Computer Science students' experience of reflecting on Team Leadership – A case study of a student-centered course on communication

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***Abstract*—Despite their proven importance, team- and leadership competences tend to be highly underrepresented in Computer Science curricula. In order to support improving team performance in Information and Communication Technology (ICT) project teams, the *rhea.framework* of team leadership interaction has been developed by one of the authors. In this Research-to-Practice Full paper, the framework is briefly introduced and the students' experience with the *rhea.framework* in a student-centered Computer Science course at Master level is studied. We focus on the process of introducing the *rhea.framework* as an open educational resource and on students' experience of applying the framework for reflecting upon their team leadership interactions. Moreover, students were asked to evaluate the *rhea.framework* in light of their initial experience with it. While students suggested improvements on the *rhea.framework*, they appreciated the class on team leadership interaction. Consequently, the framework and scenario described in this paper is intended to encourage educators to include experiential learning into their courses and to research the effects. This can be done, for example, by reusing the *rhea.framework* and joining the authors in their endeavor to provide sustainable, significant learning on handling challenging interpersonal issues in ICT projects.**

Keywords—team leadership, interpersonal interaction, experiential learning, reflection, process model

I. INTRODUCTION

According to yearly chaos reports by the Standish group [1], [2], [3], the majority of Information and Communication Technology (ICT) projects have the tendency to fail because of people issues such as interpersonal interaction.. In several respects, the ICT domain is unique and poses particular challenges. Fast technological changes need to be paced with complex product or service requirements. In ICT teams, many highly specialized experts need to work together - frequently in virtual environments, and what they produce is less concrete for a long time before the product, often intangible software, is delivered.

For clarity, in this work leadership is differentiated from management. While management deals with organization and scheduling of business processes in order to achieve business goals, leadership can be seen as a purpose-oriented social directive in an interpersonal work environment [4], [5], [6], [7]. It can be circumscribed as imagining, willing, inspiring and driving [8].

In Senge's [9] learning organization the core learning units are teams. Team participants perceived as leaders may act as prototypes in behavior for other team members [10: 77-108], [11].

Leadership involves a complex set of skills developed through very hard work [10: 204]. Learning and leadership appear to be interlinked with each other [12], [13]. Senge [9] describes a generative learning process and people engaging in this process being in continuous learning mode. Generative learning is learning that not only includes intellectual knowledge acquisition, but also impacts learners' relationships to others and their environment [9: 132]. This idea of learning correlates with significant, whole-person learning as described by the humanistic psychologist Carl Rogers: "Significant learning combines the logical and the intuitive, the intellect and the feelings, the concept and the experience, the idea and the meaning. When we learn in that way, we are whole, … [14: 20]." This approach to learning can be supported if co-workers or students [15] find space to explore what they can bring to a situation, what motivates them, what they desire, and if sharing and reflecting upon experiences is possible in a rather threat-free, trustful environment.

If we acknowledge that leadership is related to taking responsibility for (inter)personal interactions within a team in response to team members' needs in order to get tasks done effectively [16] – and, thus, perform as a team - leadership concerns and affects every participant in ICT work environments. Hence, leadership education surfaces as highly important to professional future engineers. It makes a difference, if team members skillfully play into each others' hands [17] and if diversity is positively valued [18].

While experience-based learning activities have a long history in business and educational contexts, experience-based leadership development is an approach rather recently taken [19: 281]. Many leadership development strategies revolve around action learning [20] used to increase reflection, problem-solving and decision-making skills. James and Arroba [21] present a leadership learning program that, similar to the

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rhea.framework, focuses on interpersonal dynamics in leadership. This program is structured into three workshops. The *rhea.framework*, however, is intended to be implemented in the form of continual, monthy or bi-monthly, meetings. As in the ASPIRe (Actualizing Social and Personal Identity Resources) diversity management model presented by Haslam, Steffens, Peters, Boyce, Mallett and Fransen [22], leadership in the *rhea.framework* is described in terms of social identity theory and self-categorization theory [10].

Bolden, Gosling, Marturano and Dennison [23] review several leadership development opportunities in private and public institutions. Interestingly, most presented initiatives feature some kind of reflection activity, yet no reflection process model. Consequently, we view the reflection process model of the *rhea.framework* as an innovative feature of leadership development and devote particular attention to it in the current case study. Also, we go along with DeRue, Nahrgang, Hollenbeck and Workman [24], McCall and McHenry [25], Preston-Dayne[26] and Hetzlett [27: 380] who propose to underpin reflection processes with peer- or expert-feedback and structured reflection protocols.

The paper is structured as follows: The next section presents the *rhea.framework* aimed at developing leadership competences with the focus on the reflection of team-leadership interaction. In this section, an innovative process model for case based (inter)personal reflection on leadership interaction is described. Subsequently, the third section discusses the case study by sketching a particular scenario of introducing the process model at a course in Computer Science at the Masaryk University in Brno, Czech Republic, and raising focal questions such as: In how far is the reflection process model perceived as supportive for experiential learning? The fourth and final section discusses the findings and limitations of our study. The conclusion points to issues for further research.

II. THE RHEA.FRAMEWORK AND ITS REFLECTION PROCESS MODEL

In order to support leadership, a framework of performance-related leadership team interaction was developed following a design science research approach [28], [29]. The *rhea.framework* aims to support reflection of day-to-day practice in order to enable experience-based practice-related learning for peers interested in leadership [30], [27]. The name *rhea* refers to the framework's philosophical underpinnings, namely Heraclitus' process philosophy. Activites outlined in the framework are charted in Figure 1.

The framework builds on a reflection process model that consists of two modules: A module for personal written reflection (flow elaboration) and a module on interpersonal reflection. The first consists of a reflection template (http://phaidra.univie.ac.at/o:780694), also referred to as flow template, and a reflection guideline. The template leans on pattern representations as elaborated by Alexander [31], [32], [33] as well as Coplien and Harrison [34]. Mandatory components of a flow description - an experience description concerning a significant interpersonal situation within a team - are an evocative title, a detailed description (including a problem description, an intended solution and changes in interpersonal tensions involved in the problem situation), and a list of keywords. Situations may be portrayed through differentiating polarized, conflicting aspects of constitutive interpersonal tensions [32], [35], [36]. A focus is set on personal perceptions of the situation as well as personal motivation for interaction.

The described situation can be aligned to behavioral leadership categories, risk categories [37], and Unified Process [38] life-cycle phases.

The reflection guideline is intended to help filling out template areas, e.g. by providing questions to differentiate involved interpersonal tensions (adapted from [39: 138]): How would stakeholder X perceive the situation? What would team member Y say about it? How does colleague A perceive his/her relation to colleague B concerning the situation? Further, the guideline refers to heuristic descriptions of behavior, risk and project life-cycle categories.

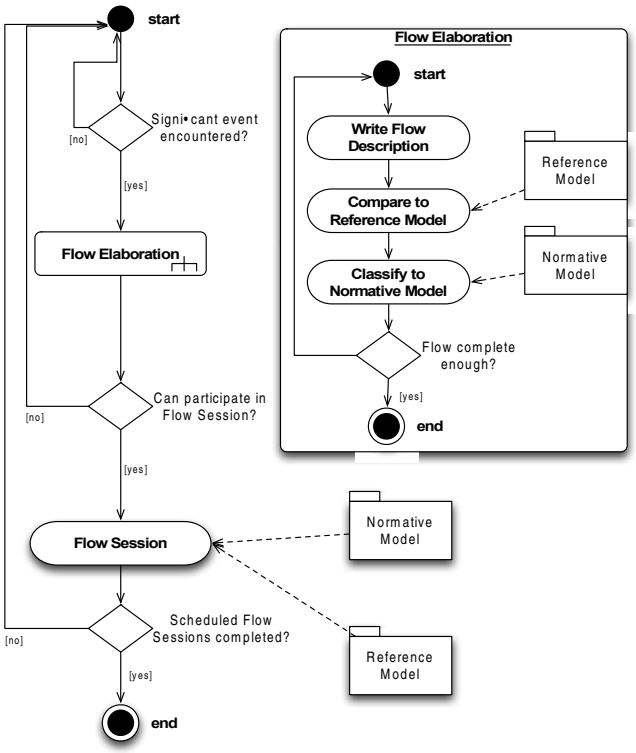

Fig. 1. *rhea.framework* Activities

The interpersonal reflection module describes a moderated peer learning process. It includes a policy outlining a learning setting as well as a standard procedure description of peer reflection sessions, also called flow sessions in the *rhea.framework*. The flow session sequence is based on the open case procedure [40], [41] specifically designed for experiential learning in time-limited workshops.

The *rhea.framework* supports a non-deterministic perspective on team leadership and project management [42] focusing on personal reflection of work practice and revisions of findings through peer learning connected to a dynamic team leadership reference model.

The reference model links experience descriptions that were systematically retrieved from peer reviewed literature [37] based on descriptions' semantic keyword relationships [43]. Reflections of interpersonal situations in work contexts can be aligned or compared to this reference model. It can be seen as a compass for personal reflection processes. It differentiates and describes four major topics, or core flows, of team leadership, namely "Prototype Team Identity", "Organize for Complexity", "Facilitate Team Cohesion", and "Structure for Task Effectiveness". Interrelated experience descriptions within the model are each part of a specific core flow. Table 1 lists key aspects of core flows. Centrality and interdependence are the main concepts underlying the reference model. Flows are preferably studied with focus on their centrality, a construct borrowed from graph theory. Central nodes in a graph are strongly connected to many other nodes [44], [45], [46], [47]. Similarly, central flows are highly interrelated or pivotal to other flows. Flows are interdependent: For example, when working out a shared vision in a team, team goals and the team's organizational setting need to be taken into consideration and vice versa. Interdependence of flows can be approached from global workspace theory [48]. In this cognitive architectural model, processes in the "spotlight" of conscious fleeting memory, which are associated with decision making and action taking, are shaped by "behind the scenes" unconscious, contextual cognitive-emotional processes.

A normative model of leadership team interaction holding taxonomies of leadership behavior and risk areas completes the *rhea.framework* [37]. It can be utilized to label interactions and to put them in specific behavioral contexts during personal reflection and in flow sessions.

Interpersonal dynamics, which are described as interpersonal tensions [36] in the flow template and lived between participants of peer learning sessions, are seen as key learning sources on interpersonal leadership team interactions in the *rhea.framework*. Ideally, sequences of personal reflection alternate with flow sessions - interpersonal reflection sessions in a group of interested peers.

TABLE I. CORE FLOW KEY ASPECTS

Prototype Team Identity	**Organize for Complexity**	**Facilitate Team Cohesion**	**Structure for Task Effectiveness**
Leadership as group function	Diversity	Collaboration	Techniques and tools to complete team goals
Vision	Creativity	Conflict Management	Team rules and constraints documentation
Differentiation, Buffering, Representing	Self-organization	Decision making	
Trust as emergent result		Team learning	

Several taxonomies are integrated in the framework in order to facilitate describing and comparing personal experience in team leadership [27: 376].

The rhea.framework is designed to be implemented flexibly in various organizational environments. It can be realized alongside or in combination with other leadership development activities. Thus, it may support integrating leadership learning in academic engineering programs [49], [50].

III. CASE STUDY ON INCLUDING THE RHEA.FRAMEWORK INTO A COURSE ON PERSON-CENTERED COMMUNICATION

The *rhea.framework* reflection process model was offered as a component in a course on person-centered communication at an academic Computer Science department. Due to the high number of confounding variables and the novelty of the task, we chose to study the integration of the *rhea.framework* in a student-centered course via a case study. Within the frame of the case study, a content analysis of students' written reactions to the third course unit was done. It served to explore how students resonated to the course sequence on team leadership interaction. In addition, short feedback given immediately after flow sessions was transcribed. In order to find out how students perceived the *rhea.framework* as an educational resource, a questionnaire that had been developed for an expert audit by one of the authors was reused.

The general course goal was specified as follows: Participants acquire personal experience, skills, and background knowledge in situations of professional and everyday communication (such as listening, articulating, speaking in a group, conflict resolution, decision making, etc.). Participants build a learning community around the concern for better communication and understanding. The course outline can be accessed at: https://cewebs.cs.univie.ac.at/pcc/ss17/.

Course participants were Master students of Computer Science with a specialization in SSME (Service Science Management and Engineering) that is being offered at the Faculty of Informatics at the Masaryk University in Brno, Czech Republic. All 18 participants (13 male and 5 female) worked at least part-time while studying and three participants already had two or more years of experience in leading small teams. The course was an elective and was being conducted as a lab course in three blocks, each lasting 1,5 days. There is no grading except for "pass" or "not pass". All 18 students, who attended the first session, completed the course and passed it.

One part of the first course unit was to elaborate students' goals and expectations. Those situations related to communication in leadership and teamwork (about 80% of all) included:

- Criticizing and giving feedback constructively
- Communicating effectively
- Increasing mutual understanding
- Giving information in an appropriate way and in a way that the other can understand it
- Active listening
- Explaining and clarifying better

- Communicating in situations of conflict and in emotionally loaded situations
- Negotiating without evocating defensiveness in the other party
- Improving communication with international partners/peers
- Improving online communication
- Communicating with an arrogant and manipulative person
- Developing a meta-view
- Deepening understanding and empathy
- Better finding out what the other wants and what I want

The theme of leadership team interaction was in the foreground in the third block, after students had experienced and practiced active listening, dialogue and sharing of personal and professional challenges in small teams and the whole group. The setting that immediately preceded the *rhea.framework*-supported experience of leadership team interaction was the open case setting [41], a conceptual ancestor of the flow session that features a process guideline slightly adapted from the open case guideline to better target the team leadership context.

In the open case setting, students were invited to suggest a "case", i.e. a situation they perceived as a challenge, a problem, an unresolved interpersonal issue or anything that touched them and they were willing to share in order to clarify their thought and get a handle on continuing their search for a solution.

Importantly, open case is not intended to be a setting in which others find solutions for the case provider. Rather it is a setting of listening and sharing in a trustful, respectful, open, and empathic atmosphere. In such a facilitative climate, the case provider himself or herself is supported to find their path by being listened to and offered several perspectives and approaches to broaden their scope of perceiving their situation. Much the same holds true for flow sessions, except for their focus on team leadership interactions and the facilitation by an experienced moderator, if available.

At the end of the second course block, one student was willing to share a case: an emotionally deep situation in which the case provider revealed feelings and doubts about some life decisions related to a work project. Since no other cases had been suggested at that point – probably because the case appealed to most participants - we formed a fishbowl with the case-provider and five interested peer-volunteers, one of whom volunteered to take on the moderator role. These six students formed an inner circle, while the other students sat in an outer circle and observed the open case session with the option to join the inner circle, if they felt they wanted to participate actively. However, nobody except for the course facilitator, who joined the inner circle towards the end of the session, made use of this option.

Thanks to the sensitive and mindful moderation, and to the volunteers' empathic listening and responding, the session served as a motivating example for further open case sessions that participants wanted to conduct during the third course block.

The case provider shared the following in his reaction sheet: "I would also like to thank for the opportunity to be the case-provider. It was a great experience and more over it really did help me. Thanks to questions and similar experiences from classmates, I could sort my ideas and feelings." In the final self-evaluation this student realized a wider essential effect of his contribution. He wrote: "[The case showed] that everybody can 'open' to the group and nobody will judge them." In fact, this statement describes a crucial precondition of open case, namely the rather non-judgmental stance of participants that is required for an atmosphere in which participants feel safe enough to share (inter-) personal issues that engage them.

The facilitator took up the participants' positive attitude towards sharing cases in small teams to suggest that students think about leadership- and teamwork-related cases that they might wish to share during the final block, in which team leadership interaction would be one of the focal themes. In order to allow participants to prepare for this theme, resources about the *rhea.framework* were uploaded on the course's online course space (https://cewebs.cs.univie.ac.at/pcc/ss17/). The evaluation of the *rhea.framework*, however, was announced to be asked for after the third course block only. At that time, students already would have experienced (parts of) the framework in practice.

During the third course block, two parallel open case sessions were conducted. One peer team was formed around the theme of a student being dissatisfied with performance at work. The other theme focused on a compromised relationship because of work-overload and frequent misunderstandings. The students preferred the setting of two parallel small peer groups, each working on a concrete case, to the fishbowl arrangement. Several students mentioned in their reaction sheets that the small team setting worked better for them than the large group because of the smaller distance, the higher level of activity, and the option to choose between themes.

Equipped with the experience of the open case sessions from the first day of the third course block, students were asked to reflect on their team leadership interactions. In particular, they were supposed to pick one interaction that mattered to them with which they would fill the personal reflection template (http://phaidra.univie.ac.at/o:780694), upload it on the course space, and consider sharing that interaction with peers in a flow session the next day, similar to the way the open case sessions had worked.

When the course started the following day, the facilitator asked students about their experience with the reflection template, distributed the flow session policy and procedure and briefly introduced the setting to her students. Then she asked who would be willing to share a leadership-related case. Three students suggested a case; the other students, as well as the facilitator, formed three peer groups, yielding a pretty well-balanced count of about five to six students per peer group. In order to minimize distraction by noise, two peer groups found

small seminar rooms for their session and all agreed to be back after 50 minutes (which actually extended to 65 minutes since one team did not want to end the session while discussion was "at its best").

Overall, the following three concurrent flow sessions were conducted within about an hour time plus 20 minutes reflection in the whole group:

1) How to motivate an inactive team member in academic student project teams

2) How to convince your boss to accept others' opinions (that were repeatedly confirmed to be better than the boss' ideas)

3) How to lead a student counsellors' club towards building a shared vision without enforcing community-building activities?

After the sessions, each participant was invited to share one word to describe his/her perception of the flow session. The following words were mentioned (translated from Czech):

> balance; questions; interest; belongingness (= belonging together or connection); experiences; feedback; openness; relaxed feeling (= relief/letting go); opportunities/options; understanding; complex; eagerness; clarity; elaborate; naturalness/genuineness; exciting/intriguing.

Finally, at the end of the third block, students were asked to provide written feedback on the flow template, the reflection guide and the flow session by filling out to the *rhea.framework* questionnaire (http://phaidra.univie.ac.at/o:780695).

IV. Model Evaluation

A. Data Collection

The *rhea.framework* reflection process model was assessed by course participants in various ways. As part of the course assignments, participants wrote open online reaction sheets reflecting on their learning in each of the three course blocks. Additionally, course participants had been asked to use the personal reflection template of the process model to work out a leadership case in their work contexts. Moreover, they could voluntarily fill out a questionnaire with a Likert-scale [51] on effectiveness and opportunities for comments on the reflection process model.

The guiding questions in the questionnaire try to capture participants' attitudes towards the reflection process model as a means of contributing to experiential learning in practice [18], [28], [52], [53]. All responses were anonymized.

1) Sample

In total, 18 (13 male and 5 female) students participated in the course. 17 reaction sheets were filled out after the first meeting. 18 reaction sheets were handed in after the second and after the third meeting, respectively. 17 students elaborated a self evaluation at the end of the course and filled out a survey on general course learning effectiveness. 15 participants tested the reflection template and worked out a work-related leadership situation. 12 students filled out the questionnaire and gave feedback on the reflection process model. For most course participants it was the first time they participated in an experiential learning setting.

B. Data Analysis

Descriptive data was analyzed by means of qualitative content analysis [54]. The qualitative content analysis was selective in the way that reaction sheets were skimmed for specific mentions of experiences concerning the *rhea.framework* reflection process model. Only descriptions within reaction sheets on parts of the reflection process model or the reflection process on work-related situations in a team were coded. Feedback from the questionnaire on the reflection process model was the main data source for qualitative coding. Contributions were coded by unit of thought. Categories concerning the effectiveness of the reflection process model for experiential learning were formed during the coding process in relation to questionnaire items. Finally, categories derived from the qualitative content analysis were compared to results of the quantitative data analysis.

In the questionnaire on the reflection process model, participants assessed the parts of the model on an unweighted ordinal 5-point scale with neutrality as center. The questionnaire holds ten Likert items. For each item, participants were asked for agreement in the following format: 1 for "No."; 2 for "Rather no."; 3 for "Partly yes."; 4 for "Rather yes."; and 5 for "Yes." In order to calculate perceived effectiveness of the process model within the group of questionnaire participants, median and mean of the sum of quantitative questionnaire elements were calculated.

C. Results

Five reactions from the third group meeting explicitly dealt with reflection on leadership in work contexts. Besides quantitative items, as presented in Table 3, the questionnaire held the following open items: "What is your general impression of the Flow Session Setting? Describe in 3 - 5 adjectives", "What is your general impression of the *rhea.framework* Process Model (personal reflection combined with Flow Sessions)? Describe in 3 - 5 sentences", and " What organizational environment circumstances need to be considered to use the *rhea.framework* most effectively, if any? Describe in keywords". These were answered by 10 of 12 questionnaire participants. In the process of coding, coding categories were established by one of the authors, discussed, and agreed upon by the other author. Category labeling was influenced by guiding questions in the questionnaire hinting at framework implementation in practice. Category labeling was tested on reactions that reflect leadership from the third meeting. Table 2 lists questionnaire participants' contributions ordered in the resulting category tree.

The usefulness of the process model was highlighted by 4 of 10 questionnaire participants who gave written feedback on the model. 5 of 10 participants particularly mentioned that the process model can help get a broader perspective on interpersonal situations. Four participants elaborated that the model enables comparing and arranging personal experiences to leadership areas. Three responses accentuated tool coherence.

TABLE II. QUALITATIVE CONTENT ANALYSIS – QUESTIONNAIRE RESULTS

Questionnaire (Qualitative Resp.)	
MODEL UTILITY	
Usefulness (4/10)	"very useful analysis tool (R1)", "quite practical, can be used in team interactions (R4)", "helpful (R5), "enables young leaders to reflect on leadership and soft skills in interpersonal interventions (R10)"
Broader perspective on interpersonal situation (5/10)	"wider and deeper understanding of issues related to leadership (R1)", "flow session helps through coherent, 'personalized' help from others (R2)", "helps to hear similar thoughts as personal and other points of view (R7)", "better understanding of problem (R8)", "look at problem from a broad perspective (R12)"
Enables arranging and comparing to leadership areas (4/10)	"helps somewhat to categorize problem and makes it easy to share (R2)", "complex (R5)", "smaller details easily noticeable (R8)", "hierarchies of terms for categorization (R12)"
Tool coherence (3/10)	"template definitely makes the description easier, template helps to focus on the problem (R2)", "clear (R5)", "roles are properly defined (R8)"
Motivating (1/10)	"fun to present (R7)"
IMPLEMENTATION CONSTRAINTS	
Willingness to participate in experiential peer learning (3/10)	"difficult to organize appropriate group if interested people for flow session: independent participants, willing to improve leadership skills, willingness of participants to solve problems independent participants, willing to improve leadership skills (R1)", "important to find person that wants to share, luck to get open people (R6)", "willingness to participate (R10)"
Group culture of open communication (4/10)	"enough level of openness (R1)", "culture (R5)", "company culture, nationalities of actors, flat organizational structure (R8)", "recommended in corporate environment eg during retrospectives, open culture (R10)"
Confidentiality (3/10)	"question of confidence (R1)", "how confidential the information is shared (R2)", "personal knowledge between people (trust?, confidentiality?) (R8)"
Group size (2/10)	"company size or team size (R5)", "company size (R8)"
Other environmental circumstances (3/10)	"life situation and backgrounds of individuals in group (R4)", "how long team already works together, kind of project (R5)", "timing (R10)"
MODEL UNDERSTANDING ISSUES	
Differentiation of model and other interpersonal processes: case study, group discussion (2/10)	"similar to case study structure (R3)", "model appears similar to plain group discussion (R7)"
Complexity and rigidity of process model (2/10)	"categories and relationships may not be useful, description is enough, but maybe in other cases important (R4)", "more rigidity in … (name of process model, authors note) than needed, not all problems fit guideline (R8)"

Questionnaire participants mentioned the willingness of participants to engage in experiential peer learning and an organizational culture of open sharing of experience as constraints to implementing the model effectively. The peer learning groups' size needs to be carefully considered. Confidentiality in the learning group was considered an important implementation constraint. Questionnaire participants were asked who could benefit the most from the reflection process. Ten responses suggested that less experienced team leaders may profit the most from using the reflection process model. Two participants also mentioned students. One participant thought that more experienced team leaders might benefit from using the reflection process model.

Distributions of answers from all 12 questionnaire participants to quantitative questionnaire items are listed in Table 3. The median of the sum of the quantitative questionnaire elements is 33 (of 50) or about 66%. The mean value is 34,4 or approximately 69%. Median and mean value of the sum of quantitative questionnaire elements hints at the interpretation that the process model was perceived as rather supportive for experiential learning; however there is room for improvement.

Questionnaire participants considered the reflection template as rather helpful. Similarly, they perceived the opportunity to categorize experiences to leadership team interaction categories supportive. The reflection guideline appears to be rather clear and easy to read. Peer reflection policy and procedure descriptions are rather clear and easy to understand. The procedure description is rather helpful. Questionnaire participants partly agreed that the reflection process model is helpful to develop or refine personal leadership qualities. They considered the process model rather accessible and innovative. They partly agreed that it is easy to read. From the written feedback of the participants it is apparent that the flow sessions could not be clearly differentiated from the more general open case setting or from group discussions. This appears to be the consequence of offering/practicing all three formats within the third workshop with distinctly more emphasis on active listening and dialogue as *uniting practices* of *person-centered communication* rather than on separating characteristics. Moreover, some participants perceived the reflection template and the peer reflection procedure as rigid guidelines, while in fact, these are designed to support reflection processes by adapting them to personal preferences and group participants' needs. In the authors' view, this flexibility would be more visible when practicing the reflection setting more often. For the first application, some rigor might even be at place in order to illustrate the intended sequence of steps. Intriguingly, the proposed sequence had never been criticized. On the contrary, students had considered it suitable and helpful for unfolding the case/flow systematically.

Findings in reaction sheets of the third meeting affirm categories established from questionnaire contributions. For example, the category "Broader perspective on interpersonal situation" was reflected by the online reaction of a student who shared: "What I liked the most was [the] discussion about team-leadership interaction in smaller groups, kind of similar to open case. It was interesting to get opinions from other perspectives, where I was given precious advice". Another student reflected the category "Tool coherence" by writing: "Another thing that resonated in me during the last block was the … flow exercise we did. Even though we had only a night before to read through the guideline, I found some very interesting information in it. Specifically. appendices 1&2 listing leadership interaction and risk categories. Remembering those whilst in a leader role might be a good thing".

TABLE III. QUESTIONNAIRE QUANTITATIVE RESPONSE DISTRIBUTION

No.	Item	Responses	Distribution					Points (in %)	Median	Arith. Mean	Standard Deviation
			NO (1)	RATHER NO (2)	PARTLY YES (3)	RATHER YES (4)	YES (5)				
1	Is the structure of the reflection template helpful?	12	0	0	6	3	3	75%	3,5	3,75	0,8660
2	Is the categorization of experiences in leadership team interaction categories helpful?	12	0	2	3	3	4	75%	4	3,75	1,1382
3	Is the reflection guideline clear and easy to understand?	12	0	2	4	6	0	67%	3,5	3,33	0,7785
4	Is the flow session policy clear and easy to understand?	12	0	1	3	6	2	75%	4	3,75	0,8660
5	Is the flow session procedure description clear and easy to understand?	12	0	0	3	8	1	77%	4	3,83	0,5774
6	Is the flow session procedure description helpful?	12	0	0	2	7	3	82%	4	4,08	0,6686
7	Is the reflection process model helpful to develop or refine personal leadership qualities?	11	0	2	5	2	2	67%	3	3,36	1,3790
8	Is the reflection process model innovative?	10	0	2	3	5	0	66%	3,5	3,30	1,4848
9	Is the reflection process model easily accessible?	10	0	1	4	3	2	72%	3,5	3,60	1,6514
10	Is it easy to read?	11	0	1	6	3	1	67%	3	3,36	1,2401

D. Limitations and Discussion

Blending quantitative findings with results of qualitative content analysis, the reflection process model appears to be perceived rather supportive for experiential learning within the group of course participants. Nevertheless, due to the modest sample size and investigation of a single course only, further research is needed to confirm or disconfirm the findings of the current case study.

In addition, the *rhea.framework* needs to be iteratively evaluated with different target audiences, in particular professional team leaders. An expert audit is currently conducted with team leaders in business environments.

Interestingly, differences in respondents' consistency have been detected in regard to the triangulated research methods used within this case study. While students' reactions consistently tended to be in favor of reflecting on team leadership interaction, questionnaire responses show different attributions to model effectiveness between qualitative and quantitative questionnaire items.

One participant describes the peer reflection process as interesting and meaningful, yet gives no ratings on any aspects of the process model (which is essentially the combination of reflection template, reflection guideline, flow session policy and procedure description). Another participant describes the model as practical and useful, but gives low ratings on innovation, possibly due to the similarity of the *rhea.framework* reflection process to other interpersonal reflection settings presented in the course. Similarly, the participant describes the model as clearly understandable, yet gives mediocre ratings on quantitative items concerning readability. This possibly portrays a gap between understanding the face-to-face setting and scanning through the accompanying resources.

One participant describes the process model as enjoyable, but gives low ratings on most quantitative items. This may be an expression of valuing the face-to-face exchange with peers, but being far less convinced about the self-reflective parts that had to be accomplished in the short time-frame of one evening between classes. Two questionnaire participants give no personal comments and mediocre ratings on quantitative items. Two participants differentiate in the qualitative feedback section between flow sessions and the process model and use labels such as open case, case study and flow session interchangeably. Apparently, the process model, its components and aims, as well as personal and organizational benefits of (inter)personal reflection processes need to be deepened, e.g. by allocating more time to leadership development in higher education.

Only a few participants were experienced in team leadership in ICT business contexts. This may explain why many questionnaire participants stated that the process model is most beneficial to less experienced team leaders.

The effectiveness of the model may be detected more distinctly after flow session participants had had a chance to put insights of flow sessions and continuous personal reflection of leadership team interactions into practice. Hirst, Mann, Bain, Pirola-Merlo and Richver [55] describe a lag between experience and facilitative leadership.

Findings of the whole case study represent a snapshot of implementing the *rhea.framework* reflection process model in a specific, academic leadership education context. They are particularly useful to illustrate the enthusiasm of most students to participate in flow sessions and support peers in collegial problem solving in the ubiquitous challenge of constructive

leadership team interaction. Moreover, findings help to iteratively improve the course scenario and the design of the reflection process model. In particular, more time needs to be allocated to introducing the components of the *rhea.framework* and to share the effects of students' personal reflection on leadership issues as well as their experience in trying to categorize their interactions within the *rhea.framework*. Corraborating our perception, related research suggests effectiveness of reflection processes and experiential learning in leadership education [27], [49], [50]. This is why we encourage colleagues-instructors to adapt our scenario and integrate the leadership reflection via the *rhea.framework* into their courses and join us in further researching the scenarios, processes, and effects.

V. Conclusion

In this study, a process model supporting experiential, case-based, on-the-job learning, is presented and its application in an academic course on communication is studied. The model combines structured personal reflection on team leadership with interpersonal, moderated reflection sessions in a small group of peers interested in learning about leadership interactions from experience.

Participants of a course on person-centered communication in a higher education Computer Science department were provided with the *rhea.framework* resource. They were guided to self-reflect upon their leadership team interactions as well as to participate in a case-based flow session. Thereupon students assessed *rhea*'s reflection process model by submitting their personal reactions to course meetings and by filling out a questionnaire. Combining quantitative and qualitative findings, participants appear to rate the reflection process model implemented in the course to be rather supportive for experiential learning. The qualitative responses point us to the finding that more course-time would be needed to facilitate a better and deeper understanding of the introduced *rhea.framework* resource. In particular, inexperienced participants (like students) tend to reflect that they benefit from the flow sessions in the social setting of small groups. However, as mirrored in the quantitative responses, some of them are likely to struggle with understanding the whole elaborate *rhea.framework* resource, in particular when studying it alone and having little time for exploring it.

In brief, the reflection process model presented in this paper may provide a valuable, flexible, and accessible means to support leadership education in Computer Science and related fields. The ongoing expert audit, further application and research are going to optimize the model as well as the scenarios of applying it in higher education and life long learning contexts. Last but not least, long-term studies will throw light on the impact of leadership education on leadership practice.

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