Development of a computer-based competency self-assessment tool for training plan design

Alexandre Baudet, Guillaume Gronier, Eric Ras

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST

1. Context

Changing competencies are needed to perform:
➢ Increasing need to manage your occupational competencies.
➢ Increasing usefulness of computer-based competency self-assessment tools.

Several perspectives from which to consider assessment effectiveness: here we focus on one psychometric indicator.

To investigate the inter-rater correlation between a competency self-assessment of mechanics and an assessment by their supervisor assessment, both assessing the same competencies, mechanics also took a Multiple Choice Questionnaire (MCQ).

Our tool, Cross Skill®, used for several purposes, was the medium used to run the competency assessments (but not the MCQ) in order to design the training plan.

2. Research question

Hypothesis: thanks to random and adaptive questions (Figure 1), we expect to see inter-rater correlations between a job incumbent competency self-assessment and its supervisor's assessment that are higher than the *usual* correlations found in performance assessment studies.

From literature: inter-rater correlation between self-assessment and supervisor assessment are between 0.05 and 0.22 (e.g. Conway & Huffcutt, 1997).

⚠ Difference between these studies and our case study: we focus only on *competency*, one of the determinants of performance but not the *performance* per se.

3. Cross Skill®: How does it work?

As a sole input - a competency model provided by an HR department - Cross Skill® aims to provide accurate and satisfactory assessments in a cost-effective manner.

Cross Skill®-compliant competency profiles are designed as a list of activities and sub-activities, broken down into competencies (in the areas of Knowledge, Skills/Know-how and Attitudes).

Despite a lull in research on rating formats, we have designed a so-called adaptive and random rating format (Figure 1) with Yes/No answers (Figure 2).
Instead of defining proficiency criteria and indicators for each competency, Cross Skill® has several assessment templates hardcoded Figure 3).
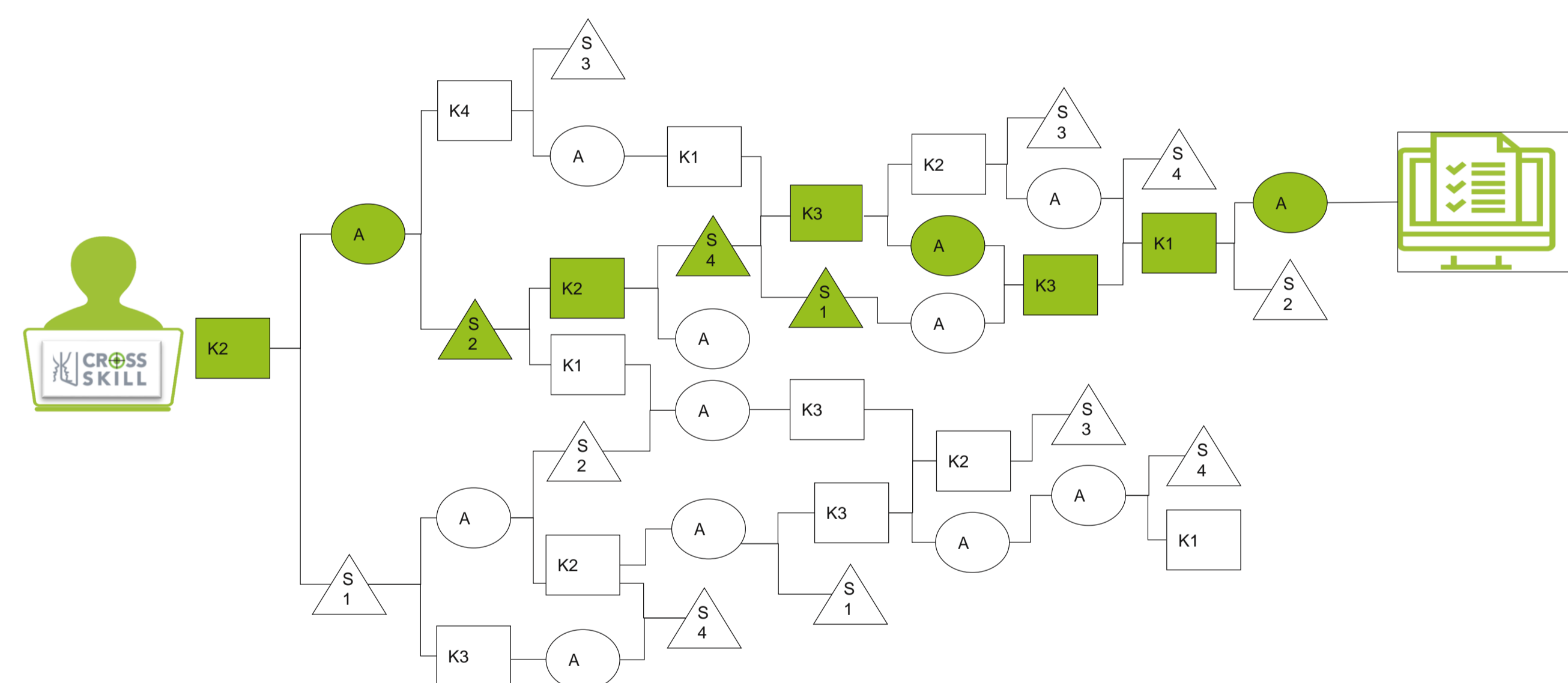

Figure 1: Illustration of an adaptive and random sequencing of items by Cross Skill®. K means Knowledge, S means Skills and A mean attitudes. 1,2,3,4 are the proficiency levels of the items.

Figure 2: Example of a forced-choice question. Know-How/Skill assessment template.

Figure 3: Illustration of the generic hardcoded know-how assessment template (4 proficiency levels).

Patent pending: US20170193449A1.

4. Method

Sample: mechanics > only men. Mean age: 44 years old (SD = 11.5). No significant difference in terms of age.
One data set encompassing 342 dyads (mechanics and their supervisor).

Three main measures were computed in SPSS 23:
1. Competency self-assessment with Cross Skill® by mechanics.
2. Competency assessment of the mechanics by their supervisor with Cross Skill®.
3. Competency assessment thanks to a MCQ (80 items) by mechanics.

5. Results

As predictable, subordinates self-assessed mean scores ($M = 63$; $SD = 16$) are slightly higher than mean scores given by the subordinates' supervisors ($M = 59$; $SD = 17$).
Reliability analysis are satisfying for each measure:
- Cross Skill® Self-assessment Cronbach's Alpha: $\alpha = 0.90$.
- Cross Skill® Supervisor-assessment Cronbach's Alpha: $\alpha = 0.89$.
- MCQ Cronbach's Alpha: $\alpha = 0.85$.

According to the correlations (see Table 1), we get significant positive interrater correlations (green cell): $r(239)= .58$ $p < .000$ by using Cross Skill®. As always, correlation is not causality and the amount of common variance gained through the use of Cross Skill® is not verifiable.

Table 1
Correlations between the Cross Skill® self-assessment, Cross Skill® supervisor assessment and Mechanic's MCQ.

		Self_assessment _Mean_Score	Supervisor_assessment _Mean_Score	MCQ_Mean_score _out_of_80
Self_assessment_Mean_Score	Pearson Correlation	1	.584**	.556**
	Sig. (2-tailed)		.000	.000
	N	342	239	338
Supervisor_assessment_Mean_Score	Pearson Correlation	.584**	1	.451**
	Sig. (2-tailed)	.000		.000
	N	239	241	236
MCQ_Mean_score_out_of_80	Pearson Correlation	.556**	.451**	1
	Sig. (2-tailed)	.000	.000	
	N	338	236	339

**. Correlation is significant at the 0.01 level (2-tailed).

It is remarkable to see that self-assessment got a higher correlation with the MCQ than the superior assessment did (blue cells).

For test-retest results or validity cues related to other use cases using Cross Skill®, please see Baudet, Ras and Latour (2018).

6. Discussion

For the current use case: significant positive interrater correlations: $r(239)= .58$ $p < .001$ by using Cross Skill®.
⚠ No proof that these correlations are explained by our rating formats and assessment templates.
This research is a new step to our "validity and generalizability journey".

Previous case study, (performance appraisal of bankers) interrater reliability between the scores of the subordinate/the supervisor: $r(59) = .26$, $p < .048$ (Baudet et al., 2018).
Does it depend on the job assessed, the job description, the test-takers (personality, organization's context, etc.)?

7. Future work

1. Deepen this "rating scale topic" by looking at the magnitudes of inter-rater correlations with other jobs (blue and white collars, managers), bigger samples, different context, etc.

2. Also consider the political, psychological and contextual determinants of assessments (see for example Levy & Williams, 2004).

3. Rater and ratee personality will be considered in future case studies.
In a previous case study, we looked and found an absence of correlation between several personality traits (self-efficacy, agreeableness, conscientiousness, modesty) and Cross Skill® competency assessments. These personality variables are usually predictors of lenient or severe assessments.

4. Plan to control the impact of the assessment's stake, as high stake assessment tend to increase rating distortion.

8. References

Baudet A., Ras E., & Latour T. (2018). Semi-automatic Generation of Competency Self-assessments for Performance Appraisal. In E. Ras & A. Guerrero Roldán (Eds.), *Technology Enhanced Assessment. TEA 2017. Communications in Computer and Information Science:* Vol. 829. 26-39. Springer, Cham. https://doi.org/10.1007/978-3-319-97807-9_3
Conway, J. M., & Huffcutt, A. I. (1997). Psychometric properties of multisource performance ratings: A meta-analysis of subordinate, supervisor, peer, and self-ratings. *Human Performance, 10*(4), 331-360. http://dx.doi.org/10.1207/s15327043hup1004_2
Levy, P. E., & Williams, J. R. (2004). The social context of performance appraisal: A review and framework for the future. *Journal of Management, 30*(6), 881-905. http://dx.doi.org/10.1016/j.jm.2004.06.005

Try Cross Skill®