Grup de tècniques estadístiques avançades aplicades a la Psicologia GTEAAP

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EXPERIENCIAS DOCENTES INNOVADORAS EN ESTADÍSTICA APLICADA
La enseñanza de la estadística aplicada mediante recursos gráficos

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ANTECEDENTS

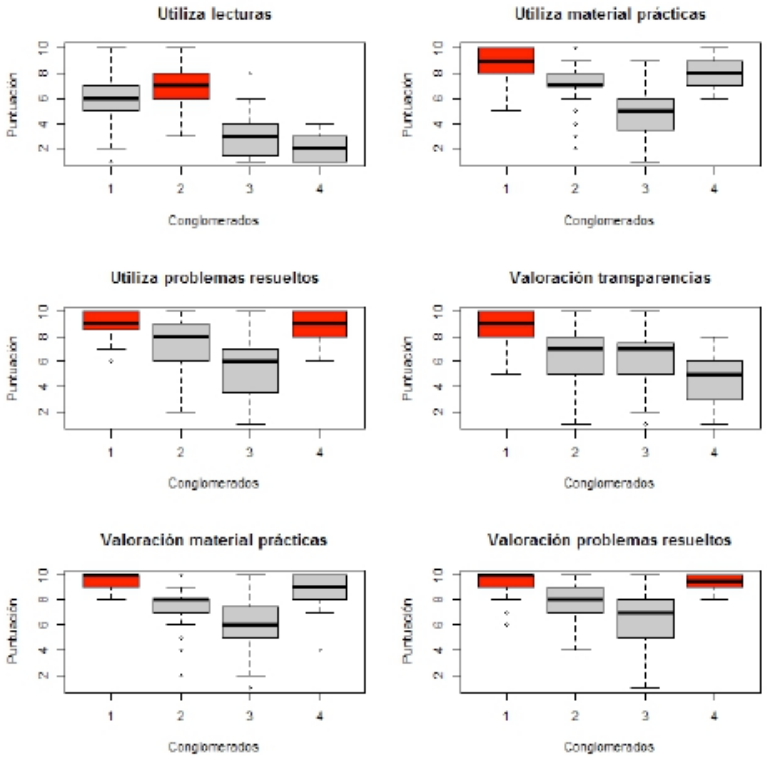


Figura 1. Diagramas de cajas agrupados para las variables utilizadas en el AC sobre uso y valoración de la utilidad. En rojo figura aquél conglomerado cuya función de distribución es significativamente mayor que el resto de conglomerados ($p < 0,05$).

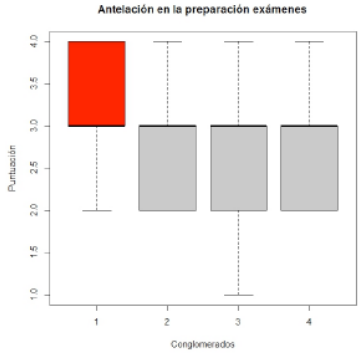


Figura 2. Diagramas de cajas agrupados para la antelación en la preparación de exámenes. En este caso únicamente se encontraron diferencias entre los conglomerados uno y tres.

CLASSIFICACIÓ RENDIMENT

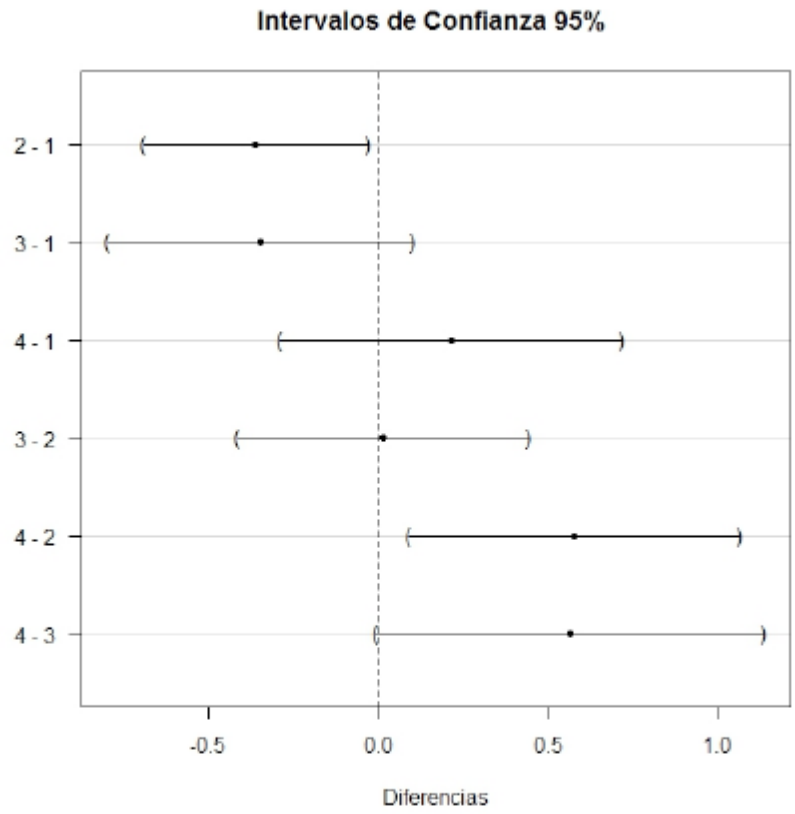


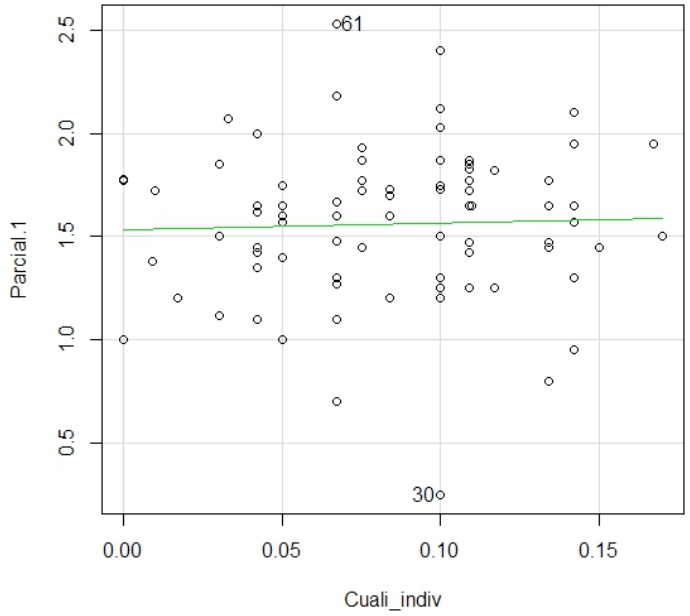
Figura 3. Contrastes post-hoc, intervalos confianza

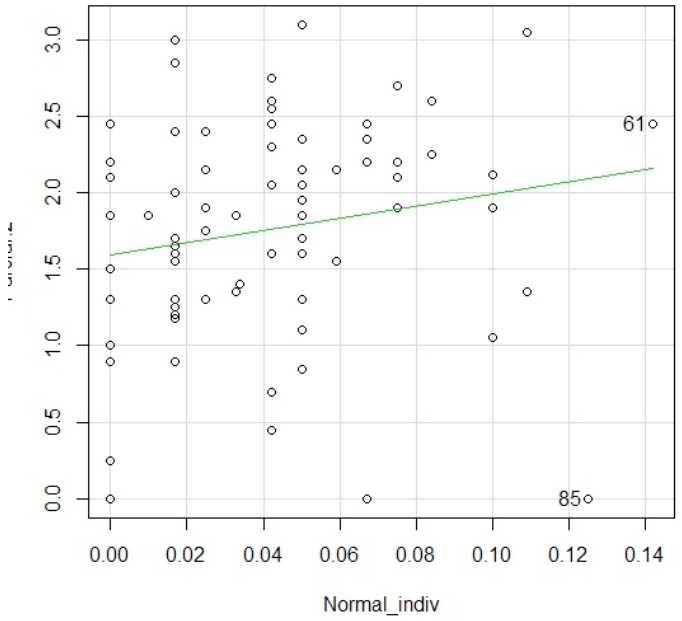
ANÀLISI ACTIVITATS I RENDIMENT

Taula 7. Taula de correlacions entre els diferents enunciats i components obtinguts i les qualificacions obtingudes en l'assignatura. Per hores de treball i les puntuacions en els components s'ha obtingut el coeficient de correlació de *Pearson* i pels diferents enunciats el coeficient de correlació de *Spearman*.

Variables	Activitats pràctiques	Treball tutoritzat	Proves avaluació	TOTAL
Hores Treball	.218 (<.001); n=315	.014 (.798); n=317	-.035 (.534); n=318	.011 (.845); n=318
Utilitat resum APA	-.073 (.094); n=328	.152 (.003); n=330	.078 (.080); n=331	.062 (.129); n=331
Utilitat rúbrica escrit	-.021 (.355); n=326	.284 (<.001); n=328	.098 (.038); n=329	.137 (.006); n=329
Utilitat tutories programades	.132 (.009); n=327	.212 (<.001); n=329	0.019 (.363); n=330	.097 (.039); n=330
Utilitat tutories sol·licitades	.028 (.333); n=234	.277 (<.001); n=234	.097 (.069); n=235	.122 (.030); n=235
Utilitat criteris oral	-.088 (.056); n=323	.159 (.002); n=324	-.046 (.204); n=325	-.032 (.282); n=325
Coordinació alumnes	.069 (.106); n=327	.442 (<.001); n=329	.153 (.003); n=330	.248 (<.001); n=330
Participació alumnes	.079 (.077); n=329	.427 (<.001); n=331	.099 (.035); n=332	.199 (<.001); n=332
Utilitat treball per aprendre	.138 (.006); n=326	.345 (<.001); n=328	.135 (.007); n=329	.213 (<.001); n=329
Utilitat treball estudiar exàmens	.140 (.006); n=328	.212 (<.001); n=329	.191 (<.001); n=330	.224 (<.001); n=330
Relació qualificació - hores dedicació	-.076 (.083); n=329	.194 (<.001); n=331	.049 (.187); n=332	.052 (.171); n=332
CP1	.087 (.100); n=218	.409 (<.001); n=218	.165 (.007); n=219	.211 (.001); n=219
CP2	.042 (.222); n=326	.468 (<.001); n=328	.161 (.002); n=329	.230 (<.001); n=329

ALTRES FORMES AVALUACIÓ





CONCEPTE GENERAL

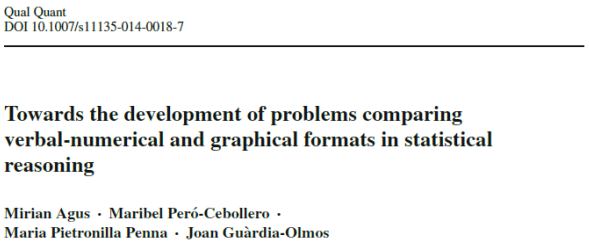
- Dificultats en l'aplicació del "Statistical Reasoning": defined as the style in which individuals reflect on statistical notions and form suppositions on statistical records (e.g. Garfield and Chance 2000). Specifically, Garfield (2003) introduces a distinction between six main classes of statistical reasoning (i.e., on data, on representations of data, on associations of variables, on statistical measures, on samples, and on uncertainty).

- During the last three decades, several authors observed that the application of distinct visual aids could facilitate statistical reasoning on uncertainty and on association among different variables (e.g. Agnoli and Krantz 1989; Brase 2009; Hoffrage et al. 2002; Garfield and Gal 1999; Moro and Bodanza 2010; Shafir and Tversky 1992). In this respect, Wild and Pfannkuch (1999) introduced the concept of "transnumeration" that allows one to obtain information on a data set when he/she switches from one representation to another within a given system. Therefore graphs are considered as powerful transnumeration instruments.

SUPOSIT TEÒRIC

Zahner and Corter (2010) analyzed the stages of processing in resolving probability word problems by connecting the use of external representations to these phases. They investigated the specific utilization of external visual representations in probability problem solving, classifying the problems in three classes: formula (in problem solving the participant wrote an explicit standard formula); procedural (the student carries out a calculation involving only numbers, without referring to any general formula); graphical (the student uses a visual device for the computation)

Visual aids could obstruct probabilistic reasoning in specific problems, because they could burden the cognitive system with unserviceable information (visual impedance hypothesis). Some relational terms could inhibit reasoning; this effect could be related to the vibrant visual particulars, evoking specific areas of the brain connected with visual tasks and not with inferential reasoning (Knauff and Johnson-Laird 2002).



Qual Quant
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Towards the development of problems comparing verbal-numerical and graphical formats in statistical reasoning

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Maria Pietronilla Penna · Joan Guàrdia-Olmos

EXEMPLES

A factory produces electronic games, but not all of them work well. Of every 100 game products:

- 20 may have an electrical problem,
- 80 can work correctly.

The company has developed control systems to identify faulty games; however, these systems do not work properly. In reality, half of the games with electrical problems continue in the production line, where they are considered as well functioning.

If you randomly extract a game that has been sent to shops for commercialization and evaluated as free of defects, what is the probability that it is defective?

a) 10 / 90
b) 10 / 100
c) 10 / 80
d) 20 / 100

Figure 1. Item example – Verbal-numerical format

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Comparing Psychology Undergraduates' Performance in Probabilistic Reasoning under Verbal-Numerical and Graphical-Pictorial Problem Presentation Format: What is the Role of Individual and Contextual Dimensions?

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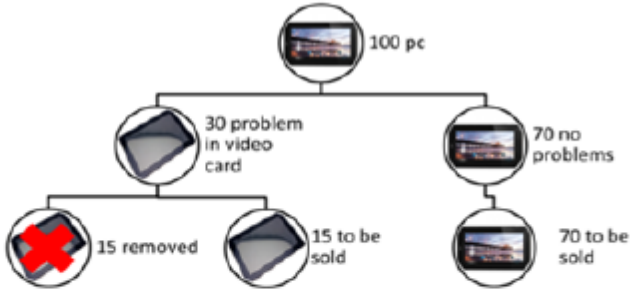


a) 15 / 100
b) 15 / 70
c) 15 / 85
d) 3 / 10

Figure 2. Item example – Graphical-pictorial format

PARTICIPANTS
The 1st , 2nd and 3rd empirical studies

	Participants	N=676
Spanish without time pressure	**n f%**	n=127; f= 71.7%
	Mean age (sd)	20.32 (sd = 6.09)
	University	BARCELONA 100%
Italian without time pressure	**n f%**	n=376; f= 78.7%
	Mean age (sd)	20.14 (sd = 4.29)
	University	CAGLIARI 7.4%, CHIETI 38.3%, GENOA 15.4%, MILAN 13.3%, NAPLES 9.3%, PAVIA 5.3%, TRIESTE 10.9%
Italian whit time pressure	**n f%**	n=173; f= 60.1%
	Mean age (sd)	19.69 (sd = 1.63)
	University	ROME 100%

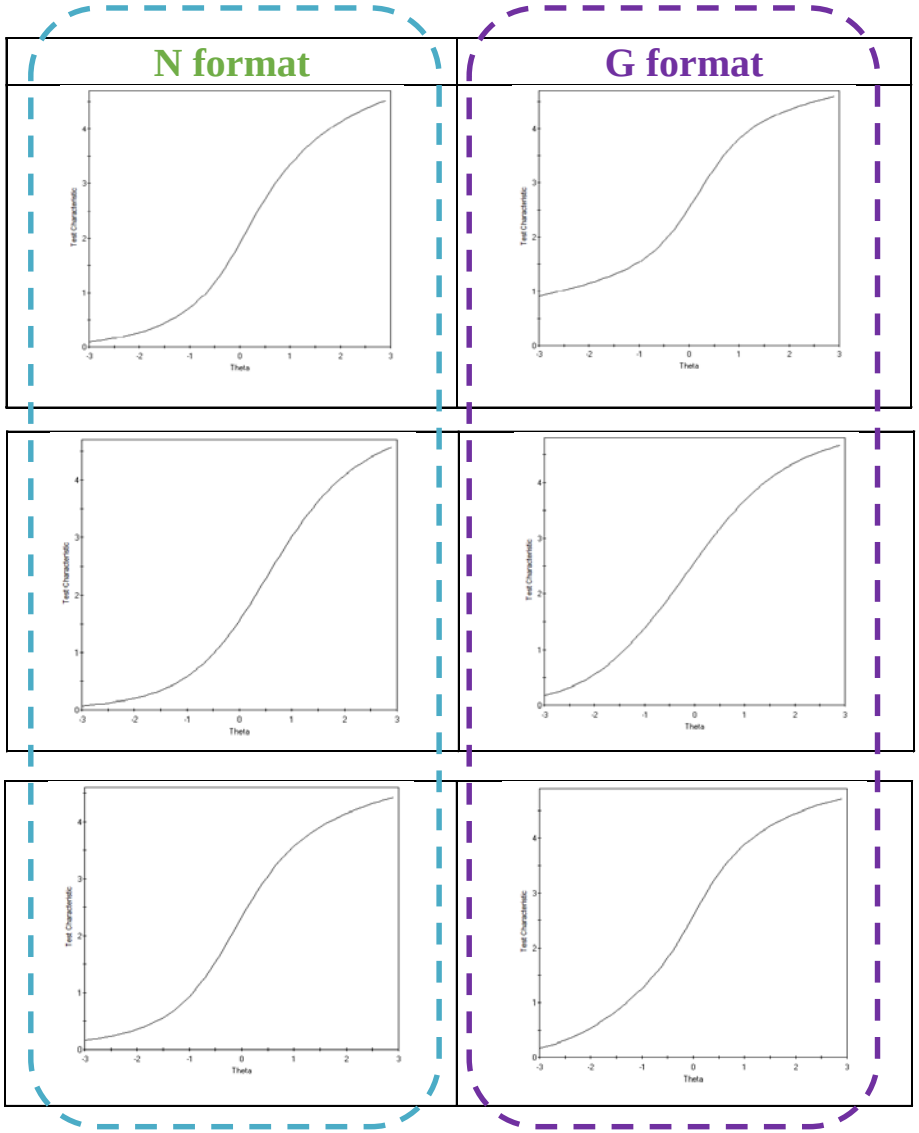
RESULTS - the 1st EMPIRICAL STUDY

IRT (2 PL) - Test Characteristic Curve (TCC) for both formats for each sample

Spanish sample without time pressure

Italian sample without time pressure

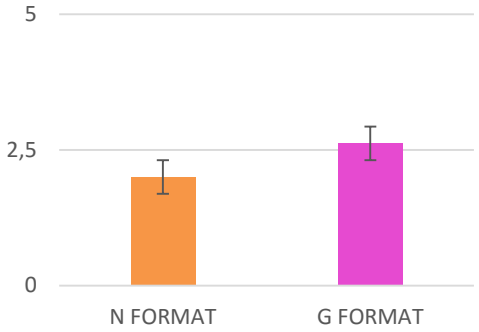
Italian sample with time pressure



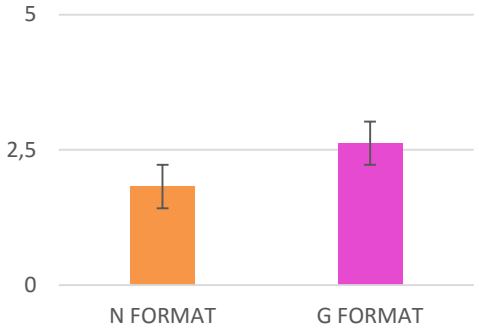
Note:
Abscissa axis:
Theta parameter;
Ordinate axis:
Test Characteristic value
(expected total score)

RESULTS of the 2nd EMPIRICAL STUDY

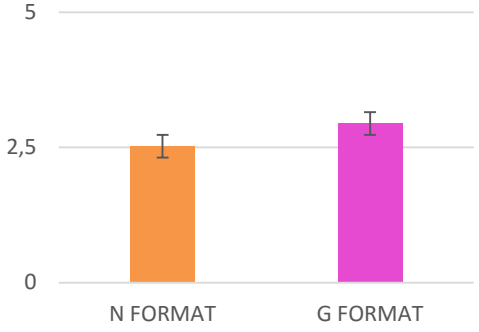
Results of mixed design ANCOVA



Spanish sample without time pressure				
	F	df	p	Eta²
FORMAT* CONFIDENCE N	12.210**	1; 122	.001	.091
FORMAT*CONFIDENCE G	15.304**	1; 122	.0001	.111



Italian sample without time pressure				
	F	df	p	Eta²
FORMAT* CONFIDENCE N	10.579**	1; 343	.001	.030
FORMAT*CONFIDENCE G	6.906**	1; 343	.009	.020



Italian sample with time pressure				
	F	df	p	Eta²
FORMAT	8.640**	1; 143	.004	.057
FORMAT* CONFIDENCE N	9.898**	1; 143	.002	.065

MODEL

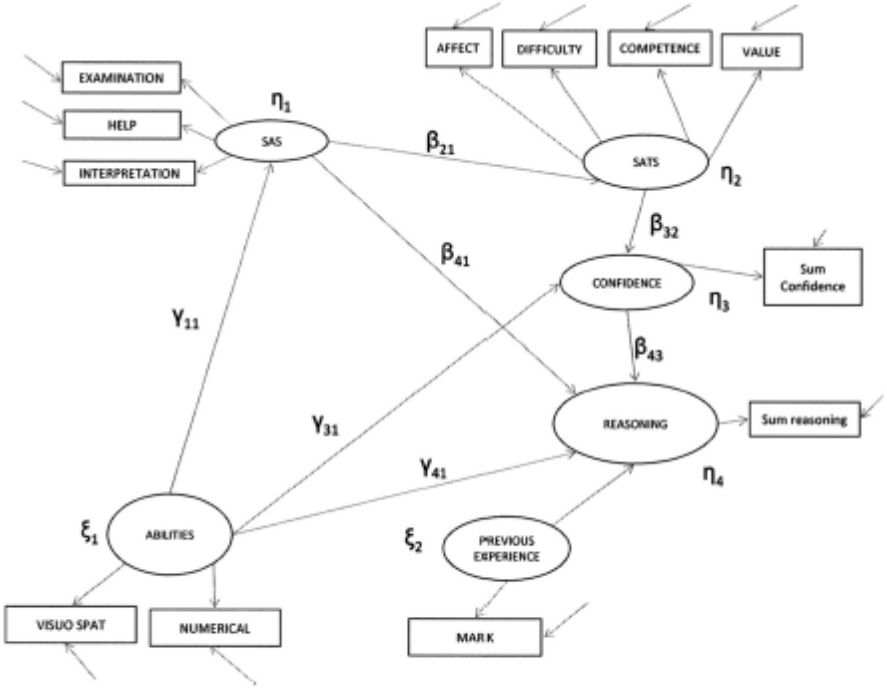


Fig. 1. Hypothesized model. *Legend*: ksi ξ: latent exogenous variable; eta η: latent endogenous variable; gamma γ: path coefficient for the effect by the latent exogenous variable on the latent endogenous variable; beta β: path coefficient for the effect by the latent endogenous variable on the latent endogenous variable; Visuo spat: Primary Mental Abilities (PMA) visuo-spatial scale; Numerical: Primary Mental Abilities (PMA) numerical scale; Mark: university entrance score; SAS: Statistical Anxiety Scale (examination anxiety – asking for help anxiety – interpretation); SATS: Survey of Attitudes Towards Statistics (affect – cognitive competence – value – difficulty); Confidence: sum of confidence in correctness of response (from item 1 to item 5); Reasoning: sum of correct responses in probabilistic reasoning (from item 1 to item 5).

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Investigating the probabilistic reasoning in verbal–numerical and graphical–pictorial formats in relation to cognitive and non-cognitive dimensions: The proposal of a model

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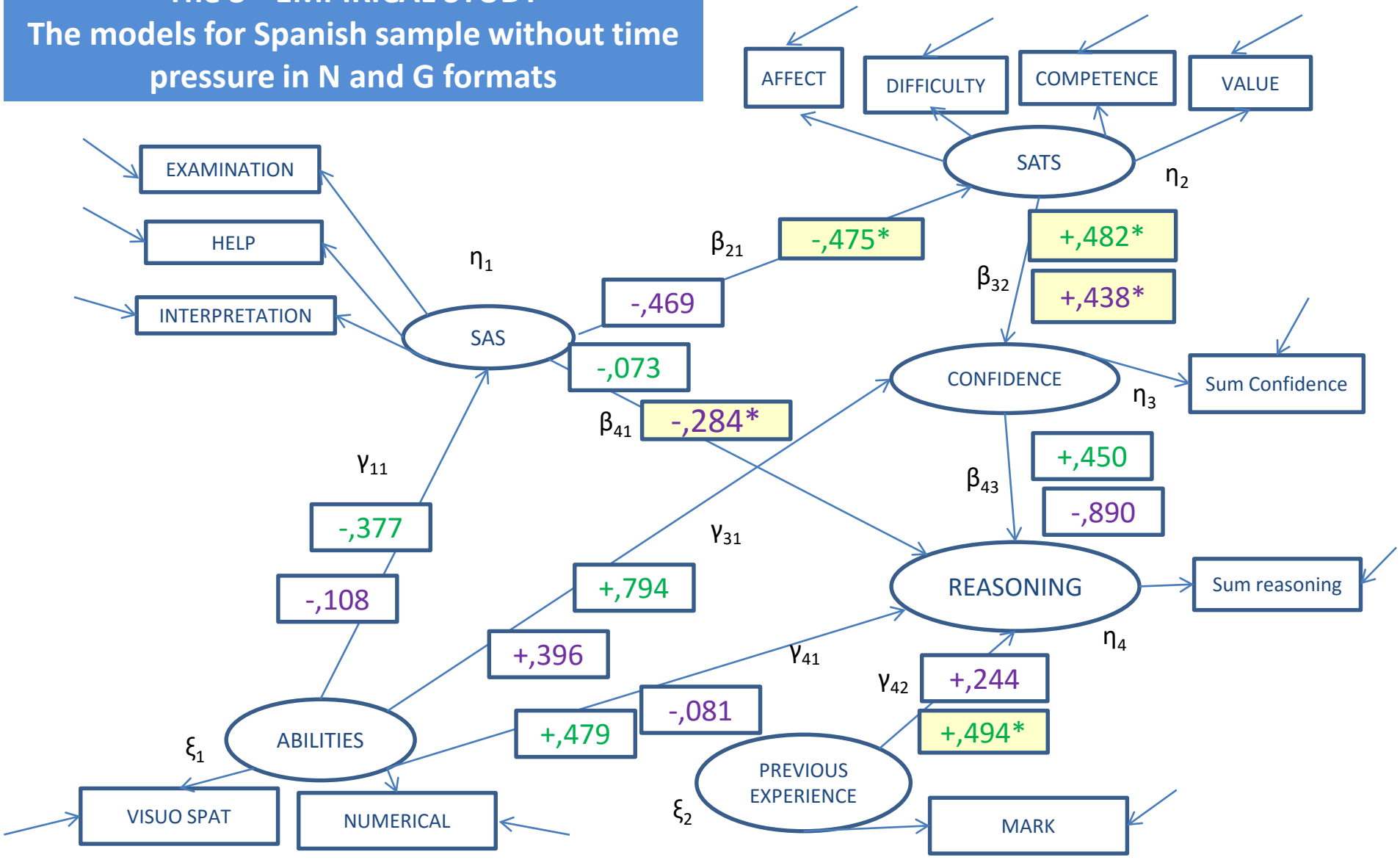
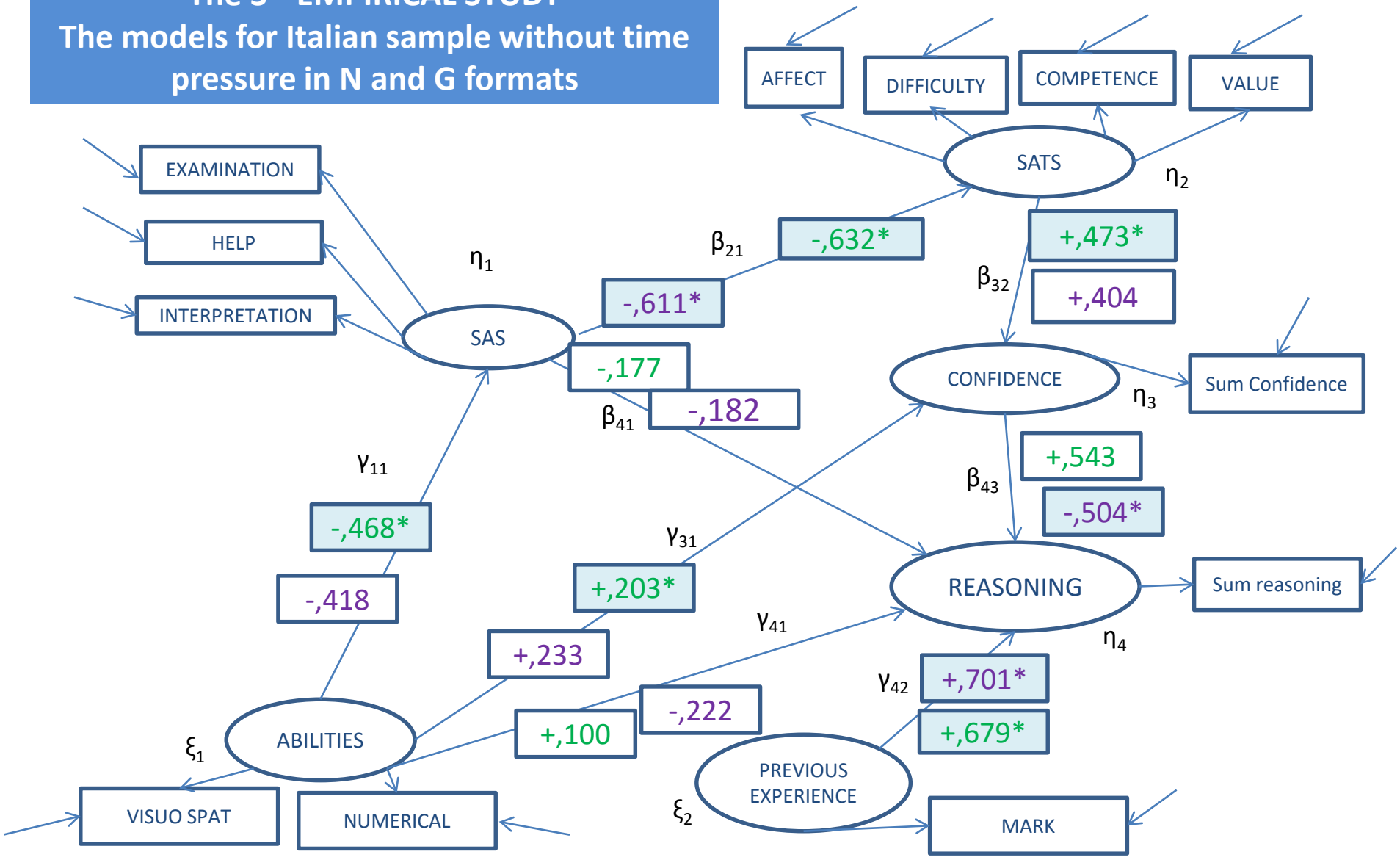
The 3rd EMPIRICAL STUDY
The models for Spanish sample without time pressure in N and G formats



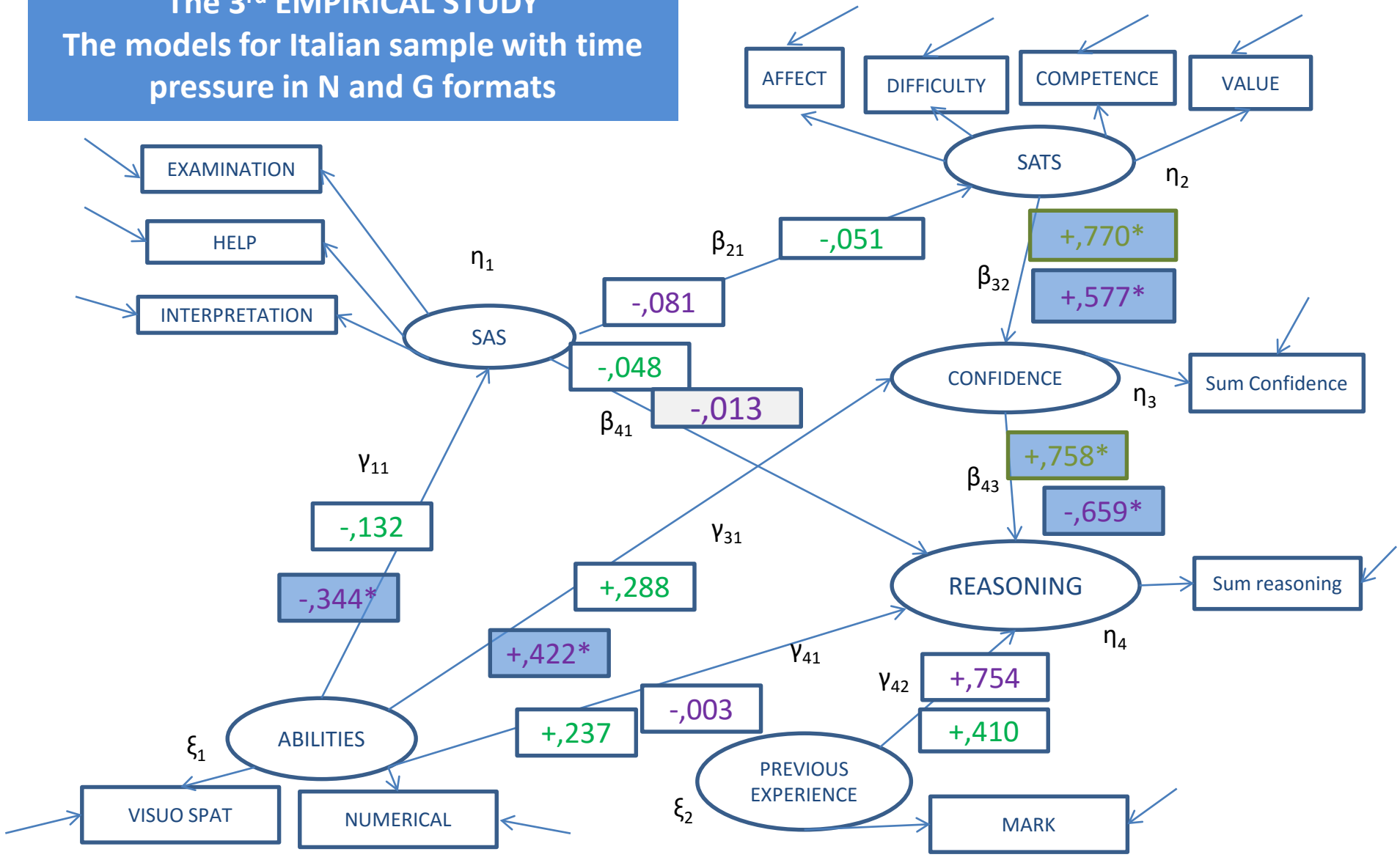
FORMAT	*df*	χ^2	χ^2/df	*p*	*RMSEA*	*RMSEA [90% CI]*
N	42	47.167	1.123	.269	.032	.000, .071
G	42	53.903	1.283	.103	.048	.000, .082

The 3rd EMPIRICAL STUDY
The models for Italian sample without time pressure in N and G formats



FORMAT	*df*	χ^2	χ^2/df	*p*	*RMSEA*	*RMSEA [90% CI]*
N	42	92.691	2.206	.001	.057	.041, .073
G	42	92.217	2.195	.001	.057	.041, .073

The 3rd EMPIRICAL STUDY
The models for Italian sample with time pressure in N and G formats



FORMAT	*df*	χ^2	χ^2/df	*p*	*RMSEA*	*RMSEA [90% CI]*
N	42	39.346	.936	.588	.000	000, .060
G	42	44.258	1.053	.376	.023	000, .071

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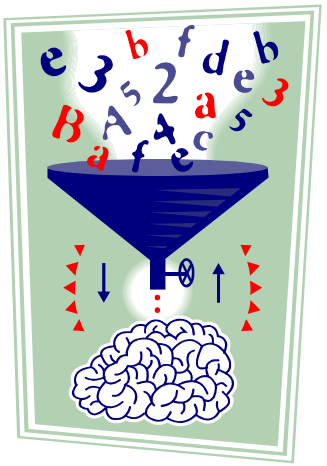

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