

# Developing Diversity Awareness of Software Engineers

## A Diversity Framework and its Application in an Academic and Life-Long Learning Context

Christina Böhm, Renate Motschnig

Faculty of Computer Science, CSLEARN - Educational Technologies

University of Vienna

Vienna, Austria

[christina.boehm@univie.ac.at](mailto:christina.boehm@univie.ac.at), [renate.motschnig@univie.ac.at](mailto:renate.motschnig@univie.ac.at)

**Abstract**—Soft skills, societal awareness and the ability to work in interdisciplinary teams are crucial traits for future software engineers. Still, these social skills seem to be underrepresented in the education of software engineers. To support a practical integration of such aspects also into education, a so-called “Diversity Framework” has been developed that helps to externalize implicit factors such as different work behaviors in project teams.

This paper firstly presents this theoretic, empirically validated framework for externalizing and managing diverse work styles in information and communication technology (ICT) environments. Moreover, the paper examines how two student teams on an undergraduate level perceived the Diversity Framework in a qualitative focus group research setting. Furthermore, the results exemplify how the different teams approached the topic differently. Finally, this work provides suggestion for future research and an integration of the framework in academic software engineering education and life-long learning.

**Keywords**—*diversity; social skills; awareness; education; framework*

### I. INTRODUCTION

In addition to technical solution skills, soft skills, societal awareness and the ability to work in interdisciplinary teams are crucial traits for future software engineers [1], [2]. Besides effective communication, ethical responsibility, and an understanding for the global, economic and societal context [3], students should be aware of intercultural aspects, such as diverse behaviors and work styles. It is proven that these aspects – for instance different perception of work [4] or cultural sensitivity [5] – have a significant impact on the success of collaborating in teams [6] as well as on the development cycle [7]. Nevertheless, systematic support in research as well as in practice is lacking [8], [9].

To support a practical integration of such aspects also into education, a so-called “Diversity Framework” has been developed within a doctoral dissertation that support teams in managing implicit behavior-based differences more effectively. In contrast to existing approaches and models this framework was designed in a generic manner that enables integration into

various project management models [10]. Hence, the model fits both traditional [11], [12] and modern agile project management philosophies such as general agile management approaches [13], [14] or specific agile methodologies [15]. Furthermore, the Diversity Framework was designed to be open to adaptation, tailoring, and extension [10]. Most importantly, in contrast to other approaches, this framework focuses on the individuals within a project team in a human-centered manner [16], [17].

The framework was developed with real ICT (Information and Communication Technology) projects in mind, but also with thoughtfulness about how to transfer or ‘teach’ it to ICT project managers and team members. The Diversity Framework consists of five systematic stages that allow application in academic education and moreover are intended to complement standards for multicultural ICT projects. Currently, trainings do not offer any standardized procedures for this topic. Therefore, more extensive application of the framework is aimed to improve practical software engineers’ skills in education as well as in industry.

In order to gain insight into the perception and usability of the framework in an academic context, qualitative research was performed with Austrian student teams on an undergraduate level. The respective focus group sessions took place in November 2015 with each team consisting of four students. These workshop-style sessions illustrated, how such a setting could help raising awareness for different behaviors and work styles in student groups and could be integrated into courses on project management. Furthermore, the results exemplified how the different teams approached the topic differently. While one team was very comfortable with a more analytic procedure, the other team highly preferred an open discussion procedure.

In addition, the testing with the student teams illustrated that, indeed, computer science students have a very profound opinion about parts of the Diversity Framework and can learn from testing and/or applying it.

This paper is structured as follows: Firstly, the developed, behavior-based Diversity Framework and its five stages are described in Section II. Before presenting the results of the focus group study in Section IV, the research design is

described in Section III. Furthermore, Section V proposes various options for integrating the developed Diversity Framework into software engineering education in an academic and a practical context. Finally, this work provides suggestion for future research and development in Section VI.

## II. THE BEHAVIOR-BASED DIVERSITY FRAMEWORK

The Diversity Framework was developed at the University of Vienna within a doctoral dissertation of the first author. It is grounded in qualitative research and literature studies and was validated with both qualitative and quantitative research methods [10]. For the purpose of the framework, diversity refers to the “variety of different behaviors (and their underlying values and beliefs) that individuals face when collaborating in project teams” [10, p. 22]. Hence, the Diversity Framework primarily deals with non-visible aspects of diversity that are not explicit such as different work styles or preferences.

The framework aims at supporting teams in managing behavioral-based diversity in their collaboration effectively. Instead of focusing on ‘hard’ facts of diversity (such as nationality, gender, age), the framework focuses on identifying behavioral differences and commonalities between the individuals in a team. This focus should help to reduce stereotypes and supports a human-centered approach in collaboration [10].

The diversity is a collection of features, techniques, and processes, and primarily consists of five main stages that build upon each other (see Figure 1).

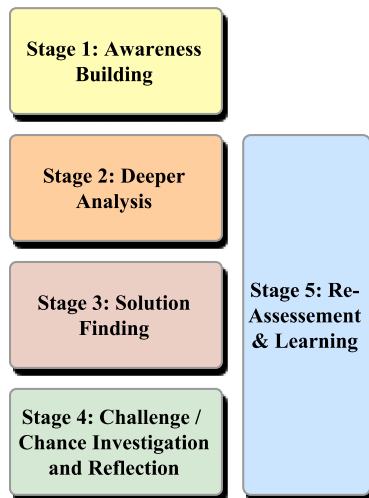


Fig. 1. Stages of the Diversity Framework.

### A. Stage 1: Awareness Building

This first stage aims at increasing awareness for the topic diversity, creating a common understanding within the team, and defining the context of the particular team situation. Furthermore, in this stage the team decides which procedure they want to use in the next stages in the diversity analysis.

### B. Stage 2: Deeper Analysis

In the second stage, a diversity analysis can be performed. This analysis allows deeper insights into the team’s expectations, behavioral preferences, and potential gaps between those preferences. Primarily, the behavioral-based diversity features are analyzed and gaps between the team’s individuals are identified. For instance, one particular diversity feature describes whether individuals prefer to work on several tasks in parallel or prefer single-threaded tasks. Here, the team has different options to perform this analysis:

- In an open group discussion.
- In a group discussion that is supported by visualizing the individuals’ opinions by positioning figures on a table.
- In a group discussion in combination with positioning of the individuals in the room.
- By using pre-defined questionnaires.

As teams could be composed differently, the various options help to choose the appropriate procedure for the particular team situation. For instance, if the team consists of highly introverted persons or a combination of rather introverted persons with a very dominant and extraverted person, an open group discussion procedure would not be recommendable. Hence, one of the other three options should be performed in this case.

### C. Stage 3: Solution Finding

In the third stage, the team continues the diversity analysis by discussing the previously investigated differences and commonalities and by elaborating solutions (e.g. guidelines and procedures) for the revealed diversity gaps. Furthermore, those solutions need to be put in action at the end of this stage.

### D. Stage 4: Challenge / Chance Investigation and Reflection

After completing the diversity analysis in Stage 3 by defining rules and procedures for a particular diversity gap, this fourth stage aims at tackling diversity challenges or chances that arise during the further team cooperation process. In particular, the challenge or chance is examined and underlying reasons as well as personal interests of the involved parties are analyzed and visualized to allow – comparably to Stage 3 – the development of a solution.

### E. Stage 5: Re-Assessment and Learning

Finally, the fifth stage can be performed in parallel to Stage 2, 3, and 4. In this stage the team on the one hand re-assesses the solutions that were defined in Stage 3 and 4. On the other hand, parallel to Stage 2 to 4 lessons learned are collected. This gives the team the opportunity to learn from the process continuously.

## III. DESIGN OF THE FOCUS GROUP STUDY

In November 2015 a focus group study [18] with two student teams was performed [10]. The study aimed at gaining insights about the users’ perception of the Diversity

Framework – in particular about the Stages 1 (Awareness Building), 2 (Deeper Analysis), and 3 (Solution Finding).

#### A. Research Setting

The eight participants of the study were approached in a compulsory ‘project management’ bachelor course. During the course the students had already worked together as a team on a small IT-project. Instead of a reflecting upon a self-chosen scientific article from the field of project management (which was evaluated with 15 percent of the total course), student teams that either had some practical experiences or were at least in the third semester of their bachelor study were offered to participate in the focus group study.

Two teams volunteered for the study. Both teams consisted of four team members. Whereas Team 1 was composed of four male participants, Team 2 had two female and two male participants. Prior to the focus group study the teams were asked to prepare themselves by reflecting on questions such as ‘How would you explain the term diversity?’ or ‘How would you find out whether your team members have different work styles?’.

The study was held in a workshop style at a lab of the university. Each workshop with the two teams lasted for three hours. The lecturer of the bachelor course moderated the study.

As a first step, the workshop started with a warm-up in which the participants introduced themselves and shared parts of their personal backgrounds such as education, work experience or hobbies. After setting the ground rules for the workshop, the focus lied on Stage 1 of the Diversity Framework: Awareness Building. At first, the participants discussed their perception of what diversity is and how it could affect collaboration. Second, the participants should draw a picture in which they illustrate what diversity means to them. This task should reveal whether the team members have rather positive or negative associations with the topic. For instance, a positive association could be a picture that illustrates different shapes or people building up one figure. On the other hand, a negative association could be drawing different people and visualizing their interaction with a flash.

Subsequently, the next Stage 2 (Deeper Analysis) was in the focus. As this stage offers different procedures, all four options were tested.

- Firstly, the team was given five selected questions from a list of polarized behavioral features and the participants were asked to discuss. Also, they should identify if there are any gaps between their preferred work styles regarding each question.
- Secondly, the participants should perform the same task but before discussing they should position a figure (their avatar) on a line on the table that helped to visualize the opposed poles of the question (for instance, if they prefer to separate professional time and private time or if there should be a strong connection). For the positioning ‘funny’ figures (e.g. rubber ducks) were used to lighten the mood. Afterwards, they should discuss what they see on the table and identify any gaps.

- Thirdly, similar to the positioning on the table the participants now were asked to position themselves in the room. Again, the poles of the question were specified before positioning. Then again, they should discuss the positions and identify any gaps.
- Fourthly, the participants should individually fill out a prepared questionnaire with certain questions on the behavioral features. After the questionnaires were completed, the moderator and the team calculated the results and identified gaps.

In addition, the team was asked to collect all gaps and find situations in which these behavioral gaps could hinder or enhance their teamwork.

Next, the third Stage of the Diversity Framework (Solution Finding) was tested. Here, the team should examine each gap separately and define rules and procedure how they want to deal with the gap. Furthermore, they discussed about potential risks and chances that arise from the gap.

Finally, an extensive discussion about the tasks usability and applicability completed the workshop. Furthermore, after each task the teams were also asked to reflect what they liked and disliked. In addition, four days after the workshop was performed the participants reflected in written form. This document included feedback on the four different procedures in Stage 2, on how what they learned, on what they liked and disliked, and on how this could be applied in a practical and university context. Both during the workshop as well as in the written reflection, the participants seemed very honest, open, and critical

#### B. Data Analysis and Limitations

The written reflections were used as a main source for the data analysis. In addition, the written feedback was randomly compared with the recordings from the workshop. In the analysis a structured content analysis [19] was performed. Here, the categories that were defined for the written reflection were used.

The study is limited due to the number of participants and investigated teams. Nevertheless, the study provides first results on the applicability of the Stages 1, 2 and 3 of the Diversity Framework and provides insight into the usability for an academic context.

Still, the effectiveness of the framework needs to be proven in further, extended research that allows drawing more conclusions on this factor. Furthermore, also the conclusions drawn for larger classes should be perceived as reference points for further development and require future research and validation.

## IV. USER-PERSPECTIVE ON THE FRAMEWORK

In this section, the major results of the qualitative focus group study with two student teams are described.

#### A. Result 1: New Insight into Team

At first the teams were asked whether they have learned something new about the team or about themselves during the workshop. All four members of Team 1 agreed that they learned more about their team. For instance, during the discussion session in Stage 2 they found out that some team members tend to prepare their work last-minute while others prefer to start earlier with tasks. In addition, in the warm-up session in Stage 1 they learned more about the others' educational and personal background. Furthermore, the workshop showed them how the team was composed and which dynamics are triggered in certain situations, e.g. in decision-making within the team.

Comparably, also Team 2 reflected that they gained new insights about their team, but also about themselves. For instance, one person examined how she/he acted differently in the discussion depending on whether she/he felt disadvantaged or not. Even though the team had worked together before and they were quite close, the team was surprised to experience unknown differences. One person stated: "I got some new insights about my team colleagues. I might have seen them before, but they were not conscious to me" [10, p. 159]. Furthermore, one team member perceived that "the workshop was an extraordinary experience that brought up new things" [10, p. 159].

#### B. Result 2: Perception of Stage 1 (Awareness Building)

In general, all eight participants perceived the tasks from the first stage as positive. Especially the drawing what they associate with diversity was perceived as motivating, funny, and informative. Furthermore, three participants mentioned that the task helped to loosen the situation. Also, it was interesting to see the others pictures and association, which already "showed the different positions of the other participants" [10, p. 221] (Team 1).

#### C. Result 3: Perception of Stage 2 (Deeper Analysis)

Regarding the second stage, the participants were asked how they perceived the explication process of differences and commonalities in their behavior in general. For Team 1 the explication phase was quite easy using the different methods. One team member stated that the workshop also helped him to improve his own work approaches.

In contrast, Team 2 perceived the explication process as unusual, but also as interesting: "It was very interesting to make the own way of working explicit, as I have not dealt with it before. Only during the workshop I had to reflect why I do things the way I do" [10, p. 159]. Another member revealed that she/he reflected more critically on the own work style.

Also Team 1 perceived the workshop very positively. They thought it was interesting to see and evaluate the different methods. Furthermore, they had expected that the workshop would be very difficult and they were surprised that it was not. Also, one participant valued the playful elements in the workshop: "The discussion was very entertaining, because the main points were elaborated playfully" [10, p. 159].

#### D. Result 4: Perception of the Four Different Analysis Procedures

Furthermore, the team members were asked to reflect the different procedures that were tested in Stage 2. Table 1 and Table 2 show the different perceptions of the teams regarding the four procedures in detail.

TABLE I. TEAM 1: USER PERCEPTION OF THE DIFFERENT ANALYSIS PROCEDURES [10, p. 161]

Procedure	Team 1
Open discussion	All team members in Team 1 liked the open discussion procedure. They felt that they could talk freely and directly, and that they could express their opinion and ideas instantly. Still, the procedure might have the disadvantage that not all team members can participate equally in the discussion. Also, the procedure consumes much time, and there is a risk that the team wanders off the discussion.
Positioning with figures	Three team members stated that positioning themselves with figures on a line on the table was their favorite method and most appropriate. They liked that "it was easy to position myself, as the figures gave me anonymity". Also, two persons stated that they had a good overview of the different opinions and they could position themselves freely. In comparison to the open discussion, this procedure ensures that the team sticks with the particular question and does not get lost. Furthermore, the small abstraction with funny figures loosened the situation.
Positioning in the room	Team 1 did not like the positioning in the room. Three participants stated explicitly that they did not like this procedure, and one person had a neutral opinion. All four members thought that the physical distance or proximity could be an issue here. In particular, the members can be "too close to others and violate their comfort zone". Also the result of this procedure might be biased as persons try to keep a physical distance and therefore might not position them where they actually wanted.
Pre-defined questionnaire	Regarding the questionnaire procedure, Team 1 was quite neutral. They reflected positive as well as negative aspects. Among the positive aspects were, for instance, that their answers were not influenced by others, or that the procedure is quick and delivers quite good results. On the other hand, "different questions could be interpreted differently, which could decrease the value of the information". In comparison, the positioning with figures provided more insights. One person noted that she/he would use this method in very large teams.

TABLE II. TEAM 2 USER PERCEPTION OF THE DIFFERENT ANALYSIS PROCEDURES [10, p. 161]

Procedure	Team 2
Open discussion	In comparison to team 1, team 2 had a very different perception of the procedures of explicating diversity differences. Three participants preferred the open discussion because it was the best method to express their opinions, reveal misunderstandings, and discuss the questions directly. One participant disliked this procedure because it is not appropriate for people who are not fond of discussions and as "people might wander off the discussion".
Positioning with figures	Whereas in Team 1 the positioning with figures on the table was the preferred method, Team 2's opinions were rather ambiguous here. Two team members liked the procedure, as they had more time to think first.

Procedure	Team 2
	Also, the procedure gave an overview and they could see how the positions changed during the discussion. On the other hand, the other two team members disliked this procedure, because they had to position their opinion on a line on the table. One person stated: "This was a problem, as I cannot classify myself on scales easily". The other person even perceived that "with the positioning some misunderstandings were provoked" and finally they figured out "that there were actually no differences".
Positioning in the room	The positioning in the room was perceived negatively by three of the four participants in Team 2. Again, one person did not like that she/he had to position him-/herself on a scale. Furthermore, there was a higher conflict potential when people "are positioned "against" each other". On the other side, one participant stated: "I liked the positioning in the room as you could move around and not only sit".
Pre-defined questionnaire	The entire Team 2 perceived the questionnaire procedure negatively. They did not like the scales and questioning, as those "did not consider particular situations or exceptions". Also, they felt that they could not express their own opinion on the topic in a questionnaire. In addition, the answers could be misunderstood when the data is interpreted. Still, one person thought that it might be an appropriate procedure for big groups.

Concluding, Team 1 preferred the positioning with figures, as their favorite procedure because the method provided quick, but also clear results. Furthermore, all members of the team also liked the group discussion, whereas three team members disliked the positioning in the room. Finally, Team 1 perceived the questionnaire neutral.

Team 2 did not have a single favorite, but showed a clear dislike for the questionnaire procedure. Furthermore, three participants also disliked the positioning in the room. In contrast to Team 1, only two participants perceived the positioning with figures on a table as positive, whereas the other two had a negative perception of the procedure. In this case, the team liked the open discussion and one person called it her favorite procedure.

#### E. Result 5: Perception of Stage 3 (Solution Finding)

Also during Stage 3 the two focus group teams had a very different perception. For Team 1 finding situations in which the behavior could be hindering or beneficial as quite easy whereas Team 2 perceived this process as 'complicated', 'difficult', and 'time-consuming'.

Furthermore, Team 1 perceived the solution finding stage as useful and helpful as defining rules and procedures "generated a common basis for the team how to react in particular situations" [10, p. 162]. Furthermore, analyzing risks and chances was not so easy, but illustrated the effects that different situations can have on the team. One member of Team 1 even stated: "I was surprised of the results of the workshop. The elaborated procedures will help for sure in the future to bring the team quicker and better on the same track and to improve communication" [10, p. 162].

On the contrary, Team 2 had difficulties finding a solution that was satisfactory for everybody. This might be the result of

the fact that in this Stage 3 Team 2 worked with a fictive example as they could not find practical situations in which the revealed gaps could have any impact on the teamwork.

#### F. Result 6: Participants' Views on Including the Diversity Framework into Software Engineering Education

Team 2 agreed that the topic was very important and this should be a topic in practice as well. Still, when they were asked if the topic diversity should be included into computer science education at university (e.g. as a part of a course or an independent course), the opinions of the participants varied. While two students of Team 1 stated that they think there should be an independent, maybe voluntary course on the topic diversity as "it is a very important soft skill for computer scientists" and "as it can be very helpful during the study or in the professional world". Other four students – of Team 1 as well as Team 2 – suggested that the topic should be part of another course. One member of Team 2 suggested discussing the topic in the project management course together with teamwork by a particular high-diversity case example. Another member suggested that this should already be a part of higher school education. Two students liked the workshop style as this was a very positive experience and would recommend such a format.

### V. PROPOSALS FOR INTEGRATING THE DIVERSITY FRAMEWORK INTO SOFTWARE ENGINEERING EDUCATION

Before discussing various educational contexts in which the Diversity Framework can be used as a resource, let us specify relevant learning outcomes in the context of multicultural ICT project management – a subfield of software engineering and social- and professional competence.

#### A. Learning Goals and Learning Outcomes

The learning outcomes are scalable and can be adapted depending on factors such as time available, target audience, academic or life-long learning context, etc.

Learning outcomes of educational offerings employing the Diversity Framework:

- Participants build or strengthen awareness about diversity features and corresponding diversity behaviors such that they can label and recognize such behaviors in themselves and others.
- They can name diversity features that are relevant in ICT project teams.
- They can explain the essence of the stages of the Diversity Framework.
- They can explain their diversity-based behaviors and preferences and understand that they may differ from others'.
- They can explain potential risks and benefits of diversity gaps within their team.
- They can describe strategies how to deal with a diversity gaps.
- They can name advantages of generic and extensible life-cycle models in regard to ICT projects.

- They can arrange the Diversity Workflow as an extension to the Rational Unified Process (RUP) [20].

#### *B. Integration into Academic Computer Science Curricula*

“The education that undergraduates in computer science receive must adequately prepare them for the workforce in a more holistic way than simply conveying technical facts. Indeed, soft skills (such as teamwork, verbal and written communication, time management, problem solving, and flexibility) and personal attributes (such as risk tolerance, collegiality, patience, work ethic, identification of opportunity, sense of social responsibility, and appreciation for diversity) play a critical role in the workplace. Successfully applying technical knowledge in practice often requires an ability to tolerate ambiguity and to negotiate and work well with others from different backgrounds and disciplines” [21, p. 15].

The above quote from IEEE/ACM’s most recent guideline for designing computer science curricula clearly makes the point that diversity-related competencies have their place in (undergraduate) computer science education and should be addressed. However, since the curriculum needs to cover a broad spectrum of competences, let us suggest a time-efficient, small-scale inclusion, based on our experience with the focus groups. Two scenarios are suggested that are intended to be fit into either a basic course on software engineering or one on project management. While the software engineering scenario emphasizes the ‘knowledge about diversity’ aspect, the project management scenario focusses on social and professional competencies, in particular professional communication in dealing with cross-cultural environments.

*1) Scenario 1: Integrating the Diversity Framework into a basic course on software engineering.*

In software engineering, software extensible life cycle models appear to provide a suitable hook for addressing diversity issues throughout the life cycle. Whereas older models deal exclusively with a disciplined way of constructing software, more recent models in general, and the standardized Unified Process [22] or Rational Unified Process (RUP) [20] in particular, are designed for coverage of a broader scope (e.g. project management workflow) and being extensible. These features prove essential for incorporating new focal issues, such as a ‘diversity workflow’, which is part of the Diversity Framework.

After having provided a knowledge input capturing the information summarized in the preceding paragraph, instructors can start a dialogue with students by asking what diversity means to them and which aspects thereof they can imagine to play a role in software development teams (e.g. preference for a particular language, starting precisely in time or waiting for all to arrive, etc.). Afterwards, students’ considerations are noted on a black- or whiteboard, or in a mind map. Thereupon, the students’ results can be compared with the diversity features and the associated behaviors

foreseen in the Diversity Framework and any commonalities and differences can be discussed.

In a subsequent lesson, the instructor would introduce the five stages of the diversity workflow. At this point, another interactive element can be introduced: Individual students or spontaneously formed small student teams are invited to think which of UML’s visual languages (UML is the language that goes along with the UP [23]) would be appropriate to capture and understandably represent the activities proposed in the stages of the Diversity Framework. Subsequently, the instructor would collect and comment upon the students’ proposals, engaging them in a dialogue on the appropriateness and expressiveness of various visual notations, given the task of modeling the stages of a conceived workflow.

Finally, the instructor would introduce students to the web-application accompanying the diversity workflow (<http://homepage.univie.ac.at/christina.boehm/>) and let them explore the application, asking students to share their impression on the framework and how it contributed to understanding the issue of diversity in software engineering.

The estimated duration of this scenario is 3 hours, however a shorter variant can be produced when cutting down the interactive elements or arranging them as assignments to be done outside of class.

*2) Scenario 2: Integrating the Diversity Framework into a basic course on project management focusing on social and professional competencies.*

In contrast to Scenario 1, in a course targeted (amongst others) at developing professional competencies, the focus is on facilitating students’ awareness of diversity issues, how they affect their collaboration, and how they could constructively deal with team-mates’ behaviors that appear ‘strange’ or ‘wrong’ or even ‘intolerable’ to them.

In such a course, the subjective experience along with the knowledge about diversity behaviors would be in the foreground. Firstly, the instructor would introduce the idea, principle and steps of the Diversity Framework to provide a basis for the subsequent team workshops. For these workshops, symmetrically to the ‘open group discussion’ and the ‘questionnaire’ approach in the Diversity Framework, student teams (e.g. those who collaborate on a common project) could choose their preferred procedure. Those preferring the open group discussion would be asked to come up with a list of work-relevant features or behaviors in which they think/feel they either differ or are consistent. Those having a preference for filling out a questionnaire would do that and afterwards informally compare their results. All in all, at the end each team would produce a short list of about 3 to 5 diverse and overlapping behaviors. The feelings and meanings accompanying some of these behaviors could be explored and the whole class would engage in a dialogue on project-related diversity behaviors. Students could dialogue, for example, about means how to deal with contradictory preferences in a

team, or what consequences undiscovered, unconscious gaps would have on the team climate and on project success.

Importantly, the second scenario deals with a highly sensitive issue and crucially needs an instructor with high empathic, social and communicative competencies. The learning from this scenario essentially depends on the depth of the self-exploration, experience, and openness of students. Its duration is estimated to be three hours.

The authors wish to note that while they have experimented with including aspects of these scenarios into their classes, they have not tested the scenarios in their entirety, such that this piece is work in progress. We also want to share that each time we engage students in aspects of the scenarios described above, we learn something new. This is also why we adapt the scenarios from course to course and can imagine interested colleagues to customize them for their and their learners' emphasis and feeling comfortable with them.

### C. Integration into project management standards

The framework touches areas of the three most acknowledged traditional project management standards [24]–[26]. Nevertheless, there are not comprehensive solutions comparably to the Diversity Framework integrated into any of the standards so far. For instance, the framework would affect the knowledge areas communication management, risk management, as well as stakeholder management or human resource management from the PMBOK® [24]. Still, either integrating the topic diversity into the above mentioned knowledge areas or adding a new area that targets 'soft' project aspects is advisable. Also, in the competency-oriented ICB 4.0 [26], for instance, the 'people competencies' personal communication, relationships and engagement, leadership, teamwork as well as conflict and crisis are affected by different behavioral preferences of the project team members. Still, as managing behavioral differences effectively could be perceived as an own competency for project managers, also here an additional competency would emphasize the importance of the topic. Alternatively, the topic diversity could be added to one the closely linked, existing competencies such as teamwork.

For practical trainings we would recommend a similar procedure as described in the previous section in Scenario 2. An experience-based learning that enhances self-awareness is preferable as 'soft' aspects are hard to learn and be taught in theoretic learning settings. In additions to Scenario 2, in trainings for project management professionals (to be) the additional procedure of 'positioning figures on a table' during the Stage 2 of the Diversity Framework could be included in the practical tasks for the participants.

## VI. CONCLUSION AND RECOMMENDATIONS

Given the importance of 'soft competencies' in ICT projects, in our view, the people-factor tends to be underdeveloped in software engineering education. Hence, with this paper we aim to contribute to coming up for this deficiency in the field of managing diversity professionally by introducing the Diversity Framework and illustrating various scenarios how instructors and students can work with it in the

context of undergraduate computer science education and life-long learning.

It is noteworthy that the Diversity Framework comes equipped with a variety of procedures, thus allowing for a situative adaptation and consideration of team members' needs and preferences. This is especially important as the focus group study revealed that even between two teams having very similar characteristics such as educational background or age, behavioral preferences could vary considerably. For instance, while one team did not like the positioning procedure with figures on a table, the other team perceived this as their favorite procedure. Also, Team 1 accepted the questionnaire procedure, whereas this procedure created high resistance in Team 2. This example illustrates that it is essential that this set of different procedures is offered to teams as they address different personality traits and preferences.

Furthermore, it proved to be helpful that the Diversity Framework includes a diversity workflow that has been designed as an extension of the RUP, a standardized, generic process template that is well-known among software engineering professionals. This feature allows for a clear, systematic integration of the Diversity Framework into ICT projects as well as software engineering and project-management education.

Further research will be devoted to studying the integration of the Diversity Framework into real as well as academic ICT projects from the inception to the transition phase. Moreover, the initial set of diversity behaviors being part of the framework will be tested in various cultural contexts in order to incrementally optimize the framework and calibrate it for use in specific intercultural settings. At the University of Vienna, we particularly welcome inputs and contributions from our international students, for example as students' projects or seminar/bachelor theses. These help investigating particular aspects of the Diversity Framework and at the same time allow students to expand their professional as well as research competence. We view them as examples of research-based learning and equally see us as instructors, researchers, and, perhaps most exciting, learners in the process of exploring a very real aspect of socio-technical development.

Finally, future research should focus on the effects of integrating the Diversity Framework into (undergraduate) education and comparing the effectiveness of the suggested two scenarios.

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## REFERENCES

- [1] U. R. Cukierman and J. M. Palmieri, "Soft skills in engineering education: A practical experience in an undergraduate course," presented at the International Conference on Interactive Collaborative Learning (ICL) 2014, 2014, pp. 237–242.
- [2] A. Holzer, S. Bendahan, I. V. Cardia, and D. Gillet, "Early awareness of Global Issues and development of soft skills in engineering education:

- An interdisciplinary approach to communication,” presented at the International Conference on Information Technology Based Higher Education and Training (ITHET) 2014, 2014, pp. 1–6.
- [3] I. Jouny and W. Hornfeck, “Teaching Soft Skills to ECE Students,” in *Creating Interdisciplinary Skills for Complex Global Environments*, 2010, pp. 1–12.
  - [4] R. Amster and C. Böhm, “Cultural-based Behavior in Global IT Projects: An Investigative Study with Indian Managers of Outsourcing Projects,” *Procedia Comput. Sci.*, vol. 64, pp. 232–239, 2015.
  - [5] B. Ives and S. L. Jarvenpaa, “Applications of Global Information Technology: Key Issues for Management,” *MIS Q.*, vol. 15, no. 1, pp. 33–49, 1991.
  - [6] B. M. Dunavant and B. Heiss, *Global Diversity 2005*. Washington, DC: Diversity Best Practices, 2005.
  - [7] B. Shore and A. R. Venkatachalam, “The Role of National Culture in Systems Analysis and Design,” *J. Glob. Inf. Manag.*, vol. 3, no. 3, pp. 5–14, 1995.
  - [8] C. Böhm, “Practical Insights on Managing Diversity in International ICT Projects,” in *Managing Flexibility: People, Process, Technology and Business*, Sushil, T. Bhal, and S. P. Singh, Eds. India: Springer, 2015, pp. 73–84.
  - [9] C. Böhm and R. Motschnig-Pitrik, “New Research Perspective on Managing Diversity in International ICT Project Teams,” in *Systemic Flexibility and Business Agility*, G. Chroust and Sushil, Eds. India: Springer, 2015, pp. 21–31.
  - [10] C. Böhm, “A Framework for Managing Diversity in ICT Projects: Processes and Techniques for Explicating Soft Facts and Dealing with Behavioral Differences,” *Doctoral Dissertation*, University of Vienna, Vienna, 2016.
  - [11] R. Gareis, *Happy Projects!: Project and programme management. Project portfolio management. Management of the project-oriented organization. Management in the project-oriented society*, 3rd ed. Wien: Manz, 2006.
  - [12] G. Patzak and G. Rattay, *Project Management: Guideline for the Management of Projects, Project Portfolios, Programs and Project-oriented Companies*, 1st ed. Wien: Linde International, 2011.
  - [13] J. Highsmith, *Agile Project Management: Creating Innovative Products*, 2nd ed. Boston, MA: Addison-Wesley, 2004.
  - [14] M. Sliger and S. Broderick, *The Software Project Manager’s Bridge to Agility*. Upper Saddle River, NJ: Addison-Wesley Professional, 2008.
  - [15] K. Schwaber and M. Beedle, *Agile Development with SCRUM*. New York: Prentice-Hall, 2001.
  - [16] C. Böhm, “The Connection between Agile Project Management and Human-Centered Principles,” in *Proceedings of the 7th International Conference on Contemporary Business and the 14th Global Conference on Flexible Systems Management (Joint Conference)*, October 15-17, Curtin University, Singapore, 2014, pp. 661–666.
  - [17] R. Motschnig, “Agile Management Needs Agile Persons – Developing Inner Flexibility,” in *Systemic Flexibility and Business Agility. Twelfth Global Conference of Flexible Systems Management (GLOGIFT 12)*, New Delhi, 2012, pp. 281–290.
  - [18] U. Flick, *An Introduction to Qualitative Research*, 2nd ed. London: SAGE Publications, 2002.
  - [19] P. Mayring, *Qualitative Inhaltsanalyse: Grundlagen und Techniken [Qualitative Content Analysis: Basic principles and methods]*, 11th ed. Weinheim/Basel: Beltz-Verlag, 2010.
  - [20] P. Kruchten, *The Rational Unified Process: An Introduction*, 3rd ed. Boston, MA: Pearson Education, 2004.
  - [21] The Joint Task Force on Computing Curricula Association for Computing Machinery (ACM) IEEE Computer Society, *Computer Science Curricula 2013: Curriculum Guidelines for Undergraduate Degree Programs in Computer Science*. ACM and IEEE, 2013.
  - [22] I. Jacobson, G. Booch, and J. Rumbaugh, *The Unified Software Development Process*. Reading, Massachusetts: Addison-Wesley Longman, 1999.
  - [23] G. Booch, J. Rumbaugh, and I. Jacobson, *The Unified Modeling Language User Guide*, 2nd ed. Addison-Wesley Professional, 2005.
  - [24] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, 5th ed. Pennsylvania, USA: Project Management Institute (PMI), 2013.
  - [25] D. Hinde, *PRINCE2(R) Study Guide*. Alameda, CA: John Wiley & Sons, 2012.
  - [26] International Project Management Association, *ICB 4.0 - Individual Competence Baseline for Project, Programme & Portfolio Management*. International Project Management Association, 2015.