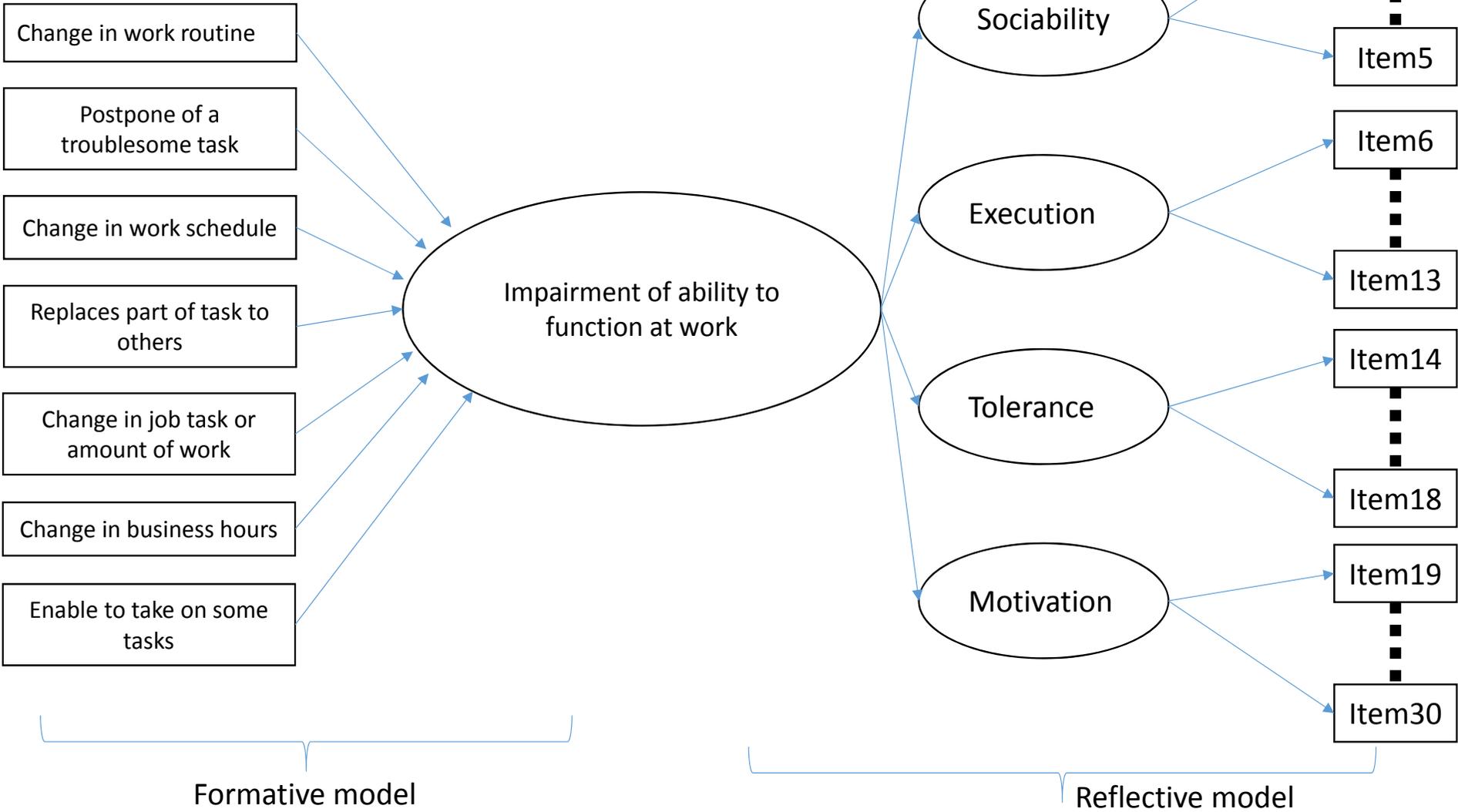


Appendix 1. Study phase and development process

Study phase	Aim	Subjects and Methods
Development stage	To conceptualize a construct To generate items To examine content validity	Focus group discussion Interview
Pilot testing	To examine a structural validity To select items To refine items and examine fitness to the Rash model	Internet survey (n=1000) Exploratory and confirmatory factor analyses Rasch model analysis
Field testing	To examine construct validity To examine differential test functioning	Manufacturing worker (n=1294) Additional samples from 5 workplaces

Appendix 2. A formative model and a reflective model of work impairment due to health problems

Items for particular job disruptions



Appendix 3. Candidate items

Compared with when you're in a typically good physical condition, how often do you currently experience the following situations?

- Item 1 I have felt that having a conversation is a pain.
- Item 2 I have not been able to smile.
- Item 3 Being affable required an effort.
- Item 4 I haven't been able to behave socially.
- Item 5 I have had a communication problem.
- Item 6 I haven't been able to utilize specialized knowledge and skill.
- Item 7 I have lacked ideas and inspiration.
- Item 8 I haven't been able to work with curiosity.
- Item 9 I haven't been able to maintain the quality of my work.
- Item 10 I have taken too long to complete work.
- Item 11 I have had trouble thinking clearly.
- Item 12 I have lacked the ability to concentration.
- Item 13 The number of mistakes I make has increased.
- Item 14 I have taken longer breaks.
- Item 15 I have taken more rests during my work.
- Item 16 I have had some difficulty reading texts.
- Item 17 I have had some difficulty preparing documents.
- Item 18 I have felt very drowsy at work.
- Item 19 I have felt that my work isn't going well.
- Item 20 I have felt that rules and instructions were inconvenient.
- Item 21 I haven't been able to make rational decisions.
- Item 22 I haven't been able to keep my goal in mind at work.
- Item 23 I could not find the work before others.
- Item 24 I have spent time doing things that were not necessary at that moment.
- Item 25 I have felt like time is passing slowly.
- Item 26 I haven't been proactive about my work.
- Item 27 I haven't been motivated.
- Item 28 I have thought of changing, leaving, or reallocating jobs due to my health
- Item 29 I haven't wanted to pick up the phone.
- Item 30 I haven't put any effort into self-improvement (qualification learning, English conversation, personal empowerment, workshop participation, etc.).

The items were originally developed in Japanese, and these were translated only for publication purposes and have not been verified with respect to back translation or cross-cultural differences. The Japanese version of the WFun is available from the corresponding author upon request.

Appendix 4. Preliminary Rasch analysis and item fit statistics

Items	Measure	SE	Infit mean-square	Outfit mean-square	Reason for deletion
Item 1	-0.59	0.04	1.14	1.16	Not necessary
Item 2	-0.42	0.04	0.99	1.06	Not necessary
Item 3	-0.54	0.04	1.05	0.97	Not necessary
Item 4	-0.31	0.04	0.97	0.9	
Item 5	0.33	0.05	1.08	0.87	
Item 6	0.63	0.05	1.16	0.89	Not necessary
Item 7	-0.12	0.04	0.92	0.9	Not necessary
Item 8	-0.27	0.04	0.85	0.78	Not necessary
Item 9	-0.24	0.04	0.89	1.11	
Item 10	-0.39	0.04	0.99	1.24	Not necessary
Item 11	-0.38	0.04	0.74	0.73	
Item 12	-0.77	0.04	0.82	1.01	
Item 13	0.07	0.04	0.9	0.84	
Item 14	0.02	0.04	1.49	1.87	Misfit
Item 15	0.23	0.04	1.21	1.25	
Item 16	0.59	0.05	1.23	1.01	Not necessary
Item 17	0.6	0.05	1.1	0.91	Not necessary
Item 18	-0.15	0.04	1.51	1.86	Misfit
Item 19	-0.2	0.04	0.81	0.87	
Item 20	0.28	0.04	0.97	0.76	Not necessary
Item 21	0.24	0.04	0.74	0.69	
Item 22	0.31	0.05	0.78	0.61	
Item 23	0.26	0.04	0.81	0.68	Not necessary
Item 24	0.26	0.04	0.97	0.84	Not necessary
Item 25	-0.26	0.04	1.34	1.62	Misfit
Item 26	0.1	0.04	0.73	0.66	
Item 27	-0.73	0.04	1.04	1.2	
Item 28	0.78	0.05	1.6	1.17	Misfit
Item 29	0.31	0.05	1.31	1.05	Not necessary
Item 30	0.37	0.05	1.34	1.08	Not necessary

Appendix 6. Factor loadings after promax rotation and inter-item and item-total correlations.

Item	Factor loadings (blanks represent <.4)				Within each factor		
	Factor 1 (motivation)	Factor2 (execution)	Factor 3 (sociability)	Factor 4 (tolerance)	Item-rest correlation	Cronbach's alpha if item deleted	Cronbach's alpha
Item 1			0.77		0.82	0.93	0.941
Item 2			0.87		0.88	0.92	
Item 3			0.79		0.85	0.93	
Item 4			0.81		0.88	0.92	
Item 5			0.67		0.78	0.94	
Item 6		0.47			0.74	0.94	0.943
Item 7		0.63			0.82	0.93	
Item 8		0.52			0.82	0.93	
Item 9		0.49			0.78	0.94	
Item 10		0.50			0.76	0.94	
Item 11		0.69			0.85	0.93	
Item 12		0.58			0.80	0.94	
Item 13		0.55			0.80	0.94	
Item 14				0.76	0.71	0.89	
Item 15				0.85	0.82	0.87	
Item 16				0.76	0.81	0.87	
Item 17				0.74	0.83	0.87	
Item 18				0.42	0.64	0.91	
Item 19	0.45				0.82	0.96	0.959
Item 20	0.62				0.83	0.95	
Item 21	0.45				0.84	0.95	
Item 22	0.53				0.86	0.95	
Item 23	0.50				0.85	0.95	
Item 24	0.48				0.80	0.96	
Item 25	0.69				0.71	0.96	
Item 26	0.61				0.86	0.95	
Item 27	0.63				0.75	0.96	
Item 28	0.58				0.72	0.96	
Item 29	0.55				0.77	0.96	
Item 30	0.50				0.77	0.96	
Eigenvalue	17.6	16.8	15.3	15.0			

Appendix 7. Discriminant and convergent validity of raw scores according to characteristics in the pilot study (n=1000)

	n	Mean	SD	p *
Sex				
Men	500	14.6	7.5	0.584
Women	500	14.3	6.9	
Age group				
20-29	200	16.2	7.7	<0.001
30-39	200	14.7	7.7	
40-49	200	15.2	7.7	
50-59	200	13.8	6.7	
60-69	200	12.3	5.6	
Employment status				
Full time	542	15.0	7.6	0.172
Non-regular employee (temporary worker, contract employee)	93	14.3	7.2	
Part time	239	13.5	6.3	
Self-employed	110	13.9	6.9	
Contract (outsourcing)	16	14.9	5.8	
Job type				
Mainly desk work	512	14.8	7.4	0.284
Mainly jobs involving interpersonal communication	231	14.0	6.8	
Mainly labor	257	14.1	7.0	
Annual income				
< 1,000,000 JPY	136	13.9	7.1	0.208
1,000,000-2,000,000 JPY	173	13.8	6.9	
2,000,000-3,000,000 JPY	167	14.8	7.3	
3,000,000-5,000,000 JPY	270	15.1	7.6	
5,000,000-7,000,000 JPY	141	13.5	6.8	
7,000,000-10,000,000 JPY	83	14.6	6.9	
> 10,000,000 JPY	30	15.8	8.1	
I have changed my work routine				
Not at all	646	12.6	6.4	<0.001 ⁺
One or more days a month	159	14.2	5.4	
About one day a week	96	18.5	7.2	
Two or more days a week	72	21.3	6.8	
Almost everyday	27	26.1	8.2	
I have postponed a troublesome task				
Not at all	542	12.2	6.4	<0.001 ⁺
One or more days a month	193	13.4	5.1	
About one day a week	121	17.0	6.2	
Two or more days a week	102	20.1	6.5	
Almost everyday	42	27.1	7.0	
I have changed a work schedule				
Not at all	661	12.6	6.3	<0.001 ⁺
One or more days a month	160	14.6	5.9	
About one day a week	98	19.3	6.8	
Two or more days a week	60	20.9	7.3	
Almost everyday	21	29.8	4.2	
I asked other staff to take a part/all of my task				
Not at all	799	13.3	6.7	<0.001 ⁺
One or more days a month	110	16.0	6.0	
About one day a week	49	21.6	6.0	
Two or more days a week	32	21.3	8.0	
Almost everyday	10	29.6	8.4	
The content or amount of my work has been				
Not at all	803	13.1	6.5	<0.001 ⁺
One or more days a month	88	16.9	6.0	
About one day a week	53	20.8	7.1	
Two or more days a week	34	21.8	6.9	
Almost everyday	22	27.2	8.4	
My work hours have been changed				
Not at all	801	13.2	6.6	<0.001 ⁺
One or more days a month	87	15.7	5.9	
About one day a week	52	19.7	6.8	
Two or more days a week	39	21.7	6.6	
Almost everyday	21	28.3	7.0	
I could not take on some work due to poor health condition				
Not at all	786	13.2	6.6	<0.001 ⁺
One or more days a month	113	16.6	6.4	
About one day a week	53	19.8	6.6	
Two or more days a week	33	22.0	7.1	
Almost everyday	15	28.5	8.6	
SF-8				
0-14	127	9.7	4.8	<0.001 ⁺
15-19	289	11.4	4.6	
20-24	306	14.2	6.1	
25-29	194	18.4	7.2	
30-	84	24.1	7.8	
Stanford Performance Scale				
0-19	112	9.0	2.3	<0.001 ⁺
20-24	184	10.5	3.9	
25-29	317	14.3	6.2	
30-34	313	16.4	7.4	
35-	74	24.7	7.4	
Follow-up status after 3 months				
I missed work more than 1 day due to bad health condition (including paid leave)	148	19.5	8.2	<0.001
I took a leave of absence	11	27.1	6.3	
I left a job and am currently not working	13	20.5	8.9	
I moved to a different job	14	15.6	9.0	
None of the above	681	14.5	6.5	

* P values were derived from ANOVA.

⁺ P values were derived from ANOVA with the linear trend test.