The Group Development Questionnaire Short (GDQS) Scales: Tiny-Yet-Effective Measures of
Team/Small Group Development

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Abstract

The Group Development Questionnaire Short (GDQS) Scales, a 13-item short form of the 60-item Group Development Questionnaire, was developed and validated across four studies. The GDQS scales with four items for Scale I, and three items for Scales II–IV, had consistent and acceptable internal consistencies across Studies 1 and 2 (α at or well above .65), similar to the parent measure. Moreover, the GDQS scales showed a comparable pattern of convergent, and criterion-related validity (Studies 1–3), and concurrent validity (Study 4). Collectively, these results indicate that the GDQS is a psychometrically acceptable and practically useful short measure of team/group development. The GDQS can freely be used for research, with written permission, and we conclude the paper with norm data and practical guidelines for researchers wanting to apply the measurement.

Keywords: group development, team maturity, group development questionnaire, integrated model of group development

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A known dilemma for most researchers is the trade-off between wanting to measure a range of constructs in their research while keeping the number of items as low as possible. It is not feasible to let participants fill out long questionnaires since that increases the risk of them becoming bored and/or irritated. Such aspect could increase the transient measurement errors (Schmidt, Le & Ilies, 2003), which researchers, of course, want to avoid. The response rates could also decrease if the time to fill out a survey is extensive. There is also a lack of longitudinal studies in, e.g. the study of groups (Kozlowski & Ilgen, 2006), which are also more easily implemented with fewer items. Researchers who want to investigate other aspects of organizational psychology could then also control for the effect of group maturity. It is quite popular to create short versions of longer questionnaires, e.g. Donnellan, Oswald, Baird and Lucas (2006). Smith, McCarthy and Anderson (2000) show that many of these short forms, though, fail to evaluate the reliability and validity and mostly rely on their parent measure. In the study by Donnellan et al. (2006), however, they apply rigorous psychometric analysis of their suggested short-form of measuring the Big Five personality traits, which inspired us in conducting the studies presented in this paper.

In the current study, we present studies conducted to develop and validate a short version of the Group Development Questionnaire (GDQ) that is used to measure the maturity of small group or teams (Wheelan & Mckeage, 1993). The GDQs has received some critique (Kozlowski, Watola, Jensen, Kim & Botero, 2009), but is nevertheless extensively used in research (Ul Hassan, Westerlund, Thor, Sandahl & von Thiele Schwarz, 2014; Raes, Kyndt, Decuyper, Van den Bossche & Dochy, 2015; Söderhjelm, Björklund, Sandahl & Bolander-Laksov, 2018; Jacobsson, Rydbo & Börresen, 2014) and practice (Wheelan, 2016). The critique lies mainly in the fact that the four stages of group development are disparate constructs, and in that the patterns that most groups go through might not be the optimal way to develop groups (Kozlowski, Watola et al., 2009). The GDQ is, however, based on the Integrated Model of Group Development

(IMGD) that is based on an effort to integrate previous research on group development into one generic model (Wheelan, 2005), which has its advantages with regard to the practice of group development. Another advantage is the possibility to apply one model to different types of group.

In organizational psychology, the increased interest in self-organizing or self-managing groups, e.g. Kaikkonen, Haapasalo and Hänninen (2018), has resulted in an increase interest in the connections between mature groups from a psychological perspective, and for example the implementation of agile teams in the software development context (Gren, Goldman & Jacobsson, In Pressa) or lean implementations in health organizations (Ul Hassan et al., 2014). In the former case, some initial research have shown that agile teams as well are helped by focusing on group development (Gren, Goldman & Jacobsson, In Pressb).

Overview of the Present Studies

We developed and validated a mini-version of the GDQ (60 items), the GDQS, with 13 items across three independent and diverse samples. We developed the 13-item version in Study 1 using a large and diverse sample from different countries answering the GDQ in English ($N = 1249$). We used Study 2 to evaluate the short version of the GDQ, and used Studies 1 and 2 to assess the convergent validity of the GDQS in relation to the complete GDQ. Studies 2 and 3 were done to assess the criterion-related validity in connection to measures of work health-, and process and performance-relevant criteria. Finally, in Study 4, we checked the concurrent validity of the GDQS against the Team Climate Inventory (TCI-14) (Kivimäki & Elovainio, 1999). We conclude this paper by suggesting practical use of the GDQS for researchers and provide group-level norm data from 2,646 groups from a fourth independent dataset.

Study 1: Development of the 13-item GDQS

Samples and Measures

Complete GDQ data were available from 1249 participants from different countries answering the GDQ in English. The main part came from USA, Sweden, Norway, Canada, Italy,

Portugal and Finland. Respondents came from a wide range of settings like schools, retail companies, manufacturing industry, medical research, health care and software development. The average group size was 9.3 members, 59% where females and 41% where males. The GDQ data stems from a consultancy firm who trains and offers consultants to use the complete Group Development Questionnaire (Wheelan & Hochberger, 1996) in working with group development in practice. Parts of the data have been used in other publications, and are detailed elsewhere, e.g. Jacobsson, Rydbo and Börresen (2014). Participants completed the 60-item GDQ with 15 items per the four subscales, on a 5-point Likert scale on whether the statements were true or not of their own group/team. Descriptive statistics for each of the 15-item subscales are shown in Table 1.

Table 1

Descriptive Statistics for the GDQ (Studies 1 and 2)

GDQ	α	MS	SD
Study 1 ($N = 1249$)			
Scale I	0.85	38.85	8.955
Scale II	0.94	35.43	11.020
Scale III	0.92	52.63	10.400
Scale IV	0.94	54.49	11.195
Study 2 ($N = 2462$)			
Scale I	0.77	40.21	7.80
Scale II	0.92	36.14	10.93
Scale III	0.88	51.90	9.17
Scale IV	0.91	52.80	9.88

Table 2

Descriptive Statistics for the GDQS (Studies 1 and 2)

GDQS	α	<i>MS</i>	<i>SD</i>
Study 1 (<i>N</i> = 1249)			
Scale I	0.75	9.84	3.09
Scale II	0.84	7.38	2.74
Scale III	0.87	10.61	2.80
Scale IV	0.85	11.28	2.61
Study 2 (<i>N</i> = 2462)			
Scale I	0.65	11.08	2.88
Scale II	0.74	7.41	2.67
Scale III	0.77	10.79	2.48
Scale IV	0.75	10.63	2.36

Results and Discussion

Method for Creating the GDQS Scales. The GDQ has been subjected to validation studies in the past (Wheelan & Hochberger, 1996). When applying a factor analytic procedure to the GDQ the four stages load on two main factors, which was confirmed in our analysis (see Figure 1). A phenomenon that has been observed before, Chang, Bordia and Duck (2003) found in an observational study an overlap between the Integrated Model of Group Development (IMGD) and the Punctuated Equilibrium Model (Gersick, 1988; Nance, 2011). The latter is a two-stage model most suitable for project groups. In Stage 1, which takes about half of the project time, the group is mostly disorganized and after half of the group's lifetime, when the pressure to deliver results increase, the groups get more organized and effective. In the observational study there was a correspondence between Stages 1 and 2 in the IMGD with Stage 1 in the punctuated equilibrium model and between Stages 3 and 4 in the former and Stage 2 in the later (Chang et al.,

Table 3

Convergent validity between the GDQ and the GDQS (Studies 1 and 2).

<i>Convergent Validity</i>	
Study 1 ($N = 1249$)	
Scale I	0.88
Scale II	0.93
Scale III	0.90
Scale IV	0.93
Study 2 ($N = 2462$)	
Scale I	0.84
Scale II	0.90
Scale III	0.84
Scale IV	0.90

2003). Wheelan and Hochberger (1996) argue that four distinct factors are not expected for the GDQ since there is evidence showing that the early stages of group development are intercorrelated. They further argue that the latter two stages are also intercorrelated in that “it is difficult to envision a work-oriented, productive group that is not cohesive and inattentive to organizational or structural issues” (Wheelan & Hochberger, 1996). Since the aim of the present study is not to add to the theoretical framework of the IMDG, but to create a short version of the GDQ with similar psychometric properties, we did not investigate this aspect further.

We conducted a reliability analysis including item analysis showing how each item contributed to the scale. We then removed the items that had the smallest contribution to the scale. The remaining items were scrutinized so they captured essential and different aspects of each stage. In more detail, to reduce the GDQ, we focused on optimizing the internal consistency of the four different scale. Therefore, we calculated a Cronbach’s α for the full GDQ and kept the

Figure 1. Scree plot showing that the GDQ only loads on two main factors/components (Study 1).

items with the lowest value on alpha if the item was removed, i.e. we wanted to remove the items with the highest obtained alpha left in the scale. We also analysed the short scales theoretically to confirm that they cover different, but connected, aspects of each scale. One interesting note is that the hierarchical leadership questions were all excluded in the scales, making them useful for use in self-organizing teams as well as more traditional team setups.

Basic Psychometric Properties of the Reduced Scales. Table 2 shows mean sums (we used this summary statistic since it has been used in previous studies on the GDQ), the standard deviation of the mean sums, and coefficient alphas for the GDQS scales. The GDQS, as can be seen in Table 2 had acceptable reliability especially due to the few items included (four items for scale I, and three items for Scales II-IV). The reason why Scale I has the lowest alpha is probably because the scale tries to measure many different aspects that are indicators of a lack of being a collaborative group. Earlier studies also confirm this fact and the Scale 1 has previously been adjusted in order to increase the alpha for that scale (Wheelan & Hochberger, 1996). All in all, the alphas were acceptable in both Studies 1 and 2. Table 3 shows the correlation coefficient

assessing the convergent validity between the complete GDQ and the GDQS. These coefficients ranged from 0.647 (Scale I, Study 2) to 0.870 (Scale III, Study 1).

Study 2: An Examination of the Content Validity of the GDQ and GDQS Scales

Sample

This sample in Study 2 consisted of 2462 employees in the manufacturing industry in Sweden. Data was collected in paper-form on site. Participant were shop managers (white collar), superintendents (white collar), supervisors (white collar), team leaders (blue collar) and production workers (blue collar). It is important to note here that in Study 2, the Scales used were the Swedish versions of the GDQ scales.

GDQ and GDQS Measures. Table 3 shows the convergent scale intercorrelations for the 60-item GDQ and the 13-item GDQS for Study 2. The values from Studies 1 and 2 are similar and show high or very high convergent validity between the GDQ and the GDQS.

Measures of Work Health-Relevant Criteria. Study 2 was also used to assess the criterion-related validity of the GDQS in relation to burnout, job satisfaction, and feelings of mastery. Burnout was measured by using the Emotional Exhaustion subscale of the Copenhagen Burnout Inventory (Kristensen, Borritz, Villadsen & Christensen, 2005), job satisfaction was measured by using the Indikator's Employee Survey (Jacobsson & Pousette, 2012), and feelings of mastery was measured by the scale suggested by Jacobsson, Pousette and Thylefors (2001). A small subset of the data used in Study 2 was separately published in Jacobsson, Rydbo and Börresen (2014).

Results and Discussion

Content- and Criterion-Related Validity. Table 4 shows the correlations between the GDQ and the GDQS and the three criterion-related measurements Emotional Exhaustion, Job Satisfaction, and Feelings of Mastery. As can be seen, the correlation coefficients are very similar between GDQ and the GDQS on all the three criterion measurements, thus it is concluded that the

GDQS has similar properties as the GDQ in predicting Emotional Exhaustion, Job Satisfaction, and Feelings of Mastery.

Table 4

Criterion-Related validity of Study 2.

GDQ ($N = 2462$)	Emotional Exhaustion	Job Satisfaction	Feelings of Mastery
Scale I	0.26	−0.23	−0.22
Scale II	0.34	−0.32	−0.28
Scale III	−0.34	0.49	0.45
Scale IV	−0.35	0.53	0.48
GDQS ($N = 2462$)	Emotional Exhaustion	Job Satisfaction	Feelings of Mastery
Scale I	0.23	−0.21	−0.17
Scale II	0.31	−0.31	−0.26
Scale III	−0.33	0.43	0.39
Scale IV	−0.32	0.47	0.44

*Note. All coefficients had $p < .01$ (2-tailed)

Study 3: An Examination of the Measures of Process-Relevant Criteria

Study 3 is based on data from two different publications. The first (Study 3A) used Scale II to assess interpersonal conflict (Gren, 2017) and the second (Study 3B) used Scale IV to assess group effectiveness (Gren, Torkar & Feldt, 2017). We analyse these jointly because the data used in the first paper were collected at the same time and from the same sample as a subset of the second paper.

Samples

In Study 3A (Gren, 2017), data were collected from three large Swedish technology organizations. The data consisted of survey responses from 68 software developers, and were collected on site and on paper. The three companies had between 14,000 and 160,000 employees and the response rate was 88%.

The second paper (Study 3B), which was published in Gren, Torkar and Feldt (2017), had participants from seven different organizations from Brazil and Sweden. The Brazilian data came from one public university, and three companies of different size in the IT industry. The three IT companies had from 35 to 5,000 employees. The data from the university was from the University of São Paulo and comprised responses from 132 students enrolled in an agile software development project course. The overall response rate for the Brazilian sample was 93%. The Swedish sample of the second consisted of the same companies as the first paper, i.e. 68 software developers. In total, the second paper had a sample of 200 with a response rate of 91% of which 198 were valid responses.

Results and Discussion

Criterion-Related Validity. As can be seen in Table 5, the patterns of the criterion-related validities are similar for both scales in both studies, however, the correlation between Iterative Development and GDQS Scale IV in Study 3B was 0.082 lower than the complete GDQ Scale IV measurement. Both these coefficients were significant at the same level, and we assess this difference as not substantial from a practical standpoint.

Study 4: An Examination of the Concurrent-related validity of the GDQS

In study 4, we examined the concurrent validity of the GDQS and GDQ against the Team Climate Inventory (TCI-14) with 14 items (Kivimaki & Elovainio, 1999). The TCI is a four-factor model of team innovation that comprises the four factors: (1) Vision, (2) Participative safety, (3) Task orientation, and (4) Support for innovation. The TCI is a well-researched and applied model

Table 5

Criterion-Related validity of Study 3.

	1. GDQS Scale II	2. GDQ Scale II	3. Iter. Dev.
Study 3A ($N = 68$)			
1. GDQS Scale II	1		
2. GDQ Scale II	-0.79	1	
3. Iterative Development	-0.37	-0.40	1
	4. GDQS Scale IV	5. GDQ Scale IV	6. Iter. Dev.
Study 3B ($N = 198$)			
4. GDQS Scale IV	1		
5. GDQ Scale IV	0.80	1	
6. Iterative Development	0.34	0.42	1

*Note. All coefficients had $p < .01$ (2-tailed)

regarding team maturity (Anderson & West, 1998). It has already been shown that the four factors of the TCI-14 and the full-GDQ have predicted convergent validity (Jacobsson & Wilmar, 2019). In Study 4, we used the same dataset to investigate if the GDQS had similar correlations. Wheelan and Hochberger (1996) also tested the complete GDQ against the Group Attitude Scale (Evans & Jarvis, 1986) with expected significant correlations to the different scales.

Sample

In total, 72 individuals belonging to 9 management teams filled in and returned the questionnaire with GDQ and TCI, for a response rate of 100%. The high response rate is because the researchers met all participants face-to-face at their management team meetings. 46 (71%) of the respondents were females, which is a normal proportion in Swedish human service organizations. The participating management team members came from three types of human

service organizations. They were leading elementary schools, municipal healthcare and health care organizations.

Results and Discussion

Concurrent-Related Validity. As can be seen in Table 6, the concurrent validity of the GDQS and full-GDQ is satisfactory across all scales. One advantage of the Integrated Model of Group Development, is that the four different scales ask about different types of behaviour. If a team in an early stage in its development only obtains lower values on the factors explaining a mature team, it is less clear what they actually need to do (Gren et al., In Pressb).

Table 6

Concurrent validity of the GDQS and full-GDQ against the TCI-14 measure, based on 72 individuals.

	GDQ	Scale I	Scale II	Scale III	Scale IV
TCI Vision		-0.40	-0.40	0.51	0.60
TCI Participative safety		-0.70	-0.71	0.76	0.74
TCI Task orientation		-0.61	-0.43	0.68	0.68
TCI Support for innov.		-0.70	-0.68	0.72	0.68
	GDQS	Scale I	Scale II	Scale III	Scale IV
TCI Vision		-0.32	-0.33	0.42	0.49
TCI Participative safety		-0.52	-0.61	0.74	0.66
TCI Task orientation		-0.48	-0.36	0.61	0.56
TCI Support for innov.		-0.56	-0.60	0.69	0.54

*Note. All coefficients had $p < .01$ (2-tailed)

General Discussion

The results from all the four conducted studies show that the GDQS is similar to its parent measure GDQ. It was similar both in relation to sufficient internal consistencies with α s at or well above .65, convergent and criterion-related validity, and concurrent validity. The convergent validity was investigated by using large datasets ($N = 1249$ and $N = 2462$ respectively) and looking at intercorrelations between the short and long version of the measures the coefficients ranged from 0.647 to 0.870). The criterion-related validity was investigated in relation to health-relevant criteria (burnout, job satisfaction, and feeling of mastery), which were all very similar to the parent measure even with a heavily reduced set of items. This was also true for a process-relevant criteria in the context of agile software development. In the final study, Study 4, we also found high concurrent validity of the GDQS as compared to the full GDQ in connection to the Team Climate Inventory (Kivimaki & Elovainio, 1999).

Since the GDQ was developed in the USA in the 1990s, some of its questions are in relation to a traditional view of a leader/manager. Our experience from using the GDQ, e.g. with agile teams, is that self-organizing teams, or teams that are expected to self-manage, have difficulty answering these questions. One example could be the Stage 1 item “Members tend to go along with whatever the leader suggests.” Fortunately, the items in the statistically reduced GDQS do not include any of these leadership items, which makes it useful in all types of work-group. We would argue that the stages of the IMGd is not dependent of traditional leadership, but on the contrary, as it includes how the leadership function is more and more shared over time (Kozlowski, Watola et al., 2009).

Sometimes, extensive surveys with more than 30 items are simply not feasible to use in research. Even if the original measures are more reliable and valid in practice, they make many interesting studies impossible to conduct due to lack of resources. The resources range from researchers’ time and participants’ attention span to available time period allowed for testing in different organizations. When it comes to research in the team-based workplace, distributing a very short reliable and valid measurement could even enable the use of group development as a

background (or blocking) variable when investigating other constructs. To enable more group development research, we created a brief measure of the Group Development Questionnaire (the GDQ) using standard psychometric methods. We managed to create a practically useful short version of the GDQ, the GDQS, only containing 13 items.

In light of the results in the current paper, we believe the GDQS can be useful for many researchers investigating, or blocking, the effects of group maturity in the workplace. The full-GDQ is copyrighted and used as a consultancy tool and comprises 60 items, which both make it cumbersome to use broadly in research. In the GDQS we reduced the number of items by 78% plus include the 13 items to be used freely in research (with written permission from GDQ Associates¹). When doing interventions in work-groups, we still recommend the full-GDQ since it covers many more aspects of group dynamics that can guide the work-groups forward.

In the paper by Donnellan et al. (2006), they conclude that they: “gained several insights into the construction of short forms that are likely to have broad applicability to researchers who opt to shorten existing measures.” We are in great debt to them leading the way in creating and validating short measures in a rigorous and scientific way. We would not have been able to create the GDQS if it was not for the extensive research and validation studies conducted on the full-GDQ in the past both in theory and practice. A short version can not exceed the validity of its parent measure, and “developing an appropriate short form requires theoretical and conceptual understanding of the constructs under investigation” (Donnellan et al., 2006). We also followed the recommendations by Smith et al. (2000) and included large independent datasets from different context. Since we obtained satisfactory results again and again, we have build confidence in the GDQS in that it measures the four stages of the IMGD.

The largest threat against this study is that no test-retest of the GDQS was conducted in this set of studies. This type of test reliability is possible if the construct under study is expected to be stable over time. In Donnellan et al. (2006), for example, personality traits are assumed to be stable at least over a period of years. Group development, on the other hand, is expected to

¹<https://gdqassoc.com/>

change and sometimes rapidly, which made it hard to sample from real groups for this purpose. Still, future studies could try to administer the GDQS with only maybe a week in between, however, we do not know about the learning effects of the 13 item- as compared to the 60-item survey so having such short time between data collection is also cumbersome. Even if longer instruments have their own potential measurement error, but if a person remembers the items, or does not have time to get in the right mindset with so few questions, the validity of the GDQS is threatened since we will have increased the measurement error instead of the opposite.

Using the GDQS in research

Collecting data and calculating mean values for each GDQ scale, just like the parent measure, can now be conducted by using the GDQS scales instead of the full GDQ when investigating group development in research. However, from our experience, groups that fill out the GDQ will most likely want to know their results as compared to other groups. When using the Integrated Model of Group Development they would then want to know where they are in the four stages as compared to norm data. A common misconception of the GDQ is that a group (or team) is in one stage only, which is not the case. A group tends to obtain higher values on one scale, but will get a result across all the four scales. In practice, stage diagnosis is based on groups' mean values in comparison to norm data on the four scales. For the practical research use of the GDQS, we offer a similar comparison for the short version.

Norm data

We obtained group-level data from the online platform used for the full GDQ between 2009 and 2016. The data is from a wide range of work groups belonging to many different economic sectors in 23 countries. About half of the sample contains Swedish work groups and the other half 22 other countries such as Norway, USA, Canada, Great Britain, Brazil, China and Australia. Norm data contains about 23.000 respondents belonging to 2,646 groups. Table 8 shows the norm data for the four different scales use for the full GDQ (previously unpublished) and Table shows the same norm data but for the short version of the GDQ (the GDQS). Groups can then find out

where they are on the four different scales and know where to focus their efforts to mature. As stated in the introduction, and also confirmed in the Punctuated Equilibrium Model (Gersick, 1988; Nance, 2011), groups should try to obtain low values on stages 1 and 2 and increase their values on stages 3 and 4 by reflecting on their collaboration in connection to the Integrated Model of Group Development (Wheelan, 2005). Please note, though, that in the full version of the GDQ, groups can break down their results on all 15 items per scale, but in the short version suggested in this paper, groups need to see their results on each scale as representative of the entire scale. Groups then need to consult the whole theory described in the Integrated Model of Group Development. If the groups only track their results on the 13 items included in the GDQS they could miss crucial aspect of each stage. We do not know which items in the full GDQ that causes a specific group to mature and, therefore, the GDQS should be used with care when basing interventions on the result on specific items. Another negative aspect in the GDQS and the comparison with norm data is that, with so few items, a small change in responses leads to more extreme changes in mean values on each scale as compared to the GDQ. Therefore, a categorization of groups into where they need to focus in order to mature over time, should take these larger fluctuations into account. Even if we are quite confident that the GDQS gives an overall maturity profile (based on the four scale mean values) we do not yet know what levels teams have when they go through the stages. Such longitudinal studies should be conducted with hope of there being threshold values in all stages for teams that fit a certain stage more than the other.

References

- Anderson, N. R. & West, M. A. (1998). Measuring climate for work group innovation: development and validation of the team climate inventory. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 19(3), 235–258.
- Chang, A., Bordia, P. & Duck, J. (2003). Punctuated equilibrium and linear progression: Toward a new understanding of group development. *Academy of Management Journal*, 46(1), 106–117.
- Donnellan, M. B., Oswald, F. L., Baird, B. M. & Lucas, R. E. (2006). The mini-ipp scales: tiny-yet-effective measures of the big five factors of personality. *Psychological assessment*, 18(2), 192–203.
- Evans, N. J. & Jarvis, P. A. (1986). The group attitude scale: a measure of attraction to group. *Small Group Behavior*, 17(2), 203–216.
- Gersick, C. J. (1988). Time and transition in work teams: Toward a new model of group development. *Academy of Management journal*, 31(1), 9–41.
- Gren, L., Torkar, R. & Feldt, R. (2017). Group development and group maturity when building agile teams: A qualitative and quantitative investigation at eight large companies. *The Journal of Systems and Software*, 124, 104–119. doi:10.1016/j.jss.2016.11.024
- Gren, L. (2017). The links between agile practices, interpersonal conflict, and perceived productivity. In *Proceedings of the 21st international conference on evaluation and assessment in software engineering* (pp. 292–297). ACM.
- Gren, L., Goldman, A. & Jacobsson, C. (In Pressa). Agile ways of working: a team maturity perspective. *Journal of Software: Evolution and Process*, e2244.
- Gren, L., Goldman, A. & Jacobsson, C. (In Pressb). The perceived effects of group developmental psychology training on agile software development teams. *IEEE Software*.
- Jacobsson, C. & Pousette, A. (2012). Psykosocial arbetsmiljö i vård och omsorg – bakgrund till Indikators medarbetarenkät [psychosocial work environment in health care sector —

- background to Indikator's employee survey]. *Unpublished manuscript, Institutet för kvalitetsindikatorer, Gothenburg, Sweden.*
- Jacobsson, C. & Wilmar, M. (2019). Group processes—the links between team climate inventory and group development questionnaire. *Clin Exp Psychol*, 5, 1–4.
- Jacobsson, C., Pousette, A. & Thylefors, I. (2001). Managing stress and feelings of mastery among swedish comprehensive school teachers. *Scandinavian Journal of Educational Research*, 45(1), 37–53.
- Jacobsson, C., Rydbo, N. & Børresen, J. E. (2014). The links between group development and health in manufacturing industry. *Small Group Research*, 45(4), 400–415.
- Kaikkonen, H., Haapasalo, H. & Hänninen, K. (2018). Characteristics of self-managing teams in rapid product development projects. *International Journal of Value Chain Management*, 9(1), 1–25.
- Kivimäki, M. & Elovainio, M. (1999). A short version of the team climate inventory: Development and psychometric properties. *Journal of occupational and organizational psychology*, 72(2), 241–246.
- Kozlowski, S. W. & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological science in the public interest*, 7(3), 77–124.
- Kozlowski, S. W., Watola, D. J., Jensen, J. M., Kim, B. H. & Botero, I. C. (2009). Developing adaptive teams: A theory of dynamic team leadership. In E. Salas, G. F. Goodwin & C. S. Burke (Eds.), *Team effectiveness in complex organizations: Cross-disciplinary perspectives and approaches* (pp. 113–155). New York, US: Routledge.
- Kristensen, T. S., Borritz, M., Villadsen, E. & Christensen, K. B. (2005). The copenhagen burnout inventory: A new tool for the assessment of burnout. *Work & Stress*, 19(3), 192–207.
- Nance, T. (2011). *A longitudinal study of multidisciplinary engineering design teams using Gersick's punctuated equilibrium model of group development*. (Doctoral dissertation, The University of Alabama in Huntsville).

- Raes, E., Kyndt, E., Decuyper, S., Van den Bossche, P. & Dochy, F. (2015). An exploratory study of group development and team learning. *Human Resource Development Quarterly*, 26(1), 5–30.
- Schmidt, F. L., Le, H. & Ilies, R. (2003). Beyond alpha: an empirical examination of the effects of different sources of measurement error on reliability estimates for measures of individual-differences constructs. *Psychological methods*, 8(2), 206–224.
- Smith, G. T., McCarthy, D. M. & Anderson, K. G. (2000). On the sins of short-form development. *Psychological assessment*, 12(1), 102–111.
- Söderhjelm, T., Björklund, C., Sandahl, C. & Bolander-Laksov, K. (2018). Academic leadership: management of groups or leadership of teams? a multiple-case study on designing and implementing a team-based development programme for academic leadership. *Studies in Higher Education*, 43(2), 201–216.
- Ulhassan, W., Westerlund, H., Thor, J., Sandahl, C. & von Thiele Schwarz, U. (2014). Does lean implementation interact with group functioning? *Journal of health organization and management*, 28(2), 196–213.
- Wheelan, S. (2005). *Group processes: A developmental perspective* (2nd ed.). Boston: Allyn and Bacon.
- Wheelan, S. & Hochberger, J. (1996). Validation studies of the group development questionnaire. *Small Group Research*, 27(1), 143–170.
- Wheelan, S. (2016). *Creating effective teams: A guide for members and leaders* (5th ed.). Thousand Oaks: SAGE.
- Wheelan, S. & Mckeage, R. (1993). Developmental patterns in small and large groups. *Small Group Research*, 24(1), 60–83.

Table 7

13-Item GDQS.

Item	Scale	Text	Original Item Number
1	I	Individuals seem to go along with whatever the group suggests.	21
2	II	People express frustration with how this group is functioning.	10
3	III	Trust is high in this group.	35
4	IV	The group acts on its decisions.	28
5	I	When members talk, they address the same few people.	25
6	II	The group seems split over a number of issues.	22
7	III	Members are satisfied with the group's progress.	39
8	IV	The group encourages innovation and creativity.	40
9	I	Members seem very concerned about feeling safe in the group.	29
10	II	There is quite a bit of tension in the group at this time.	50
11	III	We can rely on each other. We work as a team.	43
12	IV	Commitment to the group's task is high in this group.	56
13	I	People seem hesitant to express a different point of view.	37

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Table 8

Full GDQ norm data based on 2,646 groups.

	Scale I	Scale II	Scale III	Scale IV
Max. value	75.00	75.00	75.00	75.00
84th percentile	44.00	43.87	59.00	60.89
Mean value	38.41	35.10	52.60	54.20
16th percentile	32.67	27.00	46.50	48.16
Min. value	15.00	15.00	15.00	15.00
Stand. dev.	6.57	8.67	7.74	7.98

Table 9

GDQS norm data based on 2,646 groups.

	Scale I	Scale II	Scale III	Scale IV
Max. value	20.00	15.00	15.00	15.00
84th percentile	11.61	9.60	12.57	13.00
Mean value	9.65	7.37	10.65	11.34
16th percentile	7.80	5.29	8.83	9.93
Min. value	4.00	3.00	3.00	3.00
Stand. dev.	2.11	2.14	2.08	1.83