SUPPLEMENTAL MATERIAL - INSTRUMENTS AND STATISTICS FOR THE MEASURED VARIABLES

The survey was administered online in Italian. However, in the following we report both the original version and its translation in English.

A. Perception of emergency remote instruction

1. Effectiveness and organization of the course

Scale for the items: 1 = very poor (*per niente efficace*); 2 = poor (*poco efficace*); 3 = fair (*abbastanza efficace*); 4 = good (*efficace*); 5 = very good (*del tutto efficace*).

- How do you rate the organization of the courses (schedule, exams, . . .) held at your university during Emergency Remote Instruction? (*Cosa pensi dell'organizzazione dei corsi (orari, esami, . . .) adottata dal tuo CdS in fisica nei mesi di marzo - giugno 2020 causa pandemia da COVID-19?*)

- How do you rate the effectiveness of the courses held at your university during Emergency Remote Instruction? (*Cosa pensi della "didattica a distanza" erogata dal tuo CdS in fisica nei mesi di marzo - giugno 2020 causa pandemia da COVID-19?*)

2. Perceived difficulties and Relationship with the instructors

This part of the survey began with the sentence: **Please, answer the following items by referring to your experience of in-person instruction** (*Rispondi alle seguenti domande riferendoti alla tua esperienza di didattica in presenza*).

Scale for the items: 1 = definitely worse *(molto peggiorata)*; 2 = worse *(peggiorata)*; 3 = neither worse nor better *(né peggiorata né migliorata)*; 4 = better *(migliorata)*; 5 = definitely better *(molto migliorata)*.

- How do you rate your ***preparation*** after emergency remote instruction with respect to in-person instruction? (*Come è cambiata la tua preparazione generale in fisica dopo l'esperienza della "didattica a distanza" del secondo semestre scorso e quella attuale?*)

- How do you rate your perception of the ***chances of attaining your degree*** after emergency remote instruction with respect to in-person instruction? (*Come è cambiata la tua percezione delle tue difficoltà nel completare il corso di studi in fisica dopo l'esperienza della "didattica a distanza" del secondo semestre scorso e quella attuale?*)

- How do you rate your perception of the difficulties related to the ***degree program*** after emergency remote instruction with respect to in-person instruction? (*Come è cambiata la tua percezione delle problematiche relative al corso di studi in fisica dopo l'esperienza della "didattica a distanza" del secondo semestre scorso e quella attuale?*)

- How do you rate your perception of the ***study benefits*** after emergency remote instruction with respect to in-person instruction? (*Come è cambiata la tua percezione dell'utilità degli studi in fisica dopo l'esperienza della "didattica a distanza" del secondo semestre scorso e quella attuale?*)

- How do you rate your perception of the ***job perspectives*** after emergency remote instruction with respect to in-person instruction? (*Come è cambiata la tua percezione delle prospettive lavorative dopo l'esperienza della "didattica a distanza" del secondo semestre scorso e quella attuale?*)

- How do you rate your instructors' ***capability to stimulate interest*** during Emergency Remote Instruction with respect to in-person instruction? (*Com'è cambiata la capacità dei tuoi docenti di stimolare l'interesse per la materia dopo l'esperienza della "didattica a distanza" del secondo semestre scorso e quella attuale?*)

- How do you rate your instructors' ***attitude*** during Emergency Remote Instruction with respect to in-person instruction? (*Com'è cambiato l'atteggiamento dei docenti nei confronti delle tue difficoltà dopo l'esperienza della "didattica a distanza" del secondo semestre scorso e quella attuale?*)

- How do you rate your instructors' **clarity** during Emergency Remote Instruction with respect to in-person instruction? (*Com'è cambiata la chiarezza dei docenti nell'esposizione degli argomenti dopo l'esperienza della "didattica a distanza" del secondo semestre scorso e quella attuale?*)

- How do you rate your instructors' **effectiveness** during Emergency Remote Instruction with respect to in-person instruction? (*Come è cambiata la tua percezione dell'efficacia dei docenti dopo l'esperienza della "didattica a distanza" del secondo semestre scorso e quella attuale?*)

- How do you rate your instructors' **capability to interact** during Emergency Remote Instruction with respect to in-person instruction? (*Come è cambiata la tua interazione con i docenti dopo l'esperienza della "didattica a distanza" del secondo semestre scorso e quella attuale?*)

In Tables I and II, we report, respectively, the descriptive and Rasch statistics for the items of the *Perception of Emergency Remote Instruction* scales. In the reported statistics, calculated through SPSS v.26, we use 0 to denote no excess kurtosis.

TABLE I. Descriptive statistics for the items of the *Perception of emergency remote instruction* construct.

Dimension	Cronbach's alpha	Items	M	SD	Asimmetry	Kurtosis
Relationship with the instructors	0.85	Attitude	3.22	0.84	-0.034	0.627
		Clarity	3.05	0.95	-0.001	-0.004
		Effectiveness	2.99	0.10	0.0730	-0.381
		Capability to raise interest	2.81	0.95	-0.093	-0.068
		Capability to interact	2.66	1.10	0.231	-0.567
Perceived difficulties	0.80	Preparation	3.10	1.00	0.061	-0.197
		Chances of attaining your degree	2.73	0.10	0.146	-0.152
		Degree program	2.72	0.88	-0.081	0.337
		Job perspectives	2.87	0.83	-0.270	0.980
		Perception of study benefits	3.04	0.81	0.0147	1.302
Effectiveness and organization of the course	0.79	Organization (schedule, exams, . . .)	3.55	1.00	-0.502	-0.132
		Effectiveness	3.44	0.98	-0.420	-0.234

TABLE II. Rasch statistics for the items of the *Perception of emergency remote instruction* construct.

Item	Measure (logit)	PTMEA	Infit MNSQ	Infit ZSTD	Outfit MSNQ	Outfit ZSTD
Relationship with the instructors						
Attitude	-0.43	0.6703	0.8557	-1.9691	0.8595	-1.8791
Clarity	-0.07	0.6745	0.8253	-2.3992	0.8119	-2.5392
Effectiveness	+0.06	0.6755	0.8453	-2.0992	0.8424	-2.0992
Capability to raise interest	+0.42	0.6771	0.8632	-1.8591	0.8401	-2.1292
Capability to interact	+0.74	0.6768	1.4765	5.5915	1.4703	5.3015
Perceived difficulties						
Preparation	-0.18	0.6734	1.0149	0.2210	1.0025	0.0610
Chances of attaining your degree	+0.59	0.6772	1.1640	2.0912	1.3250	3.7913
Degree program	+0.62	0.6771	0.8557	-1.9891	0.8526	-1.9591
Job perspectives	+0.31	0.6769	0.9783	-0.2590	0.9843	-0.1690
Perception of study benefits	-0.06	0.6746	0.7285	-3.8893	0.7263	-3.8493
Effectiveness and organization of the course						
Organization (schedule, exams, . . .)	-1.13	0.6573	1.2685	3.4413	1.3041	3.7413
Effectiveness	-0.89	0.6622	1.0564	0.7811	1.0554	0.7411

B. Subjective well-being (SWB)

We asked the respondents to describe their feelings and emotions, felt during emergency remote instruction with respect to in-person activities, by rating each adjective in the list according to the following scale:

1 = definitely less *(decisamente meno)*;

2 = less *(meno)*;

3 = neither less nor more *(né più né meno)*;

4 = more *(più)*;

5 = definitely more *(decisamente più)*.

In Table III, the items are reported in decreasing order of average score. Cronbach's alpha is 0.93 (0.89) for positive (negative) affect.

TABLE III. Descriptive statistics for the items of *Subjective well-being*.

Item	M	$SD.$	Asimmetry	Kurtosis
Bored *(Annoiat*)*	3.63.	1.04	-0.627	-0.123
Disoriented *(Disorientat*)*	3.38	0.96	-0.137	-0.074
Pessimistic *(Pessimista)*	3.33	0.92	0.036	0.015
Stressed *(Stressat*)*	3.33	1.06	-0.130	-0.373
Sad *(Triste)*	3.31	0.95	0.011	0.213
Disappointed *(Delus*)*	3.25	0.88	-0.028	0.530
Frustrated *(Frustrat*)*	3.25	0.93	-0.174	0.357
Angry *(Arrabbiat*)*	3.23	0.92	-0.146	0.833
Scared *(Spaventat*)*	3.20	0.79	0.239	1.184
Anxious *(Ansios*)*	3.14	1.02	-0.195	-0.113
Inadequate *(Inadeguat*)*	3.05	0.79	-0.286	2.094
Respected *(Rispettat*)*	3.00	0.53	-0.326	5.943
Excluded *(Esclus*)*	2.99	0.77	-0.355	2.178
Accepted *(Accettat*)*	2.95	0.57	-0.550	5.031
Embarrassed *(Imbarazzat*)*	2.93	0.85	-0.482	0.955
Guilty *(In colpa)*	2.89	0.69	-0.985	3.222
Welcome *(Accolt*)*	2.87	0.73	-0.426	1.826
Proud *(Fier*)*	2.84	0.67	-0.818	2.675
Despised *(Disprezzat*)*	2.82	0.64	-1.683	4.364
Supported *(Supportat*)*	2.82	0.81	-0.411	0.716
Effective *(Efficace)*	2.76	1.13	0.185	-0.641
Valued *(Valorizzat*)*	2.76	0.70	-0.625	1.736
Gratified *(Gratificat*)*	2.73	0.82	-0.268	0.633
Optimistic *(Ottimista)*	2.70	0.98	-0.047	-0.384
Amused *(Divertit*)*	2.65	0.88	-0.367	-0.055
Satisfied *(Soddisfatt*)*	2.65	0.97	0.167	-0.247
Happy *(Felice)*	2.61	0.96	0.126	-0.105
Stimulated *(Stimolat*)*	2.51	1.02	0.281	-0.351
Energetic *(Energetic*)*	2.48	1.11	0.433	-0.427
Enthusiastic *(Entusiasta)*	2.48	0.99	0.259	-0.190

C.   Motivation to learn physics

Scale for the items in the three dimensions of this construct (*interest, recognition,* and *utility value*):

> 1 = not at all *(per niente)*;
>
> 2 = to a small extent *(poco)*;
>
> 3 = to some extent *(abbastanza)*;
>
> 4 = to a great extent *(molto)*;
>
> 5 = completely *(del tutto)*.

- To what extent are you interested in **physics topics**? (*Quanto ti interessano gli argomenti di Fisica?*)

- To what extent are you interested in the **latest physics results**? (*Quanto ti interessano i risultati delle ricerche in Fisica?*)

- To what extent are you interested in **physics related hobbies**? (*Quanto saresti interessat* ad avere un hobby legato alla Fisica*)

- To what extent do your **peers** consider you a good physics student? (*Quanto i tuoi compagni ti giudicano brav* in fisica?*)

- To what extent do your **instructors** consider you a good physics student? (*Quanto i tuoi docenti ti giudicano brav* in fisica?*)

- To what extent do you think that studying physics is important for your **future**? (*Quanto pensi sia utile per il tuo futuro studiare Fisica?*)

- To what extent do you think that studying physics topics is important for your future **career**? (*Quanto pensi sia utile per la tua carriera imparare argomenti di Fisica?*)

TABLE IV. Descriptive statistics for the items of the motivation toward physics construct.

Dimension	Cronbach's alpha	Item	M	SD	Asimmetry	Kurtosis
Interest	0.76^a; 0.81^b	Physics topics	4.16^a	0.71	-0.479	-0.142
			3.99^b	0.87	-0.762	0.329
		Latest physics results	3.90^a	0.87	-0.411	-0.535
			3.86^b	0.94	-0.670	0.131
		Physics related hobbies	3.54^a	1.04	-0.386	-0.407
			3.49^b	1.08	-0.364	-0.526
Recognition	0.87^a; 0.82^b	Peers	3.23^a	0.79	-0.001	0.553
			3.14^b	0.78	-0.073	0.620
		Instructors	3.15^a	0.72	0.168	0.977
			3.05^b	0.72	-0.128	1.032
Utility value	0.87^a; 0.90^b	Future	4.10^a	0.83	-0.859	0.697
			4.03^b	0.92	-0.829	0.244
		Career	4.06^a	0.83	-0.809	0.745
			3.97^b	0.92	-0.858	0.618

[a]Before emergency remote instruction; [b]After emergency remote instruction.

D. Physics Academic Orientation ~~towards Physics~~ Inventory (PAOI)

In Table V we report the statistics relative to the *Academic orientation towards physics* construct. For each item we asked: To what extent do you feel able to _____? according to the following scale:

1 = not at all *(per niente)*;

2 = to a small extent *(poco)*;

3 = to some extent *(abbastanza)*;

4 = to a great extent *(molto)*;

5 = completely *(del tutto)*.

TABLE V. Descriptive statistics for the items of the *Academic orientation towards physics* construct.

Dimension	Cronbach's alpha	Item	M	SD	Asimmetry	Kurtosis
Self-regulation	0.85^a 0.88^b	Respect schedule	3.03^a	1.01	0.219	-0.510
		(Rispettare sempre il programma di studio stabilito)	2.75^b	1.01	0.402	-0.323
		Keep a steady study rhythm	3.07^a	1.12	-0.023	-0.678
		(Mantenere un ritmo costante di studio)	2.73^b	1.23	0.336	-0.814
		Organize homework	3.00^a	1.06	0.003	-0.544
		(Organizzare il tempo di studio a casa in maniera efficace)	2.77^b	1.24	0.220	-0.967
		Schedule your study	3.09^a	0.93	0.122	-0.100
		(Programmare lo studio in base alla difficoltà degli argomenti)	2.97^b	1.07	0.053	-0.503
		Establish attainable goals	3.17^a	0.95	0.016	-0.131
		(Stabilire obiettivi di rendimento raggiungibili, valutando capacità e limiti)	3.03^b	1.09	0.071	-0.558
		Attend classes regularly	3.98^a	1.03	-0.712	-0.185
		(Frequentare le lezioni con costanza)	3.64^b	1.25	-0.582	-0.678
Metacognition	0.86^a 0.89^b	Use learning materials (textbook, notes, . . .)	3.34^a	0.84	-0.082	-0.172
		(Utilizzare efficacemente il materiale di studio (libro, appunti, . . .))	3.33^b	0.10	-0.123	-0.490
		Create links between concepts	3.43^a	0.83	-0.100	0.117
		(Creare collegamenti tra i diversi concetti che stai studiando)	3.43^b	0.94	-0.213	-0.161
		Rework the learned topics	3.41^a	0.88	-0.048	-0.203
		(Rielaborare adeguatamente gli argomenti studiati)	3.41^b	1.01	-0.2538	-0.449
		Adopt effective learning strategies	2.98^a	1.07	0.0789	-0.544
		(Fare uso di adeguate ed efficaci strategie di apprendimento)	3.00^b	1.15	0.038	-0.796
		Take notes	3.53^a	1.04	-0.345	-0.404
		(Prendere appunti)	3.52^b	1.19	-0.477	-0.596
		Reflect on lecture contents	3.49^a	0.94	-0.128	-0.261
		(Cogliere e rielaborare i contenuti essenziali di una lezione)	3.47^b	1.04	-0.273	-0.362
		Focus on the main aspects of an experiment	3.46^a	0.92	-0.147	0.011
		(Cogliere e rielaborare i contenuti essenziali di un esperimento)	3.32^b	1.05	-0.187	-0.436
		Link different subjects topics	3.45^a	0.80	-0.025	0.022
		(Saper trovare collegamenti con altri corsi)	3.44^b	0.87	-0.219	0.0594
		Reflect on main concepts	3.41^a	0.83	-0.081	0.259
		(Riflettere sui concetti più importanti)	3.30^b	0.91	-0.253	0.0298
		Focus on the main concepts	3.68^a	0.80	-0.001	-0.239
		(Concentrarti sui concetti principali)	3.61^b	0.87	-0.283	0.129
Self-efficacy	0.80^a 0.79^b	Explain clearly what you have studied	3.41^a	0.97	-0.217	-0.319
		(Esporre adeguatamente in forma orale gli argomenti che hai studiato)	3.26^b	1.05	-0.146	-0.645
		Solve simple problems	3.53^a	0.84	-0.059	-0.022
		(Risolvere correttamente semplici problemi	3.39^b	0.92	-0.006	-0.121
		Pass exams with a good grade	3.46^a	0.95	-0.056	-0.348
		(Avere un buon voto alla fine di un esame)	3.31^b	1.00	-0.079	-0.355
		Solve non-trivial problems	3.14^a	0.92	0.081	0.0784
		(Risolvere correttamente problemi complicati)	2.98^b	0.99	0.159	-0.056
Engagement	0.82^a 0.86^b	Ask for clarifications to the instructor during classes	2.75^a	1.14	0.219	-0.665
		(Intervenire in classe per chiedere chiarimenti al docente)	2.50^b	1.22	0.408	-0.805
		Participate to class discussion	2.69^a	1.11	0.285	-0.492
		(Partecipare attivamente alla discussione in classe)	2.39^b	1.15	0.561	-0.449
		Participate to laboratory discussion	3.21^a	0.98	-0.072	-0.195
		(Partecipare attivamente alla discussione in laboratorio)	2.82^b	1.13	0.072	-0.676
Anxiety	0.72^a 0.71^b	Do not dishearten when facing difficulties	2.96^a	1.14	0.177	-0.663
		(Non scoraggiarti in seguito ad un brutto voto o ad una bocciatura)	2.80^b	1.21	0.264	-0.720
		Control anxiety before examinations	2.91^a	1.18	0.086	-0.777
		(Controllare l'ansia prima dell'esame)	2.85^b	1.26	0.069	-0.980

[a]In-person; [b]During emergency remote instruction.

E. Attitude toward physics

Respondents were asked to rate their agreement with each statement, by using the following scale: 1 = not at all (*per niente*); 2 = to a small extent (*poco*); 3 = to some extent (*abbastanza*); 4 = to a great extent (*molto*); 5 = completely (*del tutto*).

TABLE VI. Statistics for the *Attitude toward physics* construct.

Dimension	Cronbach's alpha	Item	M	SD	Asimmetry	Kurtosis
Perceived value of physics in today's society	0.75^a 0.74^b	We need to understand it because it has important effects on our lives	4.05^a	0.95	-0.793	0.074
		(Abbiamo bisogno di comprenderla perché ha effetti non trascurabili sulla nostra vita)	4.09^b	0.97	-0.900	0.253
		It is relevant for technological progress	4.51^a	0.69	-1.330	1.350
		(È importante per il progresso tecnologico)	4.56^b	0.65	-1.388	1.455
		It is relevant for our country's progress	4.10^a	0.82	-0.592	-0.300
		(È importante per lo sviluppo del nostro paese)	4.13^b	0.83	-0.634	-0.317
Perceived difficulty of physics as a discipline	0.71^a 0.74^b	Too many things to know to become an expert	2.71^a	0.98	0.508	-0.128
		(Le conoscenze e i contenuti necessari per diventare un esperto sono troppi)	2.76^b	1.04	0.482	-0.335
		It is necessary to know too much to learn it well	2.77^a	1.04	0.396	-0.354
		(C'è bisogno di conoscere troppe cose per impararla bene)	2.79^b	1.07	0.360	-0.479
		It requires too many mathematical skills	4.18^a	0.77	-0.532	-0.509
		(Richiede molte conoscenze e abilità matematiche)	4.21^b	0.76	-0.536	-0.633
		It is more demanding than other subjects	3.84^a	1.00	-0.456	-0.802
		(È necessario molto più impegno di quanto richiesto per altre materie)	3.88^b	1.02	-0.577	-0.571
		Contents are too abstract	2.14^a	0.84	0.760	0.816
		(I contenuti sono troppo astratti)	2.17^b	0.86	0.774	0.774
		It is difficult to learn	3.04^a	0.98	0.301	-0.440
		(È difficile da imparare)	3.01^b	0.99	0.267	-0.477
Intrinsic interest in physics	0.73^a 0.76^b	I find it interesting	4.51^a	0.68	-1.220	0.799
		(Penso sia interessante)	4.47^b	0.76	-1.398	1.698
		It arouses my curiosity	4.48^a	0.70	-1.228	1.053
		(Stimola la mia curiosità)	4.39^b	0.80	-1.211	0.996
		I prefer it to other subjects	3.83^a	1.05	-0.675	-0.161
		(La preferisco alle altre materie del mio corso di studio)	3.83^b	1.02	-0.636	-0.225
		I am enthusiastic when studying it	3.77^a	0.95	-0.381	-0.399
		(Ne sono entusiasta quando la studio)	3.64^b	0.98	-0.355	-0.416
Personal relevance of working in a physics-related field	0.88^a 0.89^b	I am interested in working in a field that requires a deep knowledge	3.94^a	1.04	-0.709	-0.250
		(Sono interessato a svolgere un lavoro in un settore che ne richiede la conoscenza approfondita)	3.90^b	1.09	-0.704	-0.308
		I am interested in doing research	3.71^a	1.25	-0.614	-0.755
		(Sono interessato a fare ricerca)	3.59^b	1.30	-0.505	-0.925
		I am interested in pursuing a career based on it	4.03^a	1.05	-1.042	0.648
		(Sono interessato ad intraprendere una carriera legata ad essa)	3.97^b	1.07	-0.988	0.422
Relevance of learning physics at the university	0.72^a 0.70^b	Relevance lies in its usefulness in solving practical problems	3.37^a	0.94	0.045	-0.692
		(La sua importanza risiede nell'applicazione alla risoluzione di problemi pratici)	3.39^b	0.97	-0.014	-0.692
		Using the knowledge learned at school, I can explain natural phenomena to people	3.52^a	0.91	-0.390	-0.185
		(Usando le conoscenze apprese a scuola, posso spiegare i fenomeni naturali alle persone)	3.52^b	1.02	-0.372	-0.250
		The exam questions are important because they concern daily life	2.59^a	0.97	0.364	-0.069
		(Le domande all'esame sono importanti perché riguardano problemi legati al mondo reale)	2.58^b	0.98	0.367	-0.137
		What I learn in lectures affects and is relevant for daily life	2.99^a	1.04	0.208	-0.573
		(Quel che studio nei corsi influenza ed è importante per le attività di tutti i giorni)	3.01^b	1.05	0.169	-0.609
		What is taught in lectures can be applied to daily life	3.26^a	1.02	0.085	-0.612
		(La conoscenza appresa nei corsi può essere applicata alla vita quotidiana)	3.27^b	1.05	0.045	-0.708
Recognition of the physicists' role in the society	0.65^a 0.66^b	They are held in high esteem in today's society	2.59^a	0.90	0.302	-0.057
		(Nella società odierna sono molto stimati)	2.56^b	0.89	0.268	-0.069
		They are highly regarded in today's society	2.81^a	0.89	0.149	-0.142
		(Nella società odierna godono di un'altissima considerazione)	2.76^b	0.91	0.204	-0.136
		They are important for the development of today's society	4.10^a	0.84	-0.545	-0.414
		(Sono importanti per lo sviluppo della società attuale)	4.15^b	0.83	-0.540	-0.697
		They can solve many of the problems of today's society	3.41^a	0.91	0.007	-0.527
		(Possono risolvere molti problemi della società attuale)	3.46^b	0.96	-0.039	-0.790
		I trust them a lot	4.05^a	0.84	-0.536	-0.144
		(Ho molta fiducia in loro)	3.97^b	0.96	-0.738	0.168
		Our society can do without them (R)	3.72^a	0.60	-2.944	11.555
		(La nostra società può farne a meno)	3.69^b	0.67	-2.960	10.610
		Our society cannot trust them (R)	3.59^a	0.77	-2.410	6.597
		(La nostra società non può fidarsi di loro)	3.58^b	0.82	-2.423	6.094
		Their research results are always correct	2.43^a	0.93	0.360	-0.138
		(Le loro ricerche producono risultati sempre corretti)	2.43^b	0.93	0.332	-0.242
		Their research is bad for the environment (R)	3.58^a	0.63	-1.894	5.381
		(Provocano gravi problemi all'ambiente con le loro ricerche)	3.59^b	0.63	-1.948	5.592
Value of the physicists' careers	0.81^a 0.81^b	They can do many jobs	3.91^a	0.85	-0.391	-0.231
		(Ci sono molti lavori che possono svolgere)	3.88^b	0.93	-0.480	-0.423
		Their jobs are well-paid and rewarding	2.99^a	0.92	0.236	0.031
		(La carriera è remunerativa e di alto livello)	2.91^b	0.92	0.219	-0.016
		In today's society they are in high demand	2.98^a	0.93	0.199	-0.205
		(Nella società attuale c'è un'altissima richiesta)	2.92^b	0.93	0.299	-0.224
		In today's society they can earn a lot of money	2.60^a	0.88	0.301	-0.081
		(Nella società attuale hanno la possibilità di guadagnare molto dal punto di vista economico)	2.52^b	0.88	0.433	0.137
		In today's society they have a lot of job opportunities	3.32^a	0.86	0.042	-0.223
		(Nella società attuale hanno un'ampia scelta di possibili carriere da intraprendere)	3.28^b	0.87	0.072	-0.200
		Many companies are hiring them	3.01^a	0.97	0.119	-0.416
		(Nella società attuale c'è grande attenzione nel loro impiego in diverse industrie)	2.99^b	0.96	0.097	-0.421

[a]Before emergency remote instruction; [b]After emergency remote instruction. (R) indicates reversed item.

F.   Cluster analysis

In Tables VII, VIII, and IX we report the results of cluster analysis of the students' responses to SWB and *Attitude toward physics* scales, respectively. Cluster analysis was performed using the factorial scores obtained from the multiple correspondence analysis. The extracted factorial components were interpreted using the *test values* associated to the modalities. The modality of an item is one of the five values used in the Likert scale (e.g., more, definitely more, less,

TABLE VII. Subjective well-being - Modalities of the identified three clusters.

Cluster	Item	Modality	Modal/Class (%)	Class/Modal (%)	*Test values*
Cluster 1 *Significantly damaged* (N=81, 22.4%)	Satisfied	Definitely less	95.45	51.85	11.28
	Enthusiastic	Definitely less	78.79	64.20	11.10
	Energetic	Definitely less	71.79	69.14	10.93
	Stressed	Definitely more	82.76	59.26	10.91
	Sad	Definitely more	87.76	53.09	10.63
	Stimulated	Definitely less	77.78	60.49	10.55
	Optimistic	Definitely less	85.71	51.85	10.28
	Happy	Definitely less	84.00	51.85	10.11
	Pessimistic	Definitely more	86.67	48.15	9.89
	Angry	Definitely more	91.89	41.98	9.57
	Frustrated	Definitely more	91.43	39.51	9.18
	Effective	Definitely less	76.92	49.38	9.14
	Disoriented	Definitely more	79.17	46.91	9.05
	Disappointed	Definitely more	90.63	35.80	8.59
	Gratified	Definitely less	88.24	37.04	8.57
	Amused	Definitely less	71.43	43.21	7.90
	Valued	Definitely less	91.67	27.16	7.38
	Supported	Definitely less	83.33	30.86	7.32
	Anxious	Definitely more	78.79	32.10	7.15
	Scared	Definitely more	85.19	28.40	7.10
	Bored	Definitely more	54.79	49.38	6.81
	Proud	Definitely less	86.36	23.46	6.43
	Inadequate	Definitely more	94.12	19.75	6.29
	Accepted	Definitely less	72.73	19.75	5.02
Cluster 2 *Significantly supported* (N=34, 9.4%)	Proud	More	50.00	32.35	99.99
	Secluded	Definitely less	73.91	50.00	7.81
	Effective	Definitely more	66.67	52.94	7.72
	Guilty	Definitely less	66.67	52.94	7.72
	Frustrated	Definitely less	83.33	44.12	7.66
	Angry	Definitely less	68.18	44.12	6.97
	Inadequate	Definitely less	65.22	44.12	6.83
	Energetic	Definitely more	70.00	41.18	6.77
	Satisfied	Definitely less	91.67	32.35	6.70
	Disoriented	Definitely less	91.67	32.35	6.70
	Enthusiastic	Definitely more	91.67	32.35	6.70
	Pessimistic	Definitely less	100.00	29.41	6.66
	Happy	More	47.37	52.94	6.55
	Despised	Definitely less	50.00	47.06	6.26
	Valued	More	66.67	35.29	6.03
	Stimulated	Definitely more	83.33	29.41	6.03
	Gratified	More	48.39	44.12	5.91
	Optimistic	Definitely more	90.00	26.47	5.90
	Embarrassed	Definitely less	45.45	44.12	5.73
	Stimulated	More	38.10	47.06	5.41
	Happy	Definitely more	75.00	26.47	5.39
	Disappointed	Definitely less	69.23	26.47	5.18
	Amused	More	38.89	41.18	5.03
	Enthusiastic	More	41.94	38.24	5.01
Cluster 3 *Not significantly affected* (N=247, 68.2%)	Sad	Neither less nor more	92.27	72.47	10.83
	Angry	Neither less nor more	88.89	77.73	10.29
	Frustrated	Neither less nor more	91.89	68.83	10.17
	Gratified	Neither less nor more	87.85	76.11	9.63
	Disappointed	Neither less nor more	89.39	71.66	9.61
	Inadequate	Neither less nor more	83.53	86.23	9.39
	Proud	Neither less nor more	81.85	89.47	9.21
	Pessimistic	Neither less nor more	89.94	65.18	8.97
	Happy	Neither less nor more	91.88	59.51	8.94
	Disoriented	Neither less nor more	90.63	58.70	8.41
	Guilty	Neither less nor more	79.51	91.09	8.35
	Scared	Neither less nor more	83.48	77.73	8.07
	Satisfied	Neither less nor more	91.03	53.44	7.92
	Enthusiastic	Neither less nor more	90.91	52.63	7.79
	Optimistic	Neither less nor more	89.17	56.68	7.68
	Valued	Neither less nor more	81.20	82.19	7.68
	Amused	Neither less nor more	84.92	68.42	7.50
	Secluded	Neither less nor more	80.16	83.40	7.36
	Effective	Neither less nor more	90.91	44.53	6.87
	Stressed	Neither less nor more	87.42	53.44	6.76
	Accepted	Neither less nor more	76.71	90.69	6.72
	Anxious	Neither less nor more	85.98	57.09	6.66
	Supported	Neither less nor more	80.91	72.06	6.31
	Stimulated	Neither less nor more	88.28	45.75	6.24
	Despised	Neither less nor more	75.00	93.52	6.22
	Respected	Neither less nor more	75.50	91.09	6.06
	Welcome	Neither less nor more	77.51	78.14	5.42

...). The *test value* of a modality measures its distance from the centre of the factorial axis. High *test values*, in absolute value, indicate a significant contribution of the corresponding modality to the factorial axis.

We also report two indices that represent exclusivity (*Modal/Class*) and omogeneity (*Class/Modal*) of a given cluster. In particular, *Modal/Class* indicates the frequency of a modality in a given cluster over the total frequency of the same modality. For instance, in the first row of Table VII, the frequency 95.5% indicates that almost all the responses to the item *Satisfied*, characterized by the modality *definitely less*, are present in this cluster.

Class/Modal indicates the frequency of a modality with respect of all the cases in the cluster. For instance, in the

first row of Table VII the percentage 51.8% indicates that the modality *definitely less* of the item *Satisfied* is present in about half the cases of the cluster. For the sake of clarity, we only report modalities with test values corresponding to $p < 0.001$.

TABLE VIII. Main modalities of the three clusters identified for *Attitude toward physics* before emergency remote instruction.

	Item	Modality	Modal/Class (%)	Class/Modal (%)	Test values
Cluster 1 *Accepted discipline* (N=171, 47.2%)	PHYSICISTS – I trust them a lot	Completely	73.10	61.99	8.07
	PHYSICS – We need to understand it because it has important effects on our lives	Completely	75.40	55.56	7.85
	PHYSICS – Is relevant for our country's progress	Completely	69.03	62.57	7.16
	PHYSICS – I am interested in working in a field that requires a deep knowledge	Completely	74.55	47.95	6.85
	PHYSICISTS – Are important for the development of today's society	Completely	69.85	55.56	6.64
	PHYSICS – I am interested in pursuing a career based on it	Completely	70.43	47.37	5.97
	PHYSICS – I am enthusiastic when studying it	Completely	66.17	51.46	5.42
	PHYSICS – PHYSICS - I prefer it to other subjects	Completely	66.94	48.54	5.34
	PHYSICS – Is relevant for technological progress	Completely	67.27	43.27	4.96
	PHYSICS –Requires too many mathematical skills	Completely	62.50	55.56	4.86
	PHYSICIST - Can do many jobs	Completely	62.09	55.56	4.76
	PHYSICS – Its relevance lies in its usefulness in solving practical problems	Completely	63.72	42.11	4.13
Cluster 2 *Blurred discipline* (N=79, 21.8%)	PHYSICISTS – I trust them a lot	To some extent	55.95	59.49	7.99
	PHYSICS – Is relevant for our country's progress	To some extent	53.85	44.30	6.26
	PHYSICS – We need to understand it because it has important effects on our lives	To some extent	51.39	46.84	6.20
	PHYSICISTS – Our society can do without them	To a small extent	50.68	46.84	6.11
	PHYSICS – I am enthusiastic when studying it	To a small extent	74.07	25.32	5.90
	PHYSICS – What is taught in lectures can be applied to daily life	To a small extent	49.32	45.57	5.83
	PHYSICS – I find it interesting	To some extent	70.00	26.58	5.78
	PHYSICS – I am interested in working in a field that requires a deep knowledge	To some extent	46.91	48.10	5.73
	PHYSICS – I am interested in working in a field that requires a deep knowledge	To a small extent	71.43	25.32	5.72
	PHYSICS – Is relevant for technological progress	To some extent	73.08	24.05	5.66
	PHYSICISTS – Are important for the development of today's society	To some extent	46.25	46.84	5.53
	PHYSICISTS – Our society cannot trust them	To a small extent	44.32	49.37	5.46
	PHYSICS – I am interested in doing research	Not at all	76.19	20.25	5.30
	PHYSICS – I am interested in pursuing a career based on it	To some extent	46.38	40.51	5.02
	PHYSICS – It arouses my curiosity	To some extent	64.29	22.78	4.90
	PHYSICS – We need to understand it because it has important effects on our lives	To a small extent	73.68	17.72	4.77
	PHYSICISTS – Can solve many of the problems of today's society	To a small extent	49.06	32.91	4.67
	PHYSICISTS – Can do many jobs	To a small extent	84.62	13.92	4.66
	PHYSICS – I prefer it to other subjects	To a small extent	60.00	22.78	4.59
	PHYSICISTS – In today's society have a lot of job opportunities	To a small extent	49.02	31.65	4.55
	PHYSICS – What I learn in lectures affects and is relevant for daily life	To a small extent	38.10	50.63	4.51
	PHYSICS – I am enthusiastic when studying it	To some extent	37.38	50.63	4.37
	PHYSICS – I am interested in doing research	To a small extent	47.17	31.65	4.35
	PHYSICS – What I learn in lectures affects and is relevant for daily life	Not at all	65.00	16.46	4.08
	PHYSICS – I am interested in pursuing a career based on it	Not at all	76.92	12.66	4.06
Cluster 3 *Niche discipline* (N=112, 31.0%)	PHYSICISTS – Are important for the development of today's society	Completely	66.18	80.36	11.25
	PHYSICS – We need to understand it because it has important effects on our lives	Completely	64.54	81.25	11.08
	PHYSICS – It is relevant for our country's progress	Completely	66.67	76.79	10.85
	PHYSICISTS – I trust them a lot	Completely	65.04	71.43	9.90
	PHYSICS – It is relevant for technological progress	Completely	47.51	93.75	9.14
	PHYSICS – I find it interesting	Completely	47.06	92.86	8.84
	PHYSICS – I am interested in working in a field that requires a deep knowledge	Completely	58.82	71.43	8.78
	PHYSICS – I am enthusiastic when studying it	Completely	69.23	56.25	8.78
	PHYSICISTS – Can do many jobs	Completely	66.67	57.14	8.50
	PHYSICISTS – Can solve many of the problems of today's society	Completely	88.64	34.82	8.42
	PHYSICS – It arouses my curiosity	Completely	47.17	89.29	8.29
	PHYSICS – I am interested in pursuing a career based on it	Completely	54.67	73.21	8.15
	PHYSICS – Using the knowledge learned at university, I can explain natural phenomena to people	Completely	75.00	40.18	7.64
	PHYSICS – I prefer it to other subjects	Completely	58.77	59.82	7.52
	PHYSICS – What I learn in lectures affects and is relevant for daily life	Completely	90.91	26.79	7.42
	PHYSICS – What is taught in lectures can be applied to daily life	Completely	78.00	34.82	7.30
	PHYSICISTS – In today's society have a lot of job opportunities	Completely	87.10	24.11	6.64
	PHYSICS – I am interested in doing research	Completely	53.13	60.71	6.57
	PHYSICISTS – Their research is bad for the environment (R)	Not at all	41.92	85.71	6.08
	PHYSICS – Relevance lies in its usefulness in solving practical problems	Completely	71.74	29.46	5.98
	PHYSICS – I prefer it to other subjects	Completely	51.33	51.79	5.44
	PHYSICISTS – Many companies are hiring them	Completely	83.33	17.86	5.30
	PHYSICISTS – Their jobs are well-paid and rewarding	Completely	82.61	16.96	5.09
	PHYSICS – Requires too many mathematical skills	Completely	46.43	58.04	4.91
	PHYSICISTS – In today's society are in high demand	Completely	81.82	16.07	4.88
	PHYSICS – The exam questions are important because they concern daily life	Completely	92.86	11.61	4.67
	PHYSICISTS – Our society cannot trust them (R)	Not at all	37.70	84.82	4.24
	PHYSICS – It is difficult to learn	Not at all	90.91	8.93	3.90
	PHYSICISTS – Are held in high esteem in today's society	Completely	90.91	8.93	3.90
	PHYSICISTS – Are regarded very highly in today's society	Completely	100.00	7.14	3.81

TABLE IX. Main modalities of the three clusters identified for *Attitude toward physics* after emergency remote instruction.

	Item	Modality	Modal/Class (%)	Class/Modal (%)	Test values
Cluster 1 *Accepted discipline* (N=180, 49.7%)	PHYSICISTS − I trust them a lot	Completely	78.36	58.33	8.42
	PHYSICS − We need to understand it because it has important effects on our lives	Completely	73.95	48.89	6.43
	PHYSICS − I am enthusiastic when studying it	Completely	70.37	52.78	6.01
	PHYSICS − Is relevant for our country's progress	Completely	68.71	56.11	5.92
	PHYSICS − I am interested in working in a field that requires a deep knowledge	Completely	73.27	41.11	5.53
	PHYSICISTS − Can do many jobs	Completely	66.20	52.22	4.96
	PHYSICISTS − I prefer it to other subjects	Completely	66.10	43.33	4.25
	PHYSICISTS − Can solve many of the problems of today's society	Completely	65.57	44.44	4.21
	PHYSICISTS − Are important for the development of today's society	Completely	64.62	46.67	4.15
	PHYSICS − Requires too many mathematical skills	Completely	63.01	51.11	4.07
Cluster 2 *Blurred discipline* (N=101, 27.9%)	PHYSICISTS − I trust them a lot	To some extent	62.96	50.50	7.53
	PHYSICS − What is taught in lectures can be applied to daily life	To a small extent	63.64	48.51	7.41
	PHYSICS − I find it interesting	To some extent	85.29	28.71	7.22
	PHYSICS − I am enthusiastic when studying it	To a small extent	79.49	30.69	6.99
	PHYSICS − Is relevant for our country's progress	To some extent	65.63	41.58	6.91
	PHYSICS − We need to understand it because it has important effects on our lives	To some extent	64.18	42.57	6.84
	PHYSICS − It arouses my curiosity	To some extent	76.19	31.68	6.82
	PHYSICISTS − Are important for the development of today's society	To some extent	60.53	45.54	6.69
	PHYSICS − What I learn in lectures affect is relevant for daily life	To a small extent	52.94	53.47	6.34
	PHYSICS − The exam questions are important because they concern daily life	To a small extent	45.45	59.41	5.46
	PHYSICS − I am interested in working in a field that requires a deep knowledge	To some extent	52.38	43.56	5.38
	PHYSICISTS − Can solve many of the problems of today's society	To a small extent	56.67	33.66	5.04
	PHYSICS − I am interested in doing research	To a small extent	58.18	31.68	5.02
	PHYSICISTS − Can do many jobs	To a small extent	74.07	19.80	5.01
	PHYSICS − I am interested in working in a field that requires a deep knowledge	To a small extent	70.00	20.79	4.85
	PHYSICISTS − I trust them a lot	To a small extent	83.33	14.85	4.80
	PHYSICISTS − Can do many jobs	To some extent	48.86	42.57	4.76
	PHYSICS − I am interested in doing research	Not at all	68.97	19.80	4.63
	PHYSICS − I prefer it to other subjects	To some extent	47.78	42.57	4.58
	PHYSICS − Is relevant for technological progress	To some extent	73.91	16.83	4.54
	PHYSICS − We need to understand it because it has important effects on our lives	To a small extent	78.95	14.85	4.53
	PHYSICS − Is relevant for technological progress	Completely	45.63	46.53	4.51
	PHYSICS − I am enthusiastic when studying it	To some extent	44.44	47.52	4.36
	PHYSICISTS − Our society cannot trust them	To a small extent	48.72	37.62	4.34
	PHYSICISTS − In today's society are in high demand	To a small extent	44.04	47.52	4.28
	PHYSICISTS − Our society can do without them	To a small extent	49.32	35.64	4.27
	PHYSICISTS − In today's society have a lot of job opportunities	To a small extent	52.73	28.71	4.11
	PHYSICS − I find it interesting	Completely	43.69	44.55	4.01
Cluster 3 *Niche discipline* (N=81, 22.4%)	PHYSICS − We need to understand it because it has important effects on our lives	Completely	48.03	90.12	10.16
	PHYSICS − It is relevant for our country's progress	Completely	50.00	85.19	9.85
	PHYSICISTS–I trust them a lot	Completely	52.03	79.01	9.45
	PHYSICS − I am enthusiastic when studying it	Completely	64.86	59.26	9.01
	PHYSICISTS Are important for the development of today's society	Completely	45.58	82.72	8.73
	PHYSICS − What I learn in lectures affects and is relevant for daily life	Completely	88.24	37.04	8.57
	PHYSICS − I am interested in working in a field that requires a deep knowledge	Completely	46.72	79.01	8.53
	PHYSICISTS − Can solve many of the problems of today's society	Completely	70.91	48.15	8.42
	PHYSICS − What is taught in lectures can be applied to daily life	Completely	71.15	45.68	8.16
	PHYSICS − I find it interesting	Completely	35.32	95.06	7.88
	PHYSICS − I am interested in pursuing a career based on it	Completely	43.97	76.54	7.73
	PHYSICISTS − Can do many jobs	Completely	49.51	62.96	7.38
	PHYSICS − Using the knowledge learned at university, I can explain natural phenomena to people	Completely	60.32	46.91	7.20
	PHYSICS − I prefer it to other subjects	Completely	46.09	65.43	7.05
	PHYSICS − It is relevant for technological progress	Completely	32.62	93.83	6.76
	PHYSICS − It arouses my curiosity	Completely	34.65	86.42	6.48
	PHYSICISTS − In today's society have a lot of job opportunities	Completely	74.19	28.40	6.32
	PHYSICS − The exam questions are important because they concern daily life	Completely	100.00	17.28	6.19
	PHYSICS − I am interested in doing research	Completely	42.15	62.96	6.12
	PHYSICISTS − In today's society are in high demand	Completely	80.95	20.99	5.70
	PHYSICISTS − Their research is bad for the environment (R)	Not at all	30.90	88.89	5.44
	PHYSICS − Relevance lies in its usefulness in solving practical problems	Completely	54.00	33.33	5.18
	PHYSICS − It is more demanding than other subjects	Completely	39.17	58.02	5.14
	PHYSICISTS − Their jobs are well-paid and rewarding	Completely	75.00	18.52	4.96
	PHYSICS − It is difficult to learn	Not at all	90.00	11.11	4.31
	PHYSICS − It is necessary to know too much to learn it well	Not at all	59.26	19.75	4.15
	PHYSICS − Contents are too abstract	Not at all	42.25	37.04	4.12
	PHYSICS − Requires too many mathematical skills	Completely	33.56	61.73	4.12