



# The effect of gender differences on creative self-efficacy

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# Top 10 Skills You Need to Thrive in 2020

## in 2020

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1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management
5. Coordinating with Others
6. Emotional Intelligence
7. Judgment and Decision Making
8. Service Orientation
9. Negotiation
10. Cognitive Flexibility



## in 2015

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1. Complex Problem Solving
2. Coordinating with Others
3. People Management
4. Critical Thinking
5. Negotiation
6. Quality Control
7. Service Orientation
8. Judgment and Decision Making
9. Active Listening
10. Creativity



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# *Creativity*

***Creativity*** is a stable, continuously distributed trait, separate from intelligence, that is the source of novel, original, and appropriate solutions (Brown, 1989; Guilford, 1950)

Creativity can be expressed through **two dimensions**:

***Creative thinking*** is an internal mental state-like expression of creativity in which fluency, flexibility, elaboration, and originality enables an individual to produce novel, original, and appropriate thoughts (Torrance, 2008)

***Creative performance***, in contrast, is seen as an external social state-like expression of creativity in which an individual's internal drive, the domain appropriateness of his or her work, and the approval of that domain's gatekeepers lead to recognition (Csikszentmihalyi, 1996)

## *Factors of creative thinking*

**Fluency** - the ability to offer a large number of new ideas per time unit

**Flexibility** - the ability to offer various ideas, use different problem-solving strategies

**Elaboration** - the ability to develop, supplement, modify already arisen ideas

**Originality** - ability to propose ideas that are different from the generally accepted, obvious, banal

## *Factors of creative performance*

**Domain** - sphere of activity, in which there is the creative process (art, science, engineering, etc.)

**Field** - environment that assesses the creative process (critics, art historians, spectators, users, etc.)

**Personality** - personal characteristics and properties of the individual (self-confidence, motivation, independence of judgments, openness to experience, etc.)

# *Self-Efficacy*

***Self-efficacy*** is a motivational state that is an individual's self-rated capacity to execute certain actions in order to achieve some objective. Self-efficacy “ is concerned not with what one has but with belief in what one can do with whatever resources one can muster” (Bandura, 2007). A self-efficacy construct exists for every domain of functioning.

***Creative self-efficacy*** is a motivational state that is an individual's self-efficacy for expressing creativity. It also has two dimensions (Abbott, 2010):

***Creative thinking self-efficacy (CTSE)*** is an individual's belief in his or her own ability to express creative thinking.

***Creative performance self-efficacy (CPSE)*** is an individual's belief in his or her own ability to express creative performance.

# Research Questions

1. What is the latent structure of creative self-efficacy?  
*(measurement model, dimensionality, the model fit)*
2. Are there any differences between men and women in creative self-efficacy?  
*(DTF, DGF and DIF analysis, bias or impact, reason of the construct multidimensionality)*

## Data Collecting

**Sample:** 248 Ukrainian students (181 girls and 67 boys) of the three faculties (Physics and Mathematics -101, Natural Sciences and Geography - 57, and Psychology and Social Work - 90) from Nizhyn University.

**Inventory:** CTSE and CPSE questionnaire which contains 28 items, proposed by Abbott (2009).

Factor	Creative Thinking Self-Efficacy (CTSE)
fluency	<ol style="list-style-type: none"> <li>1. Get a large number of different ideas or responses</li> <li>2. Come up with many possible solutions to a situation</li> <li>3. Arrive at a variety of conclusions given a difficult situation</li> <li>4. Think of many answers to a difficult problem or situation</li> </ol>
flexibility	<ol style="list-style-type: none"> <li>5. Come up with different kinds of responses, not just different responses?</li> <li>6. Answer problems in different ways, each of which are unique and special?</li> <li>7. Think of many types of ideas while considering a problem?</li> <li>8. Answer problems in different forms or styles?</li> </ol>
elaboration	<ol style="list-style-type: none"> <li>9. Think of ways to defend a 'crazy' thought, by thinking back on what you already know?</li> <li>10. Talk to your friends about wild ideas, and make them sound reasonable?</li> <li>11. Tell stories based on dreams you had, even if you need to fill in answers?</li> <li>12. Connect day-dreams or new ideas to things you have already learned?</li> </ol>
originality	<ol style="list-style-type: none"> <li>13. Be the first in a group to come up with an original suggestion?</li> <li>14. Arrive at a novel solution before other people?</li> <li>15. Beat other people in imagining a brand new idea first?</li> <li>16. Think of ideas no one else has?</li> </ol>



Factor	Creative Performance Self-Efficacy (CPSE)
domain	17. Make sense of something you want to learn to do? 18. Start to learn to do something, even if there are obstacles to doing so? 19. Teach yourself how to do something new? 20. Choose do something that is more important within your culture?
field	21. Create a novelty that people will choose, over other novelties available? 22. Find an audience that is well-connected to others in society? 23. Network with people to convince them that what you made is the best? 24. Convince others that you have made a valuable contribution?
personality	25. Be motivated to come up with new ideas? 26. Have fun coming up with new ideas, after having learned from others? 27. Wake up feeling like you can come up with new ideas if you want to? 28. Sustain wonder about something, even after working with it for years or decades?

Rate your degree of confidence by recording a number from 0 to 4.

0 means Not at All Confident. 4 Means highly certain that you can do the task.

# Measurement model

## Rating Scale Model (D.Andrich, 1978)

The probability that the person  $i$  in the item  $j$  chooses the  $l$  category is:

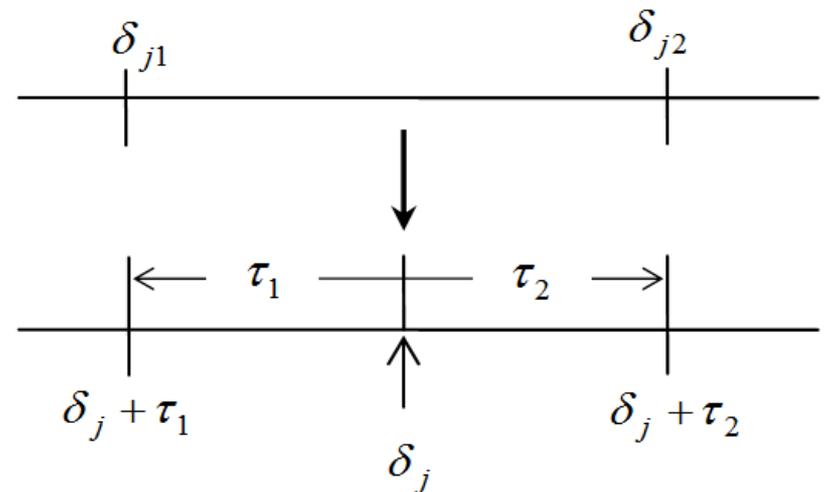
$$(l = 0, 1, 2, \dots, m)$$

$$P_{lij} = \frac{\exp\left[-\sum_{g=0}^l \tau_g + l \cdot (\theta_i - \delta_j)\right]}{\sum_{h=0}^m \exp\left[-\sum_{g=0}^h \tau_g + h \cdot (\theta_i - \delta_j)\right]}$$

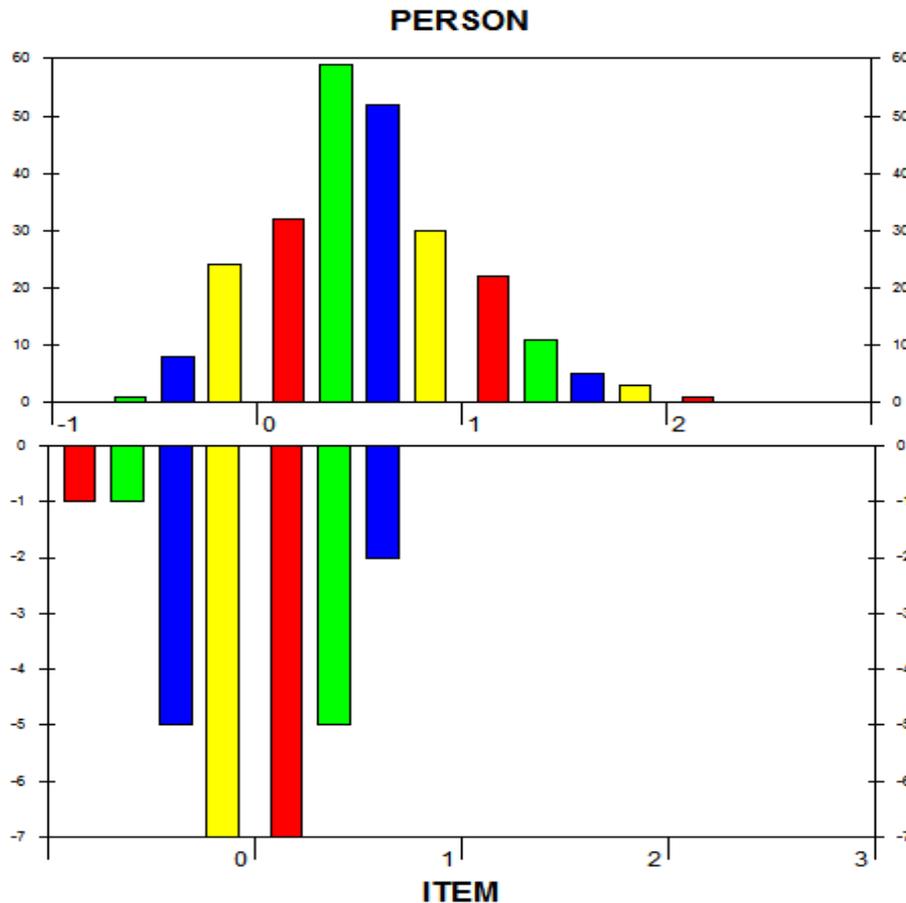
$\delta_j$  - Item difficulty

$\tau_l$  - Category difficulty  
(the same for all items)

$\theta_i$  - Level of creative self-efficacy



# Results



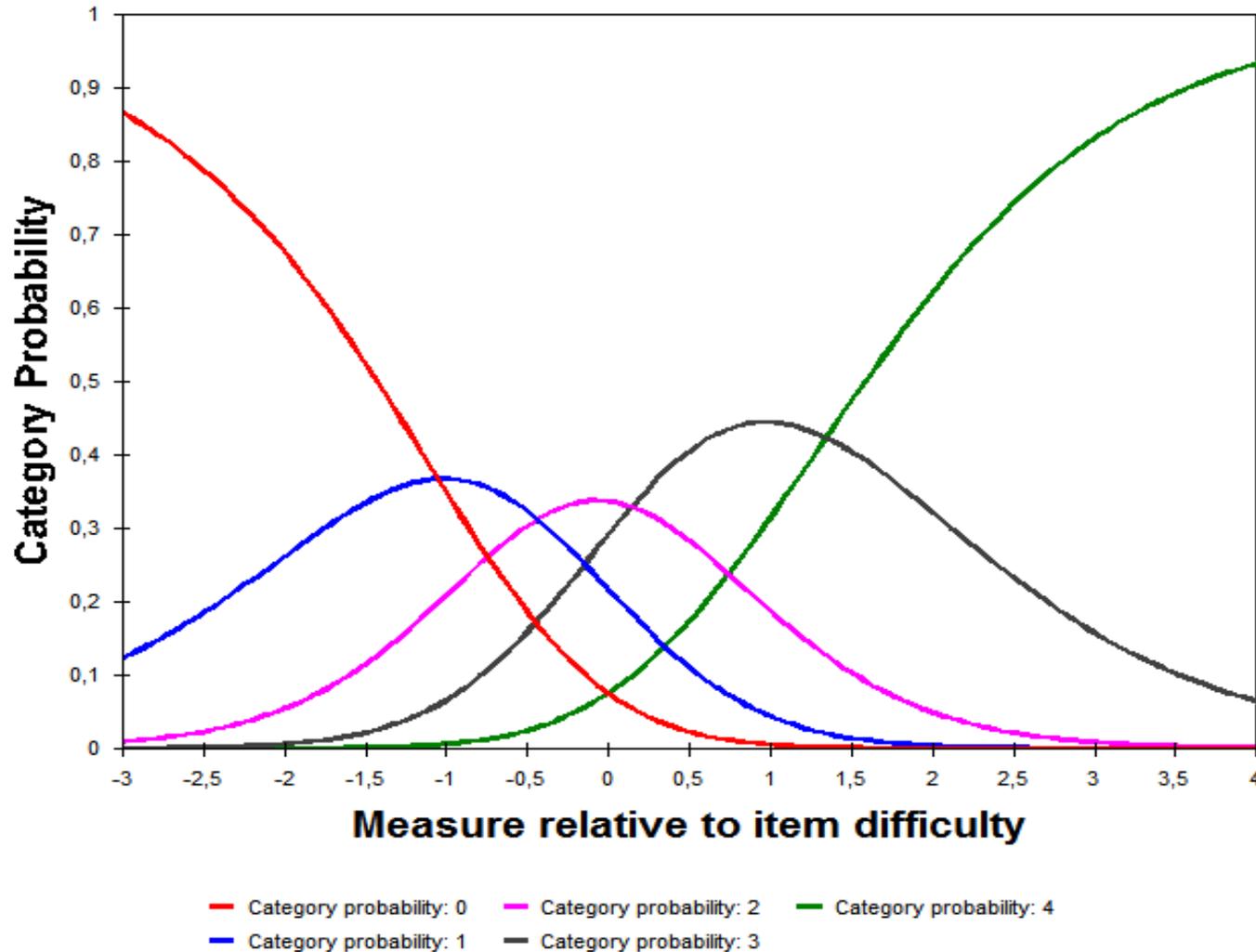
**Person:** min = -0,6 logit,  
max = 2,18 logit

**Item:** *min* = -0.81 logit, that corresponds to the lowest level of creative self-efficacy (CPSE, domain) - *“Make sense of something you want to learn to do?”* (for female and male)

*max* = 0,69 logit, that corresponds to the highest level of creative self-efficacy (CPSE, field) - *“Create a novelty that people will choose, over other novelties available?”* (for female)

and *“Convince others that you have made a valuable contribution?”* (for male)

# Category Probability Curves



$$\tau_1 = -1,05$$

$$\tau_2 = -0,44$$

$$\tau_3 = 0,14$$

$$\tau_4 = 1,34$$



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# Model fit

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	TOTAL MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEASURE-A CORR.	EXACT MATCH EXP.%	EXACT MATCH OBS%	ITEM	
11	755	246	-.60	.08	1.58	5.2	1.53	4.7	A .36	.35	38.6	43.8	T11ela
22	724	247	-.41	.07	1.51	4.8	1.55	5.1	B .22	.37	36.0	42.0	P22fie
10	595	246	.17	.06	1.43	4.7	1.43	4.6	C .27	.41	30.1	36.9	T10ela
7	644	246	-.04	.07	.75	-3.2	.73	-3.4	c .55	.40	41.1	38.8	T07fle
2	722	248	-.39	.07	.71	-3.5	.72	-3.3	b .46	.37	50.4	42.0	T02flu
6	550	245	.35	.06	.70	-4.2	.70	-4.2	a .51	.43	40.4	35.6	T06fle
MEAN	629.8	245.9	.00	.07	1.01	-.1	1.01	.0			38.7	38.7	

# Dimensionality

Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)

		-- Empirical --		Modeled
Total raw variance in observations	=	36.7	100.0%	100.0%
Raw variance explained by measures	=	8.7	23.8%	24.1%
Raw variance explained by persons	=	2.0	5.3%	5.4%
Raw Variance explained by items	=	6.8	18.4%	18.7%
Raw unexplained variance (total)	=	28.0	76.2%	75.9%
Unexplned variance in 1st contrast	=	3.2	8.7%	11.5%
Unexplned variance in 2nd contrast	=	2.3	6.3%	8.3%
Unexplned variance in 3rd contrast	=	1.9	5.3%	6.9%
Unexplned variance in 4th contrast	=	1.6	4.3%	5.6%
Unexplned variance in 5th contrast	=	1.5	4.0%	5.2%



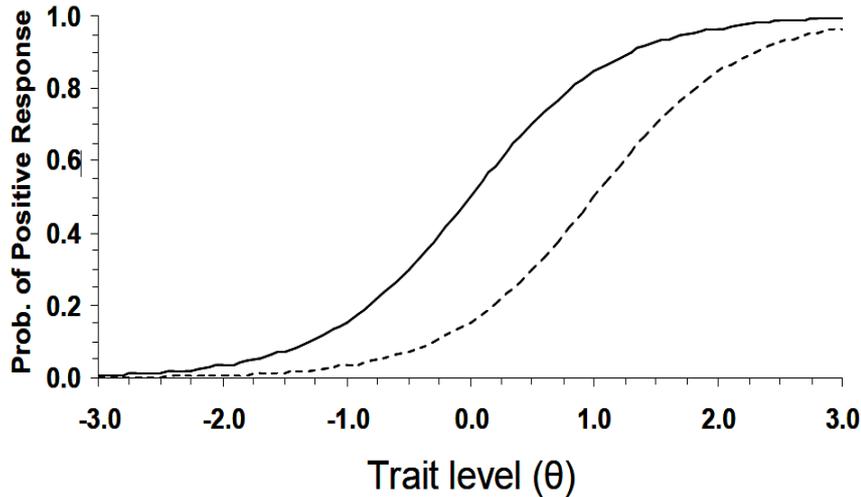
# *Bias and Differential Item Functioning (DIF)*

- *Differential Item Functioning* (DIF) “occurs when examinees from groups R (reference) and F(focal) have the same degree of proficiency in a certain domain, but difference rates of success on an item” (Camilli, 2006: 226).
- “*Item impact* described the situation in which DIF exists, because there were true differences between the groups in the underlying ability of interest being measured by the item.
- *Item bias* described the situations in which there is DIF because of some characteristic of the test item that is not relevant to the underlying ability of interest” (Zumbo, 2007: 224).

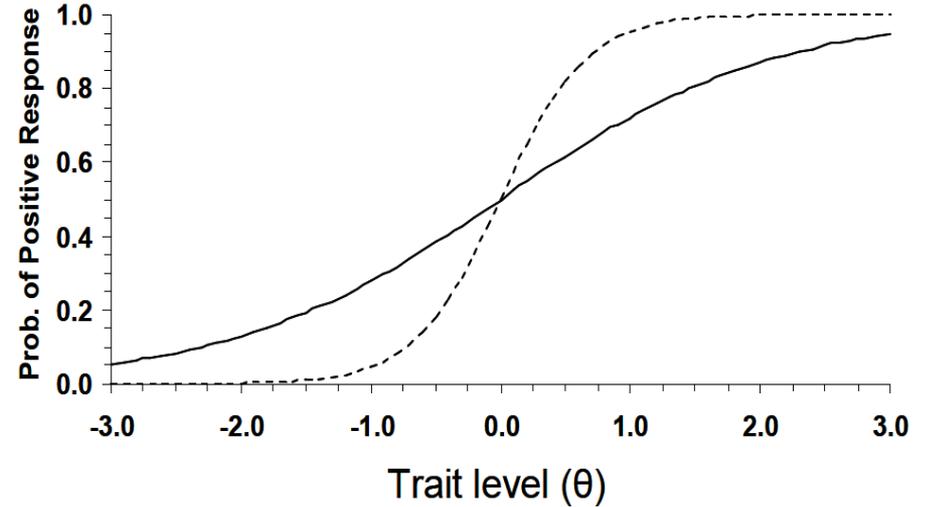


# Types of DIF

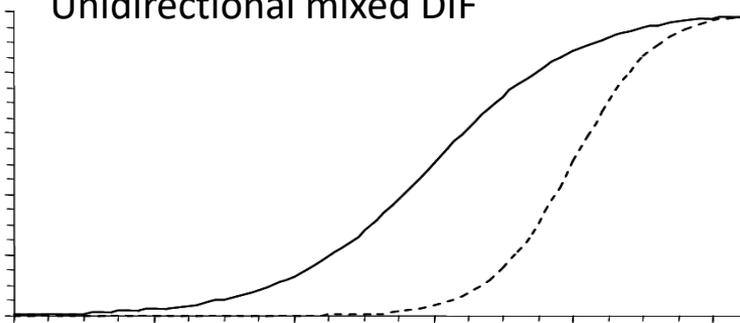
## Uniform DIF



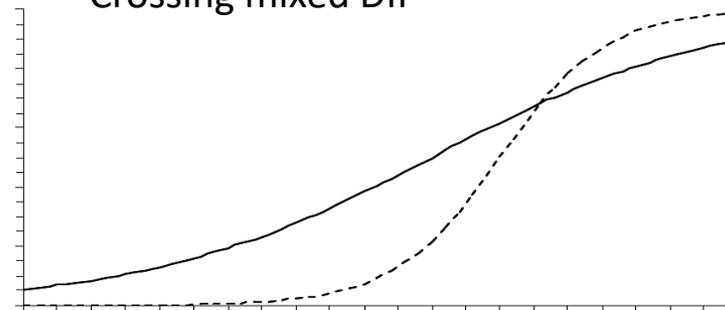
## Non-uniform DIF



## Unidirectional mixed DIF



## Crossing mixed DIF



# Mantel-Haenszel methods for detecting DIF

**Null hypothesis:** no relation between group membership and test performance on one item

Level $j$	1	0	Total
Reference gr.	$A_j$	$B_j$	$N_{rj}$
Focal gr.	$C_j$	$D_j$	$N_{fj}$
Total	$T_{1j}$	$T_{0j}$	$T_j$

**Test:** the Chi-Square statistic (with one degree of freedom)

$$\chi_{MH}^2 = \frac{\{|\sum_j (A_j - \varepsilon(A_j))| - 0.5\}^2}{\sum_j \text{var}(A_j)}$$

**Measure of effect size :** the log odds-ratio

$$\alpha_{MH} = \frac{\sum_j A_j D_j / T_j}{\sum_j B_j C_j / T_j} \quad \text{or} \quad \Delta_{MH} = -2.35 \ln(\alpha_{MH})$$

**Classification** (in Winsteps):

**C** (large) – if  $|DIF| \geq 0.64$

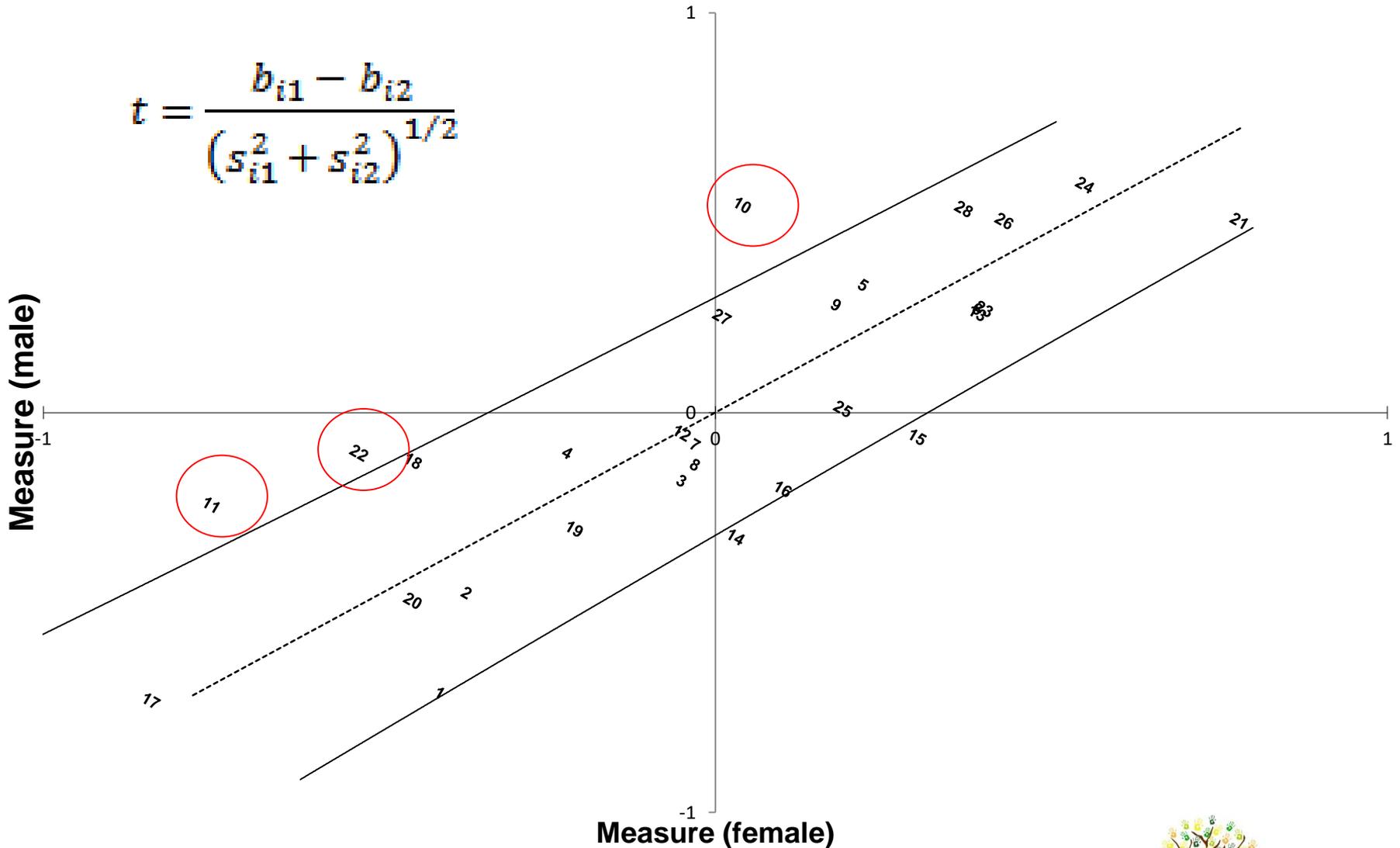
**B** (moderate) – if  $0.43 \leq |DIF| < 0.64$

**A** (negligible) – if  $|DIF| < 0.43$

**Significance level:** 0.05

# Differential Test Functioning

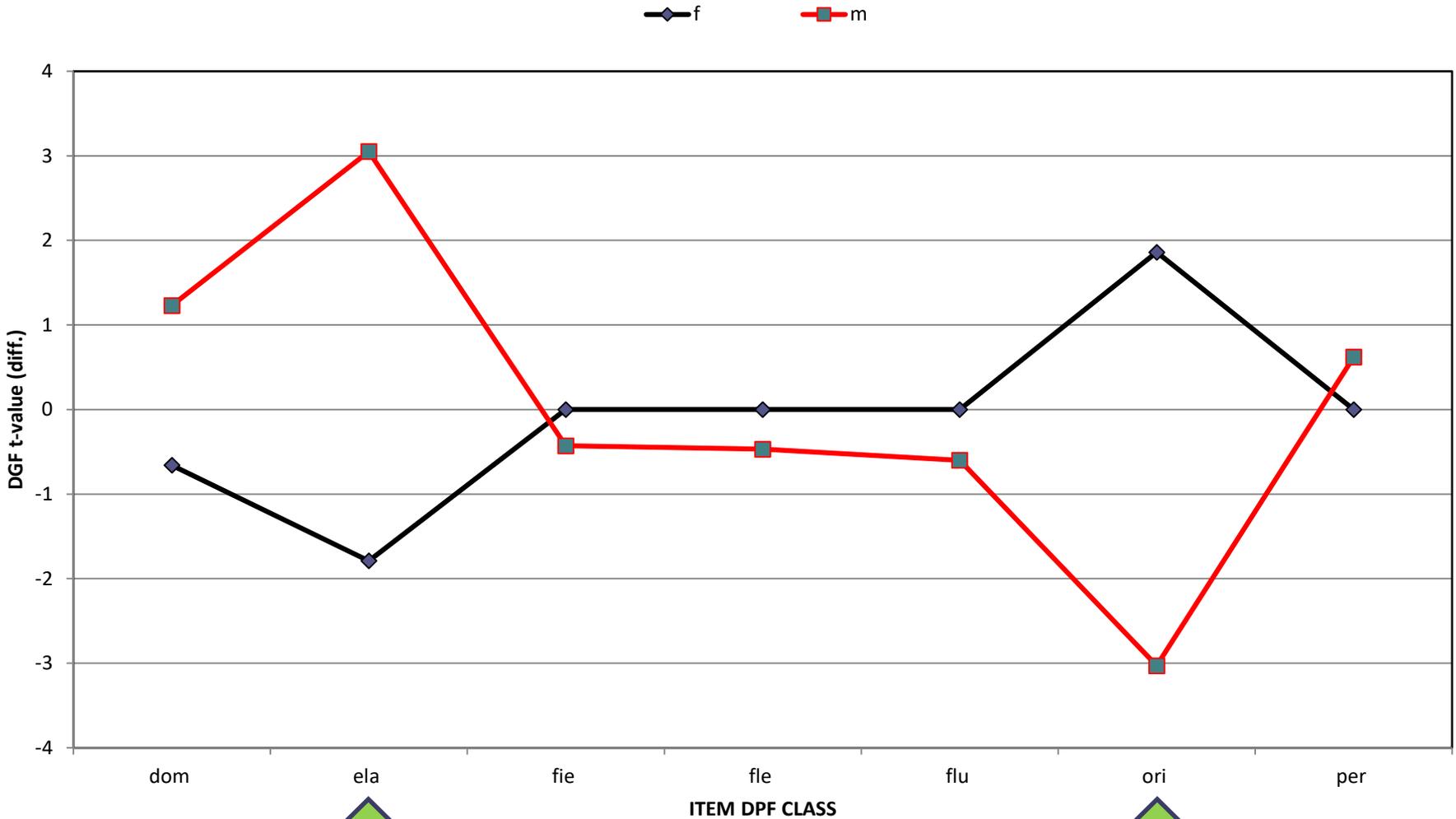
$$t = \frac{b_{i1} - b_{i2}}{(s_{i1}^2 + s_{i2}^2)^{1/2}}$$



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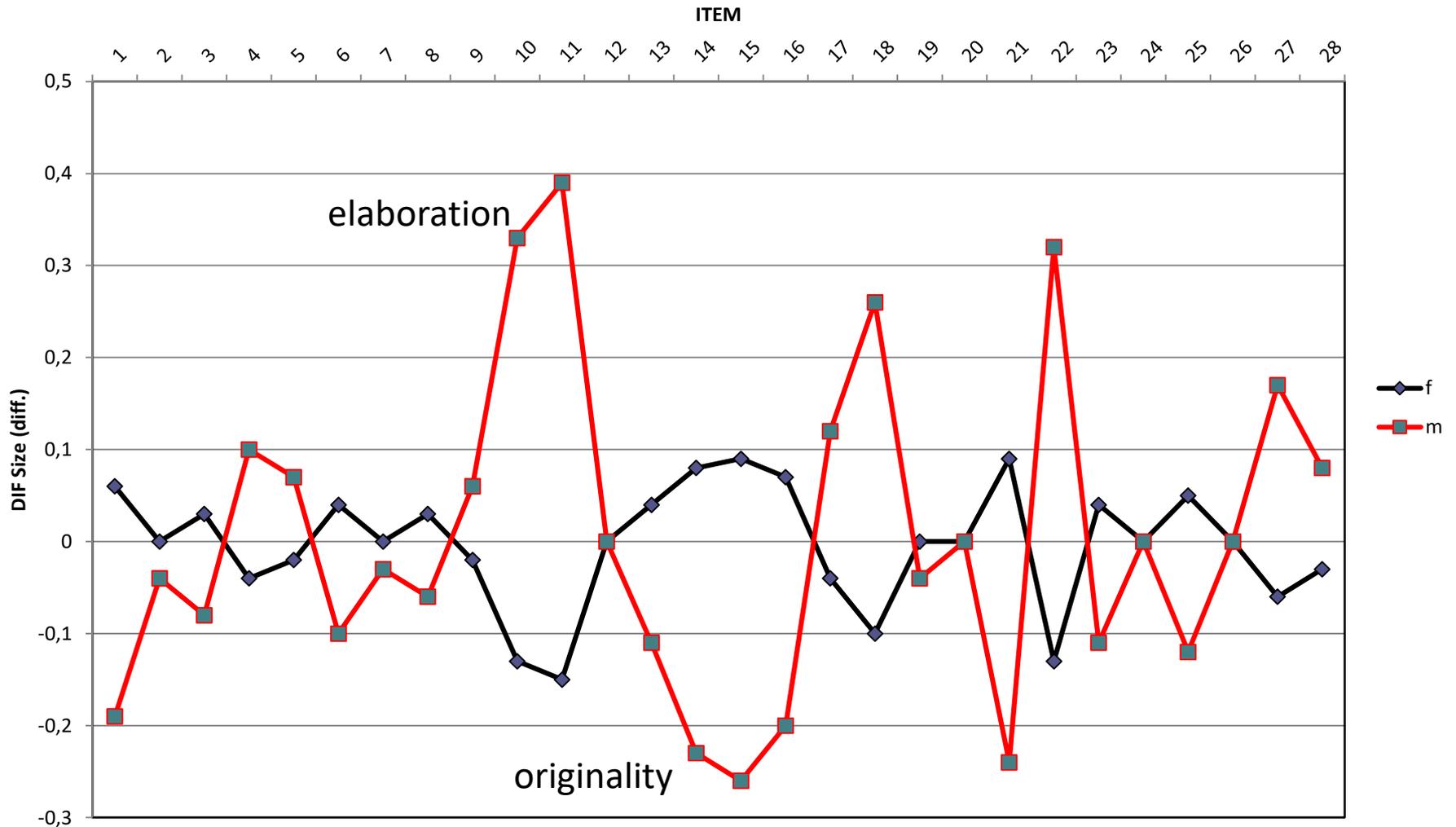
# Differential Group Functioning



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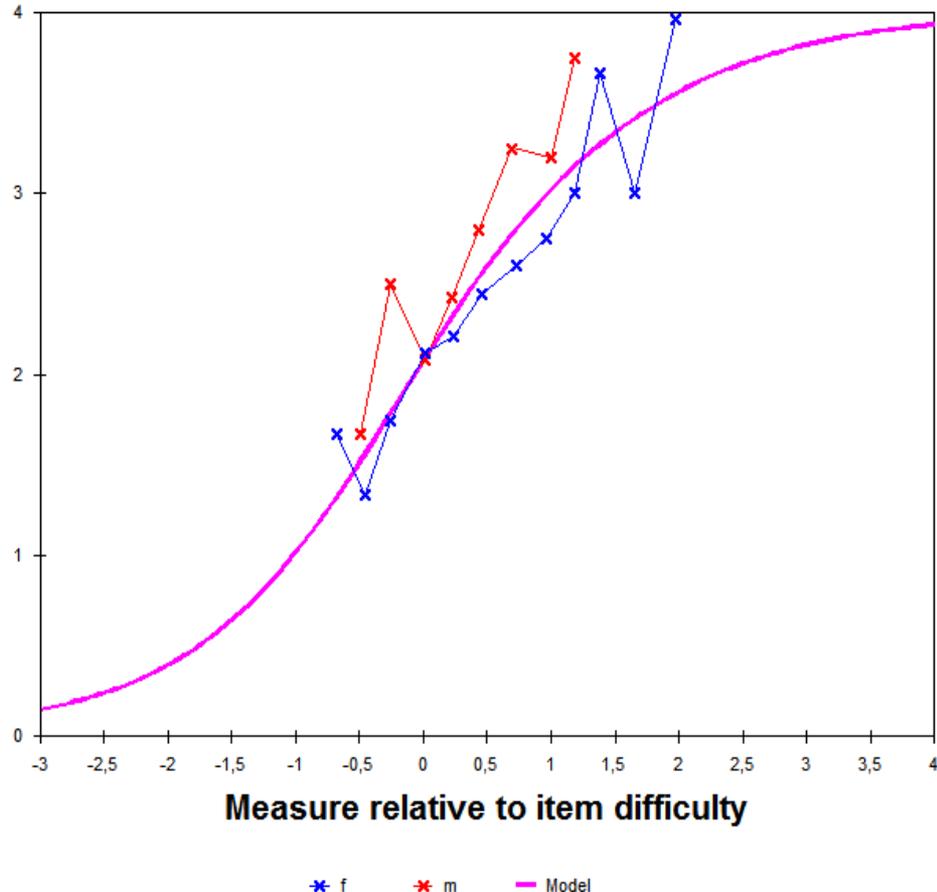
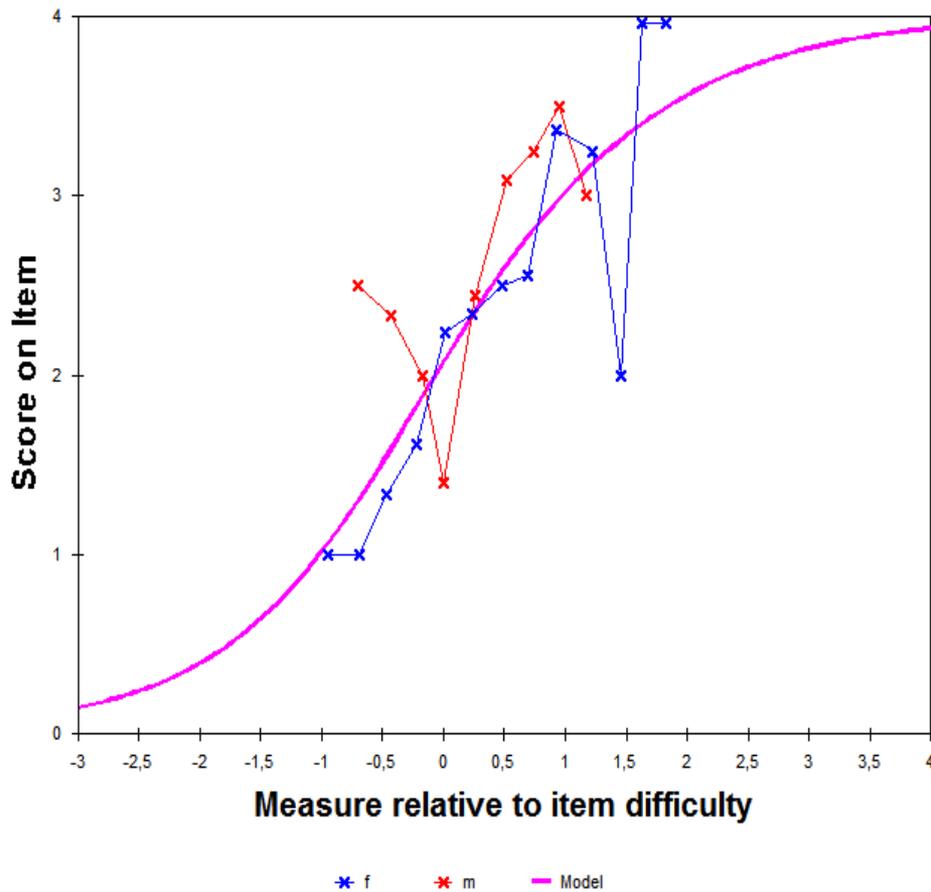
# Differential Item Functioning



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# Non-uniform DIF in favor of male (originality)



13. Be the first in a group to come up with an original suggestion?

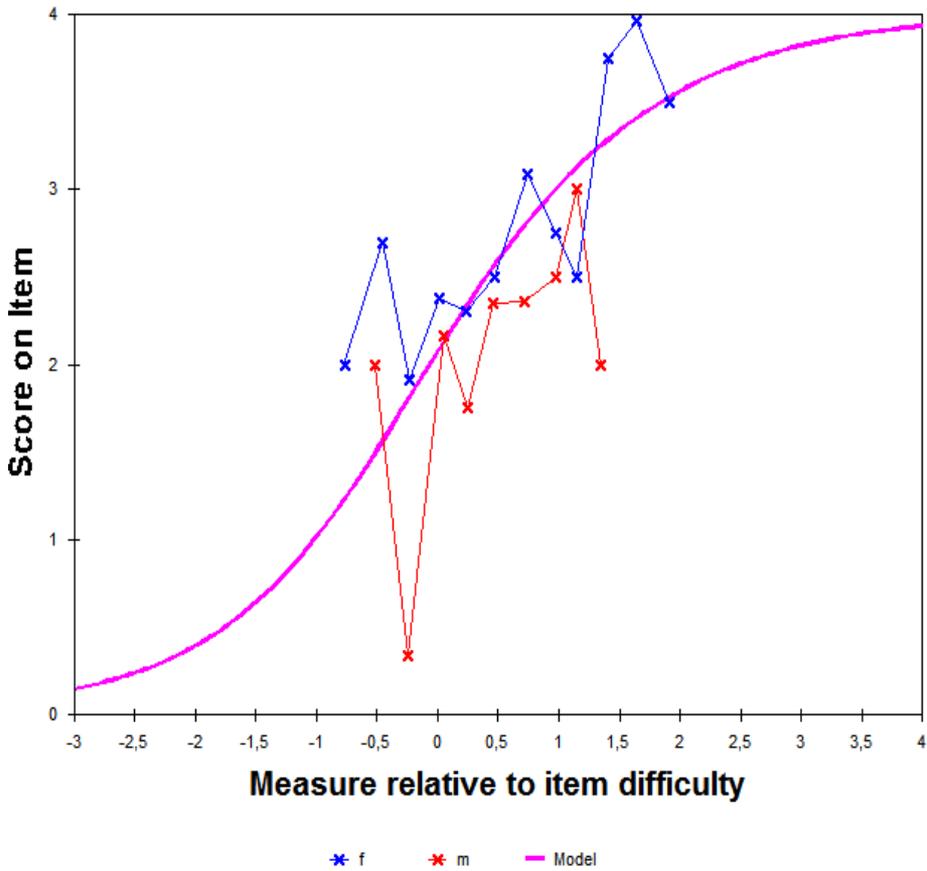
15. Beat other people in imagining a brand new idea first?



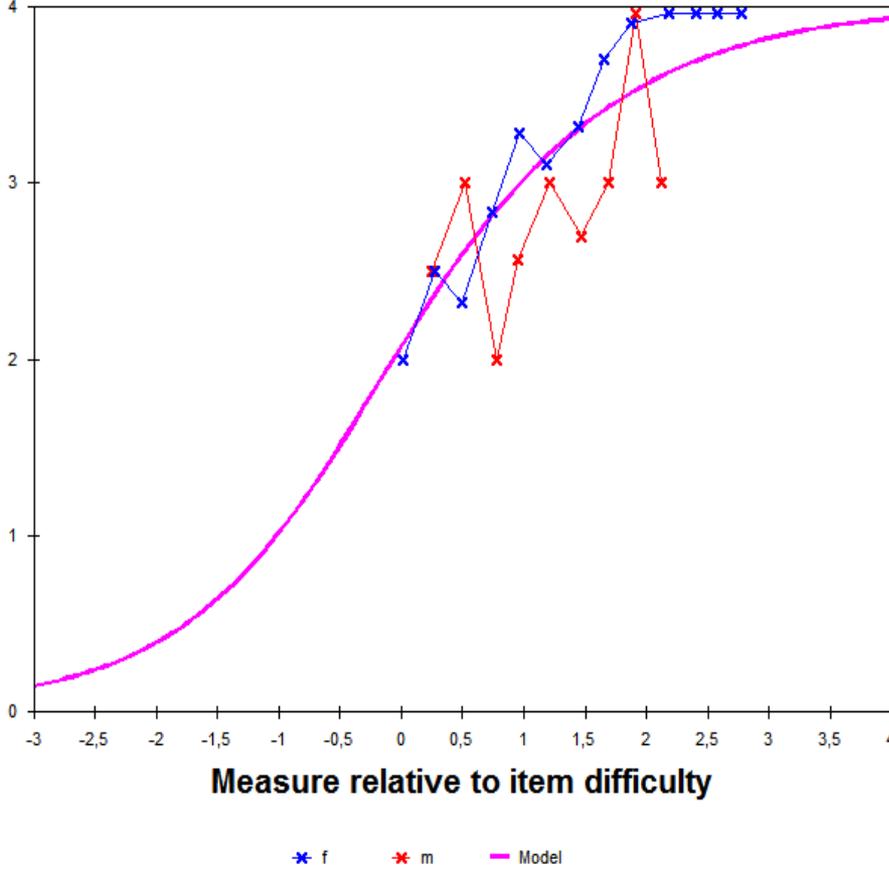
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# Non-uniform DIF in favor of female (elaboration)



10. Talk to your friends about wild ideas, and make them sound reasonable?



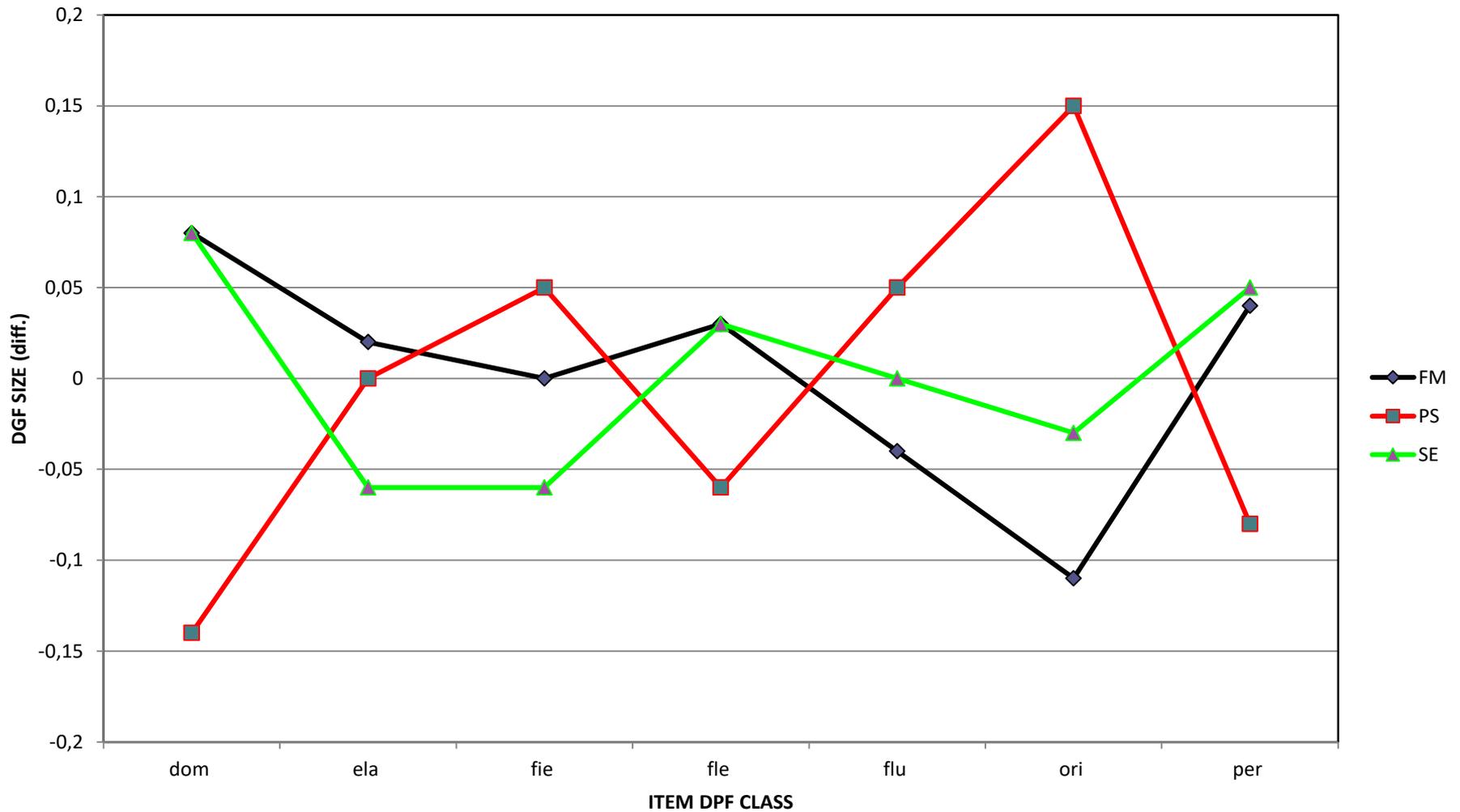
11. Tell stories based on dreams you had, even if you need to fill in answers?



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# Differential Group Functioning by the faculties



# Conclusion

- Модель може бути використана
- Багатовимірність присутня у мисленні
- Причина може бути у різниці між чоловіками і жінками



**Thank you for attention!**  
**Merci de votre attention!**

**Aċiū uż dėmesj!**  
**Дякую за увагу!**



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