Evolution acceptance and high school students. Methodological considerations and new perspectives of investigation

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Summary

- Observa Science in Society Institute
- Biological evolution research
- ROSES project, Brazil Italian comparison
- Research design: methods and statistical analysis
- Results

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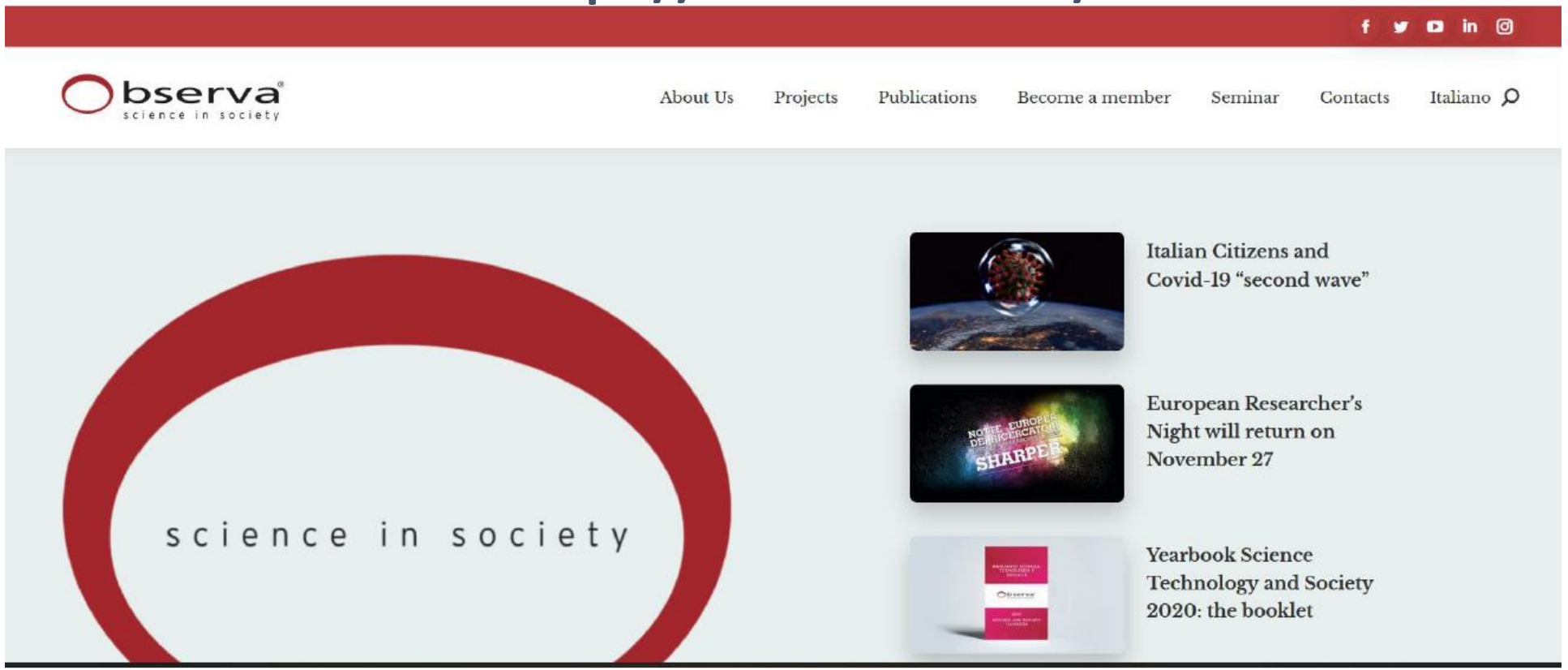

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II PART: SCIENCE, TECHNOLOGY AND SOCIETY DATA
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Cittizens, Science and Technology
4) Technology and everyday life
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Resources
6) Science and Technology relevant dates
7) References and Web sources
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LATEST NEWS

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Biological evolution research

- Biological evolution measure
- Factors that influence knowledge and acceptance of evolutionary theories
- The Italian-Brazilian research group questions
- Definition of evolution acceptance
- Statistical analysis
- Sociocultural factors and religious background

Evolution education and factors

- 3 main factors: key biological concepts, religious factors, understanding of the nature of science

- Test to measure evolution acceptance:

  Measure of Acceptance of the Theory of Evolution (MATE)
  Inventory of Student Evolution Acceptance (I-SEA)
  The Generalized Acceptance of Evolution Evaluation (GAENE)

Barnes studies on n= 2300 using 6 different tests. Different instruments led to different results

Evolution education and factors

- Understanding evolutionary concepts (e.g. natural selection) vs. evolution acceptance

- Evolution knowledge: different tools and lack of consensus UK study (Mead R, Hejmadi M, Hurst LD, 2017)

- Challenges for research: key constructs (attitudes, acceptance, knowledge understandings); different tools; evolution as a multidimensional concept

Recent studies

- The EEQ tool: Acceptance and Knowledge of Evolution Theory (Beniermann et al. 2021; Kuschmierz et al. 2021)
- Religious belief: main factor to predict low acceptance of evolution theory (Barnes et al. 2020)
- Evolution is controversial among both religious and non religious individuals
- Religious belief as intrinsically antievolutionist (complex an not unanimous)

Recent studies

- Correlation between religious affiliation and understanding-acceptance of evolution (Barnes et al. 2021)

- Common view of religious affiliation under discussion (Bradshaw WS et al 2018; Clement P. 2015)

Two countries and different cultures

- Italy and Brasil: coomon roots, different phenomena (creationism in Brasil)

- Evolutionary theory non rejected in Italy, creationism in Brasil
  (Berti AE et al. 2017; Pew research 2020)

- Acceptance of evolution in Brazil (51%), in Italy (74%)

Belief and acceptance

- Belief: a self disposition - not imply an admission…
- Acceptance: a commitment to a policy of premising that concept or theory
- acceptance as the expression of explicit recognition of the objective validity of known scientific statements about evolution under absolute anonymity.
- 1. scientific statements 2. objective condition

Belief and acceptance

- Anonymous participation must be guaranteed
- Likert scale: for the main items
- Separated section with dichotomous questions, factual statements
- “The age of the earth is at least 4 billion years”

Material and Methods

- 5 statements: earth age, fossil record, common ancestry , origin human being

Part of the international ROSE (Relevance Science Education)

- The formation of our planet occurred some 4.5 billion years ago;
- Fossils are evidence of living beings that lived in the past;
- Present-day species of animals and plants originated from other species of the past;
- Evolution occurs in both plants and animals;
- Humans are descended from other primate species;
- The human species has inhabited planet Earth in the last 100,000 years;
- Different organisms may have a common ancestor;
- The first humans were prey to carnivorous dinosaurs

Sample design, research activities

- Stratified samplig – Brasil Pisa sampling, Italy School Universe
- 2 variables: geographical, 2 grade high school, 2 implicit variables: school type, town or province; random selection of 100 schools
- Final sample Brasil: Final sample Italy: 3503 students
- Age: 15

Religious orientation

- Brazil: Catholic 56%, Pentecostal 21%, Evangelicals 10%, Orthodox, Lutheran, and Anglican Christians was low, less than 1%, %. Other religions 13%

- Italy: Catholic 67%, no religion 22%, non catholic Christians 3%, other religions 3,5%

- Tot. n. catholics in both countries: 3000 cases

Statistical and numerical analysis

- Chisquare tests statistics
- Global significance level of 5%
- Association using MCA
- Other tables (excluding neutral position) proposing a biplot graph

Statistical and numerical analysis (n: 3881)

- 1 = BC + (Brazilian Catholic who answered “True”);
- 2 = BC—(Brazilian Catholic who answered “False”);
- 3 = BNC + (Brazilian non-Catholic Christian who answered “True”);
- 4 = BNC—(Brazilian Christian non-Catholic who answered “False”);
- 5 = IC + (Italian Catholic who answered “True”);
- 6 = IC- (Italian Catholic who answered “False”);
- 7 = INC + (non-Catholic Christian Italian who answered “True”);
- 8 = INC- (Italian Christian non-Catholic who answered “False”).

Differencies between Chris. Denomination and same Religion

- BCat-BNCat = **ΔBChr** (Cat and non Cat)

- ICat—BCat = **Δcat** (Cat in diff. countries)

- **IntcI** = | **Δcat** |/| **ΔBChr** |

- **Intcl** higher than 1 IntCI>1 - sociocultural factors count

Intercultural Index

Table 5. Intercultural Index (IntcI) related to evolution acceptance.

	BCat	BNCC	ICat	|ΔCat|	|ΔBChr|	IntcI
G75 (Planet age)	0.483	0.409	0.736	0.252	0.074	**3.43**
G76 (Fossils)	0.848	0.788	0.911	0.103	0.059	**1.72**
G77 (Emergence of species)	0.666	0.592	0.852	0.186	0.074	**2.51**
G79 (Primate origin of human beings)	0.485	0.294	0.847	0.362	0.192	**1.89**
G80 (Age of the human species)	0.277	0.294	0.199	0.077	0.017	**4.58**
G81 (Common ancestor)	0.311	0.279	0.602	0.292	0.032	**9.02**

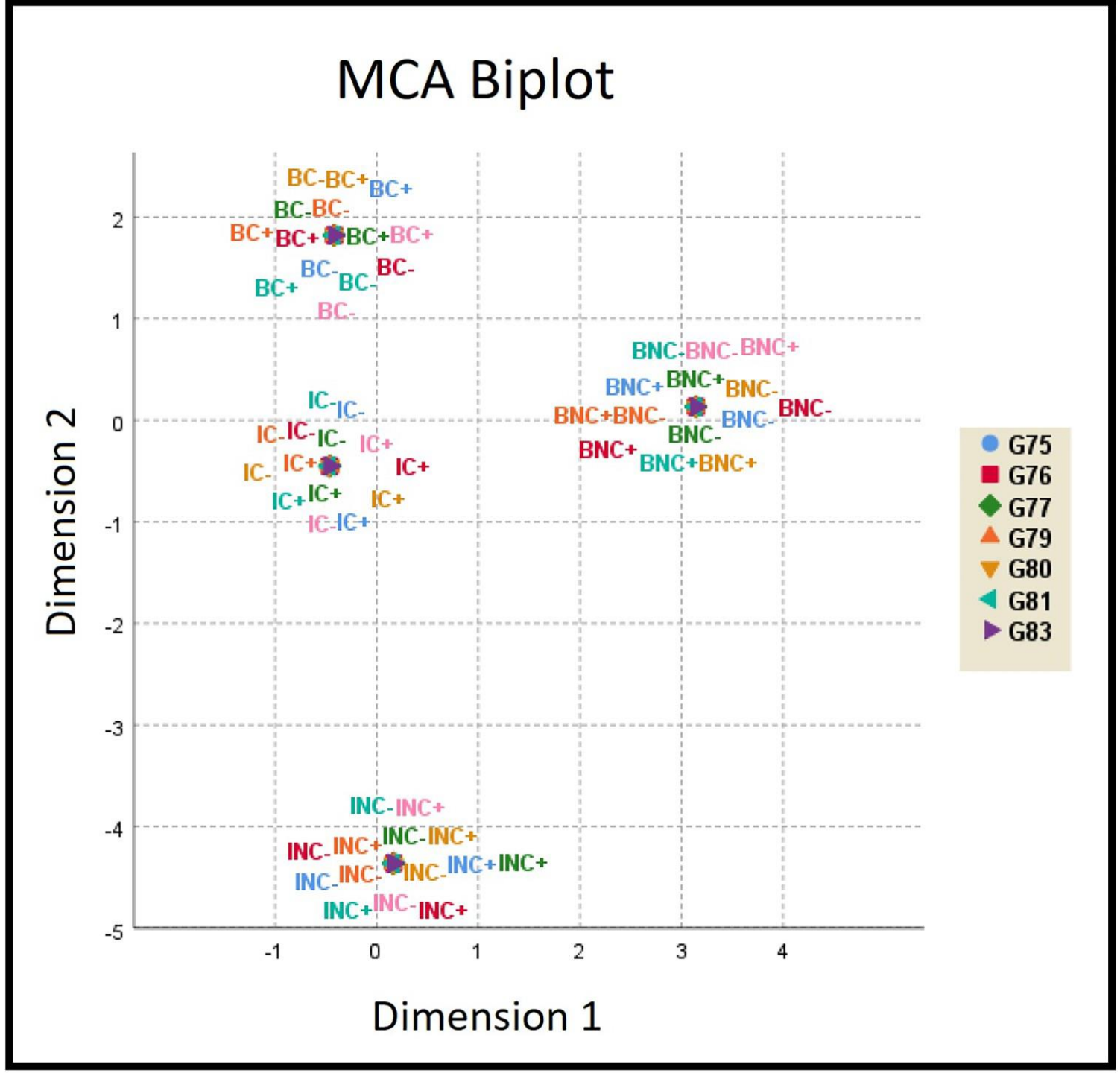
Results

- Comparing Cath of the 2 countries we found significant differences

  Planet Age: p. 0.0005 - Fossils: p. 0.0005 - Emergence of species: p. 0.0005
  Primate origins: p. p. 0.0005 - Age of the Human species: p. 0.0005
  Common ancestor: p. 0.0005 - Human dinosaur coexistence - p. 0.0005

- Cath. And Ncath in Brazil: 4 items no differencies
  2 items: «Human species has inhabitated planet earth in the last 100,000 years»; “Different organisms may have a common ancestor”
  higher number of I would not know how to put it

- ??Understanding of geological time??


MCA Biplot
Dimension 2
Dimension 1
2
1
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-1
-2
-3
-4
-5
-1
0
1
2
3
4
BC-BC+BC+
BC-BC-
BC+BC+BC+BC+
BC-BC-BC-
BC+
BC-
BNC-BNC-BNC+
BNC+BNC+BNC-
BNC+BNC-BNC-BNC-
BNC-
BNC+BNC+BNC+
IC-IC-
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IC-IC+IC+
IC+IC+IC+
IC-IC+
INC-INC+
INC-INC+INC-INC+
INC-INC+INC-INC+INC+
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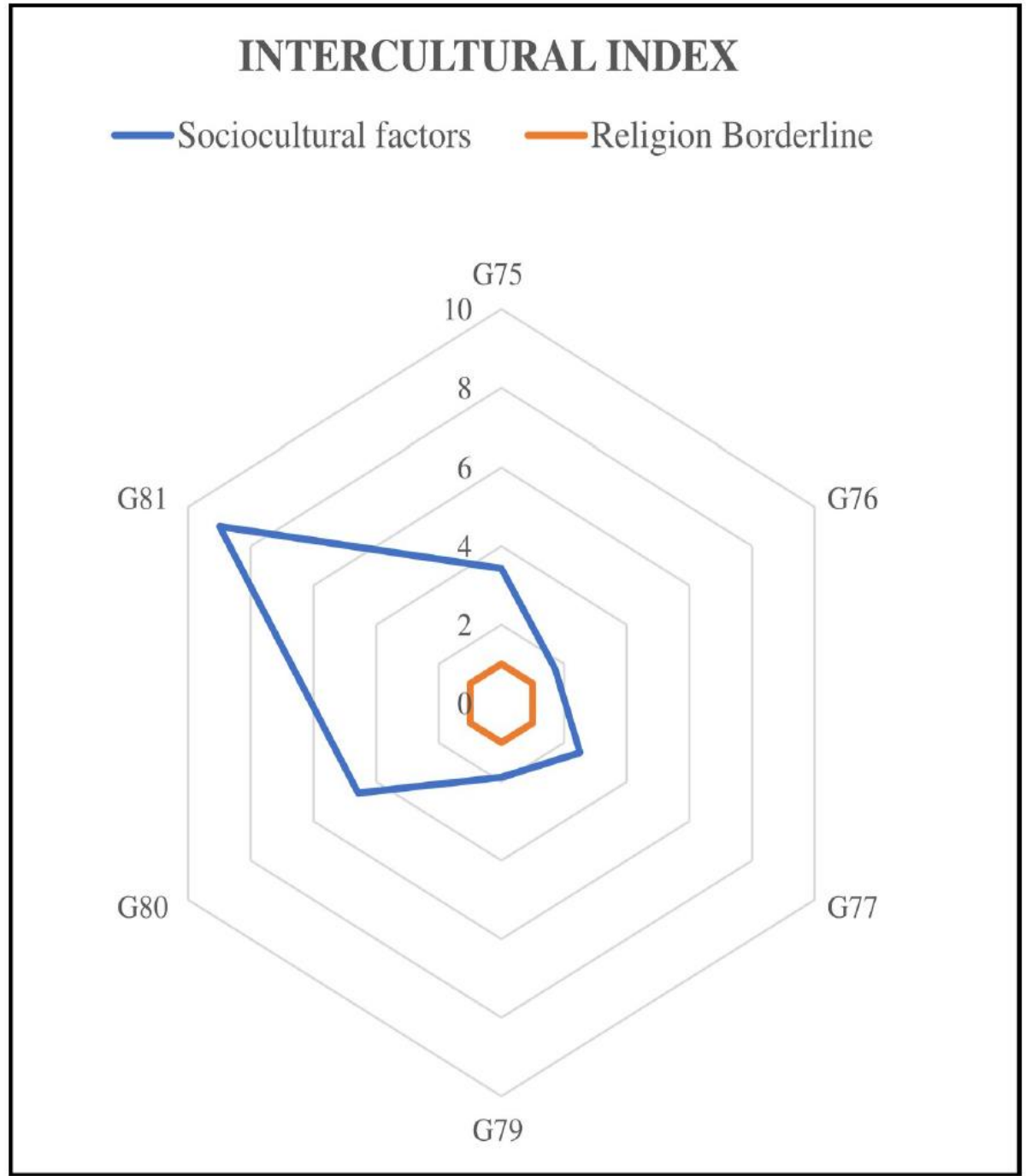
INC+INC-INC+
G75
G76
G77
G79
G80
G81
G83


INTERCULTURAL INDEX
Sociocultural factors
Religion Borderline
G75
10
8
6
4
2
0
G76
G77
G79
G80
G81

Results


Analyze Data
Draw Conclusion
State Problem
Collect Data
Scientific Method
Formulate Hypothesis
Design Experiment

PLOS ONE

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RESEARCH ARTICLE

Acceptance of evolution by high school students: Is religion the key factor?

Graciela da Silva Oliveira, Giuseppe Pellegrini, Leonardo Augusto Luvison Araújo, Nelio Bizzo

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Abstract

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  LALA: FAPESP (2020/07961-0 – São Paulo, Brazil; www.fapesp.br)
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Table 3. Answers of Brazilian Christians, with Chi-square tests.

			Catholic	Non-Catholic Christian	Total	p-value (Chi-Square)
G75 (Planet age)	True	N	465	225	690	**0.002**
		Perc. (%)	48.34%	40.98%	45.67%	
	False	N	77	69	146	
		Perc. (%)	8.00%	12.57%	9.66%	
	Don't Know	N	420	255	675	
		Perc. (%)	43.66%	46.45%	44.67%	
	Total	N	962	549	1511	
		Perc. (%)	100.00%	100.00%	100.00%	
G76 (Fossils)	True	N	821	432	1253	**0.012**
		Perc. (%)	84.81%	78.83%	82.65%	
	False	N	50	42	92	
		Perc. (%)	5.17%	7.66%	6.07%	
	Don't Know	N	97	74	171	
		Perc. (%)	10.02%	13.50%	11.28%	
	Total	N	968	548	1516	
		Perc. (%)	100.00%	100.00%	100.00%	
G77 (Emergence of species)	True	N	641	324	965	$<$ **0.001**
		Perc. (%)	66.63%	59.23%	63.95%	
	False	N	95	93	188	
		Perc. (%)	9.88%	17.00%	12.46%	
	Don't Know	N	226	130	356	
		Perc. (%)	23.49%	23.77%	23.59%	
	Total	N	962	547	1509	
		Perc. (%)	100.00%	100.00%	100.00%	
G78 (Evolution in plants and animals)	True	N	656	363	1019	0.077
		Perc. (%)	68.19%	66.61%	67.62%	
	False	N	95	74	169	
		Perc. (%)	9.88%	13.58%	11.21%	
	Don't Know	N	211	108	319	
		Perc. (%)	21.93%	19.82%	21.17%	
	Total	N	962	545	1507	
		Perc. (%)	100.00%	100.00%	100.00%	
G79 (Primate origin of human beings)	True	N	466	161	627	$<$ **0.0005**
		Perc. (%)	48.54%	29.38%	41.58%	
	False	N	206	225	431	
		Perc. (%)	21.46%	41.06%	28.58%	
	Don't Know	N	288	162	450	
		Perc. (%)	30.00%	29.56%	29.84%	
	Total	N	960	548	1508	
		Perc. (%)	100.00%	100.00%	100.00%	
G80 (Age of the human species)	True	N	265	160	425	0.778
		Perc. (%)	27.72%	29.41%	28.33%	
	False	N	149	84	233	
		Perc. (%)	15.59%	15.44%	15.53%	
	Don't Know	N	542	300	842	
		Perc. (%)	56.69%	55.15%	56.13%	
	Total	N	956	544	1500	
		Perc. (%)	100.00%	100.00%	100.00%	

(Continued)