engineers without Borders – International" (Lucena and Schneider, 2008) may thusly particularly benefit from the humanistic approach in MI within their intercultural work.

Finally, MI covers a range of practical communication skills and is therefore well suited for WBL programs. In WBL programs, universities cooperate with work organizations to create new learning opportunities in the workplace (Boud and Solomon, 2001). Verbal skills that are acquired by learners in MI higher education can be directly transferred to situations in the learners' workplace. As MI aims to change the verbal behavior of learners, engineers who take part in WBL programs are given the possibility to apply their skills within many customer- or team-related work situations. Furthermore, audio-recordings of these work-related interactions can be integrated into WBL programs to provide feedback to learners. Recordings can be used to reiterate verbal behavior of learners and allow them to verify whether they might have shown controlling-authoritarian behavior. We have presented a coding scheme (the MISC) that can be used for quality assurance. Furthermore, recorded interactions can also reiterate how conversational partners respond to certain behaviors. As tape recordings can be replayed again, it allows learners to become aware of their own communication skills, whereas in debriefing sessions, they can reflect on alternative means for dealing with similar situations.

Limitations and implications for future research

One limitation of this study is that training outcomes were measured only two weeks after training. We do not know whether the verbal changes can be maintained over a longer

period. Future studies should use more delayed follow-up measurements and investigate if MI skills can be maintained over longer time periods. Second, our results are restricted to a small sample size. Yet, the large increases in communication skills – measured by observational and performance measures – indicate that the positive effects of the training could even be replicated with smaller samples. Finally, the results of this study only showed that MI enhanced communication skills of participants. While improved communication is important for the employability of engineers, MI is not necessarily a panacea for the higher education of engineers. The higher education of engineers still needs to cover technical knowledge and analytical thinking (Martin *et al.*, 2005). Based on the results of this study, we recommend that future research needs to further explore the effectiveness of MI in the field of engineering. Future studies should investigate effects of MI trainings using larger samples in order to test how input variables (e.g. gender, personality measures, technical knowledge) or training design variables (duration, amount of feedback, role-playing) influence the acquisition of MI skills. In addition, future studies need to evaluate how engineers with MI training show better job-related performances. Therefore, MI training could also be implemented with workforce samples, that is, engineers who work with costumers on project-related tasks (e.g. implementation of sustainability programs in non-residential buildings; cf. Kauran, 2013).

Conclusion

The present study showed how a short training in MI positively affected observable verbal skills of engineering students. Using a pre/post design, we showed that trainees gained skills in asking open-ended questions and using reflective listening, while their directive-confrontational behaviors nearly diminished. This is the first study that tested the effects of MI training for a technical population. In sum, we showed how a method that originates from clinical psychology can enhance the curriculum of engineering students and help them to gain skills for their professional lives.

References

Amrhein, P.C., Miller, W.R., Yahne, C.E., Palmer, M. and Fulcher, L. (2003), "Client commitment language during motivational interviewing predicts drug use outcomes", *Journal of Consulting and Clinical Psychology*, Vol. 71 No. 5, pp. 862-878.

Bakeman, R. and Quera, V. (2011), *Sequential Analysis and Observational Methods for the Behavioral Sciences*, Cambridge University Press, Cambridge, NY.

Boud, D. and Solomon, N. (Eds) (2001), *Work-Based Learning: A New Higher Education?*, The Society for Research into Higher Education & Open University Press, Buckingham.

Brehm, S.S. and Brehm, J.W. (1981), *Psychological Reactance: A Theory of Freedom and Control*, Academic, New York, NY.

Brown, R.F., Bylund, C.L., Gueguen, J.A., Diamond, C., Eddington, J. and Kissane, D. (2010), "Developing patient-centered communication skills training for oncologists: describing the content and efficacy of training", *Communication Education*, Vol. 59 No. 3, pp. 235-248.

Byrne, A., Watson, R., Butler, C. and Accoroni, A. (2006), "Increasing the confidence of nursing staff to address the sexual health needs of people living with HIV: the use of motivational interviewing", *AIDS Care*, Vol. 18 No. 5, pp. 501-504.

Campbell, D. (2005), "Motivational interviewing techniques in employee evaluation. A social work practitioner self-assessment of the use of motivational interviewing techniques in employee evaluation", University of Iowa, Lowa City, available at: http://fog.its.uiowa.edu/~c042252/text/281%20Papers/Campbell–Self%20Evaluation.doc (accessed April 23, 2015).

Campbell, D.E. and Campbell, J.E. (2013), "Engineering sustainability", in Huffman, A.H. and Klein, S.R. (Eds), *Green Organizations: Driving Change with IO Psychology*, Routledge, New York, NY, pp. 186-207.

Cicchetti, D.V. (1994), "Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology", *Psychological Assessment*, Vol. 6 No. 4, pp. 284-290.

Comer, L.B. and Drollinger, T. (1999), "Active empathetic listening and selling success: a conceptual framework", *Journal of Personal Selling & Sales Management*, Vol. 19 No. 1, pp. 15-29.

Daff, L. (2012), "Lessons from successes in medical communication training and their applications to accounting education", *Accounting Education*, Vol. 21 No. 4, pp. 385-405.

Dannels, D.P., Anson, C.M., Bullard, L. and Peretti, S. (2003), "Challenges in learning communication skills in chemical engineering", *Communication Education*, Vol. 52 No. 1, pp. 50-56.

Darling, A.L. and Dannels, D.P. (2003), "Practicing engineers talk about the importance of talk: a report on the role of oral communication in the workplace", *Communication Education*, Vol. 52 No. 1, pp. 1-16.

Deci, E.L. and Ryan, R.M. (1985), *Intrinsic Motivation and Self-Determination in Human Behavior*, Plenum, New York, NY.

Fleiss, J.L. and Shrout, P.E. (1978), "Approximate interval estimation for a certain intraclass correlation coefficient", *Psychometrika*, Vol. 43 No. 2, pp. 259-262.

Ford, D.F. and Teare, S.W. (2006), "The right answer is communication when capstone engineering courses drive the questions", *Journal of STEM Education*, Vol. 7 Nos 3-4, pp. 5-12.

Gordon, T. (1977), *LET: Leader Effectiveness Training*, Wyden, New York, NY.

Hunt, G.T. and Cusella, L.P. (1983), "A field study of listening needs in organizations", *Communication Education*, Vol. 32 No. 4, pp. 393-401.

Jones, S.M. (2011), "Supportive listening", *The International Journal of Listening*, Vol. 25 Nos 1-2, pp. 85-103.

Jung, M., Chong, J. and Leifer, L. (2012), "Group hedonic balance and pair programming performance: affective interaction dynamics as indicators of performance", *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, *May*, pp. 829-838.

Jung, M.F. (2011), "Engineering team performance and emotion: affective interaction dynamics as indicators of design team performance", unpublished dissertation, Stanford University, Stanford, CA.

Katz, S.M. (1993), "The entry-level engineer: problems in transition from student to professional", *Journal of Engineering Education*, Vol. 82 No. 3, pp. 171-174.

Kauran, K. (2013), "Motivation of energy-users is crucial!", *Re-Co Newsletter*, No. 2, p. 5, available at: www.re-co.eu/sites/default/files/files/Re_Co_Newsletter_No2.pdf (accessed April 23, 2015).

Keyton, J., Caputo, J.M., Ford, E.A., Fu, R., Leibowitz, S.A., Liu, T., Polasik, S. S., Gosh, P. and Wu, C. (2013), "Investigating verbal workplace communication behaviors", *Journal of Business Communication*, Vol. 50 No. 2, pp. 152-169.

Klonek, F.E. and Kauffeld, S. (2012), "'*Muss, kann … oder will ich was verändern? Welche Chancen bietet die Motivierende Gesprächsführung in Organisationen*' ['Do I need to, am I able to … and do I even want to change? Which does Motivational Interviewing potentially offer for organizations']", *Wirtschaftspsychologie*, Vol. 4 No. 4, pp. 58-71, available at: www.tu-braunschweig.de/Medien-DB/aos/hinterlegte-pdfs/klonek___kauffeld_2012_muss_kann_oder_will_ich_was_veraendern.pdf (accessed April 23, 2015).

Klonek, F.E., Lehmann-Willenbrock, N. and Kauffeld, S. (2014), "The dynamics of resistance to change: a sequential analysis of change agents in action", *Journal of Change Management*, Vol. 44 No. 3, pp. 334-360.

Klonek, F.E., Paulsen, H. and Kauffeld, S. (in press), "They meet, they talk … but nothing changes: meetings as a focal context for studying change processes", in Allen, J.A., Lehmann-Willenbrock, N. and Rogelberg, S.G. (Eds), *The Cambridge Handbook of Meeting Science*, Cambridge University Press, New York, NY.

Lombardi, D.R., Button, M.L. and Westra, H.A. (2014), "Measuring motivation: change talk and counter-change talk in cognitive behavioral therapy for generalized anxiety", *Cognitive Behaviour Therapy*, Vol. 43 No. 1, pp. 12-21.

Lucena, J. and Schneider, J. (2008), "Engineers, development, and engineering education: from national to sustainable community development", *European Journal of Engineering Education*, Vol. 33 No. 1, pp. 247-257.

Lundahl, B.W., Kunz, C., Brownell, C., Tollefson, D. and Burke, B.L. (2010), "A meta-analysis of motivational interviewing: twenty-five years of empirical studies", *Research on Social Work Practice*, Vol. 20 No. 2, pp. 137–160.

McEwen, T. (1997), "Communication training in corporate settings: lessons and opportunities for the academe", *American Journal of Business*, Vol. 12 No. 1, pp. 49-58.

McGraw, K.O. and Wong, S.P. (1996), "Forming inferences about some intraclass correlation coefficients", *Psychological Methods*, Vol. 1 No. 1, pp. 30-46.

Madson, M.B., Loignon, A.C. and Lane, C. (2009), "Training in motivational interviewing: a systematic review", *Journal of Substance Abuse Treatment*, Vol. 36 No. 1, pp. 101-109.

Mangold (2010), *INTERACT 9 Quick Start Manual: Mangold International GmbH*, Arnstorf.

Martin, R., Maytham, B., Case, J., and Fraser, D. (2005), "Engineering graduates' perceptions of how well they were prepared for work in industry", *European Journal of Engineering Education*, Vol. 30 No. 2, pp. 167-180.

Miller, W.R. and Mount, K.A. (2001), "A small study of training in motivational interviewing: does one workshop change clinician and client behavior?", *Behavioural and Cognitive Psychotherapy*, Vol. 29 No. 4, pp. 457-471.

Miller, W.R. and Moyers, T.B. (2006), "Eight stages in learning motivational interviewing", *Journal of Teaching in the Addictions*, Vol. 5 No. 1, pp. 3-17.

Miller, W.R. and Rollnick, S. (2013), *Motivational Interviewing: Helping People Change*, 3rd ed., Guilford Press, New York, NY.

Miller, W.R., Hedrick, K.E. and Orlofsky, D.R. (1991), "The helpful responses questionnaire: a procedure for measuring therapeutic empathy", *Journal of Clinical Psychology*, Vol. 47 No. 3, pp. 444-448.

Miller, W.R., Moyers, T.B., Ernst, D. and Amrhein, P. (2008), "Manual for the motivational interviewing skill code (MISC): Version 2.1", available at: http://casaa.unm.edu/download/misc.pdf (accessed April 23, 2015).

Mishara, B.L. and Daigle, M.S. (1997), "Effects of different telephone intervention styles with suicidal callers at two suicide prevention centers: an empirical investigation", *American Journal of Community Psychology*, Vol. 25 No. 6, pp. 861-885.

Morreale, S.P. and Pearson, J.C. (2008), "Why communication education is important: the centrality of the discipline in the 21st century", *Communication Education*, Vol. 57 No. 2, pp. 224-240.

Morreale, S.P., Osborn, M.M. and Pearson, J.C. (2000), "Why communication is important: a rationale for the centrality of the study of communication", *Journal of the Association for Communication Administration*, Vol. 29 No. 1, pp. 1-25.

Motivational Interviewing Network of Trainers (MINT) (2008), "Motivational interviewing: training for new trainers", *Resources for Trainers*, available at: www.motivational interview.org/Documents/TNT_Manual_Nov_08.pdf

Moyers, T., Martin, T., Catley, D., Harris, K.J. and Ahluwalia, J.S. (2003), "Assessing the integrity of motivational interviewing interventions: reliability of the motivational interviewing skills code", *Behavioural and Cognitive Psychotherapy*, Vol. 31 No. 2, pp. 177-184.

Noels, K.A., Clément, R. and Pelletier, L.G. (1999), "Perceptions of teachers' communicative style and students' intrinsic and extrinsic motivation", *The Modern Language Journal*, Vol. 83 No. 1, pp. 23-34.

O'Connor, P., O'Dea, A., Flin, R. and Belton, S. (2008), "Identifying the team skills required by nuclear power plant operations personnel", *International Journal of Industrial Ergonomics*, Vol. 38 No. 11, pp. 1028-1037.

Opheim, A., Andreasson, S., Eklund, A.B. and Prescott, P. (2009), "The effects of training medical students in motivational interviewing", *Health Education Journal*, Vol. 68 No. 3, pp. 170-178.

Passmore, J. (2007), "Addressing deficit performance through coaching – using motivational interviewing for performance improvement at work", *International Coaching Psychology Review*, Vol. 2 No. 3, pp. 265-275.

Rahner, T. (2007), "Motivational Interviewing in der ambulanten Suchthilfe – Abschätzung des Fortbildungsbedarfs in NRW" ("Motivational Interviewiewing in the ambulant addiction help – estimation of the amount of training"), unpublished Master's Thesis, Katholische Fachhochschule NW, Köln.

Rautalinko, E. and Lisper, H.O. (2004), "Effects of training reflective listening in a corporate setting", *Journal of Business and Psychology*, Vol. 18 No. 3, pp. 281-299.

Reeve, J. (2006), "Teachers as facilitators: what autonomy-supportive teachers do and why their students benefit", *The Elementary School Journal*, Vol. 106 No. 3, pp. 225-236.

Reeve, J. (2009), "Why teachers adopt a controlling motivating style toward students and how they can become more autonomy supportive", *Educational Psychologist*, Vol. 44 No. 3, pp. 159-175.

Reeve, J., Bolt, E. and Cai, Y. (1999), "Autonomy-supportive teachers: how they teach and motivate students", *Journal of Educational Psychology*, Vol. 91 No. 3, pp. 537-548.

Reeve, J., Jang, H., Carrell, D., Jeon, S. and Barch, J. (2004), "Enhancing students' engagement by increasing teachers' autonomy support", *Motivation and Emotion*, Vol. 28 No. 2, pp. 147-169.

Rogers, C.R. (1951), *Client-Centered Therapy*, Riverside Press, Cambridge, MA.

Salas, E. and Cannon-Bowers, J.A. (2000), "The anatomy of team training", in Tobias, L. and Fletcher, D. (Eds), *Training and Retraining: A Handbook for Business, Industry, Government, and the Military*, MacMillan, New York, NY, pp. 312-335.

Seat, E., Parsons, J.R. and Poppen, W.A. (2001), "Enabling engineering performance skills: a program to teach communication, leadership, and teamwork", *Journal of Engineering Education*, Vol. 90 No. 1, pp. 7-12.

Stoltz, K.B. and Young, T.L. (2013), "Applications of motivational interviewing in career counseling facilitating career transition", *Journal of Career Development*, Vol. 90 No. 4, pp. 329-346.

The Cline, S. (2005), "Soft skills make the difference in the workplace", *Colorado Springs Business Journal*, April 1, available at: http://csbj.com

Vest, D., Long, M. and Anderson, T. (1996), "Electrical engineers' perceptions of communication training and their recommendations for curricular change: results of a national survey", *IEEE Transactions on Professional Communication*, Vol. 39 No. 1, pp. 38-42.

Visočnik, B.P. (2014), "Turn off when not needed!", *Re-Co Newsletter*, No. 4, pp. 5-6, available at: www.re-co.eu/sites/default/files/files/Re-Co_Newsletter_No4.pdf (accessed April 23, 2015).

Young, T.L. and Hagedorn, W.B. (2012), "The effect of a brief training in motivational interviewing on trainee skill development", *Counselor Education and Supervision*, Vol 51 No. 2, pp. 82-97.

Young, T.L., Gutierrez, D. and Hagedorn, W.B. (2013), "Does motivational interviewing (MI) work with nonaddicted clients? A controlled study measuring the effects of a brief training in MI on client outcomes", *Journal of Counseling & Development*, Vol. 91 No. 3, pp. 313-320.

Further reading

Kurtz, S., Silverman, J. and Draper, J. (2005), *Teaching and Learning Communication Skills in Medicine*, Radcliffe Publishing, Oxford.

Maes, J.D., Weldy, T.G. and Icenogle, M.L. (1997), "A managerial perspective: oral communication competency is most important for business students in the workplace", *Journal of Business Communication*, Vol. 34 No. 1, pp. 67-80.

Miller, W.R. and Rollnick, S. (2002), *Motivational Interviewing: Preparing People for Change*, 2nd ed., Guilford Press, New York, NY.

Papa, M.J. and Graham, E.E. (1991), "The impact of diagnosing skill deficiencies and assessment-based communication training on managerial performance", *Communication Education*, Vol. 40 No. 4, pp. 368-384.

Sypher, B.D. and Zorn, T.E. Jr (1986), "Communication-related abilities and upward mobility: a longitudinal investigation", *Human Communication Research*, Vol. 12 No. 3, pp. 420-431.

Sypher, B.D., Bostrom, R.N. and Seibert, J.H. (1989), "Listening, communication abilities, and success at work", *Journal of Business Communication*, Vol. 26 No. 4, pp. 293-303.

Appendix. Sample transcript of dyadic pre- and post-training conversation. Transcripts have been edited to improve readability

In this example, the trainee uses confrontations ("If you studied more and showed more commitment, then you'd remember!") and arguments ("yes, but" – sentences) trying to push the conversational partner into change. However, this very moralizing and educative tone results in more sustain talk ("I still have a couple of semesters to go"; "So it can't be that important!") that express the conversational partner's resistance to change.

Speaker	Transcript	MISC code
Trainee	So what kind of goal did you set for yourself?! Are you even interested in pursuing a master's degree? Are you aware that you have to do well in your bachelor's degree if you want to get accepted into a master's program?	Closed Question
CP	But I'm in my second semester! I still have a couple of semesters to go …	Sustain Talk
	And then I can still, when I think it might be a close call, I can work even harder then	Sustain Talk
Trainee	Yes, but the problem is, you learn the basics now - you build on those! And if your basics aren't in place, you'll keep running into problems!	MI inconsistent (warn)
CP	But even now, I don't remember what the topics were in my first exams. So it can't be that important!	Sustain Talk
Trainee	But that's exactly what you're saying now. You don't remember. If you studied more and showed more commitment, then you'd remember!	MI inconsistent (confronation)
CP	But the courses are … not everything builds on one another. I'm taking different courses now in subjects that I've never taken before. So it's a new beginning every time	Sustain Talk
	So I'll always get another chance to do better	Sustain Talk
Trainee	Yes, but during your last two semesters, nothing has gotten better	MI inconsistent (confronation)
CP	But the grades are ALWAYS worse in the first couple of semesters	Sustain Talk

Note: CP, Conversational partner

Table AI. Pre-training conversation with target behavior "engagement in college"

Speaker	Transcript	MISC Code
Trainee	What advantages do you see if you showed more pro-environmental behavior?	Open Question
CP	As I said, the question is how the products are actually recycled. Whether it even makes sense, and if my effort to put plastic in the recycle bin will actually be effective!	Follow Neutral
	I guess it has rather no effect!	Sustain Talk
Trainee	Could you explain that to me a little bit more?	Closed Question
CP	If I actually did this, I would have to separate paper and plastic. That is really a huge effort!	Sustain Talk
Trainee	You want to say that you are too lazy	Complex Reflection
CP	That's correct (*laughs*)	Sustain Talk
Trainee	Okay (*laughs*). I think we can summarize this in the following way. One of the major disadvantages is that recycling would result in extra work for you	Simple Reflection
	How do you think this relates to sustainability?	Open Question
CP	Yes (laughs) – that behavior is obviously a bit problematic	Change Talk
	I want to say that – well, it is often in the media – that sustainable products preferably should be used. I mean – if we use them, we should also recycle them. I think that this makes sense as well	Change Talk
	It would pay out particularly with paper, I guess. I mean, there are many products that are based on recycled paper – toilet paper for instance. I do think that this is possible	Change Talk
	And of course – I start to have thoughts on this	Change Talk
	But as I said. Right now, I am not doing it!	Sustain Talk
Trainee	And could you imagine that this topic may become more important to you in the future?	Open Question
CP	Well. I would think that these products are cheaper – I mean if they are recycled, because the production is cheaper. I could imagine that this affects the costs of these products. As a user of these products, I will have higher costs if products are no longer recycled	Change Talk
Trainee	You just mentioned the unwrought goods – that they will get more expensive. What would be an extreme development, I mean, what is the worst case that could happen?	Open Question
CP	I think that – let us not focus so much on plastic and paper – in particular, electronic devices – those that need noble metal. For example, we all use cell phones and they can be recycled too. In this case, the unwrought goods will get more expensive because they are so rare. I think if we started to recycle this, we could create a real price difference for users. Preventing prices from becoming more expensive in the future, I think, with electronic device – it really makes sense!	Change Talk
Trainee	May I ask what you study?	Closed Question
CP	Biology	Follow Neutral
Trainee	Biology, okay. Then it seems to be an important subject for you	Complex Reflection
CP	Yes – definitely! (*laughs*)	Change Talk
Trainee	And how do you handle issues of sustainability in biology?	Open Question
CP	Mmh. As I said, we do waste a lot	Sustain Talk
	But the sciences have a greater usage of material – plastic material in particular	Change Talk

(*continued*)

Table AII. Post-training conversation with target behavior "sustainable behavior"

Speaker	Transcript	MISC Code
	And in this case, I ask myself 'Okay, I use a lot of plastic material and I do not know in the end how this is re-used'	Follow Neutral
	We simply throw a lot of stuff away	Sustain Talk
	And, well, I think … That is a bit of a problem	Change Talk
	If I continued to work in the sciences and started to put some thoughts into how I could design my experiments in a sustainable way; if I plan everything accordingly and have little usage, 'Could I change something?' I think, if this was planned on a larger scope, we could really make a change	Change Talk
Trainee	That's a great thing!	Affirm

Table AII.

Note: CP, Conversational partner

In this example, the trainee used a lot of communication skills from MI. The trainee showed a significant increase in using OARS throughout the entire interaction; that is, applying "open questions," "affirmations," "reflections," and "summaries." In the beginning, the trainee showed resistance to change ("That is really a huge effort!"). The trainee uses open questions to make the conversational partner think about his own reasons for why change might be important for him. In contrast to the first interaction of the trainee, in which he started to argue for changes himself, the roles are reversed in this example. It is the conversational partner who started to argue for change (e.g. "If we used them, we should also recycle them"; "It would pay out particularly with paper, I guess.!"; and later "because they are so rare. I think if we started to recycle this, we could create a real price difference for users. Preventing prices from becoming more expensive in the future, I think, with electronic device – it really makes sense!").

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