

Open Schooling for Deeper Learning in Science



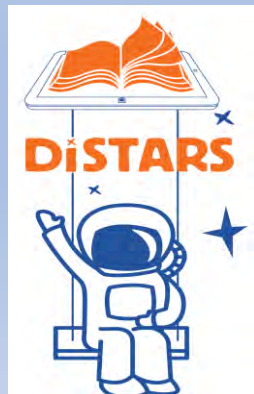
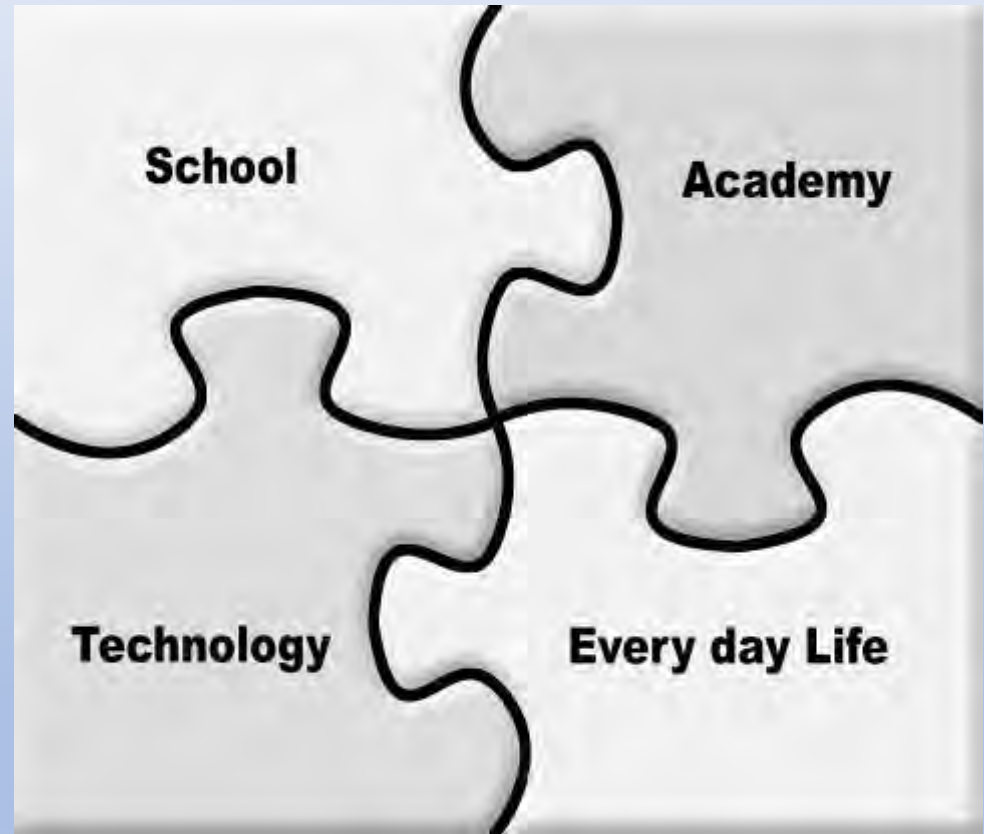
Prof. Dr. F.X. Bogner

Z-MNU (Centre of Math & Science Education)

University of Bayreuth, DE

The vision

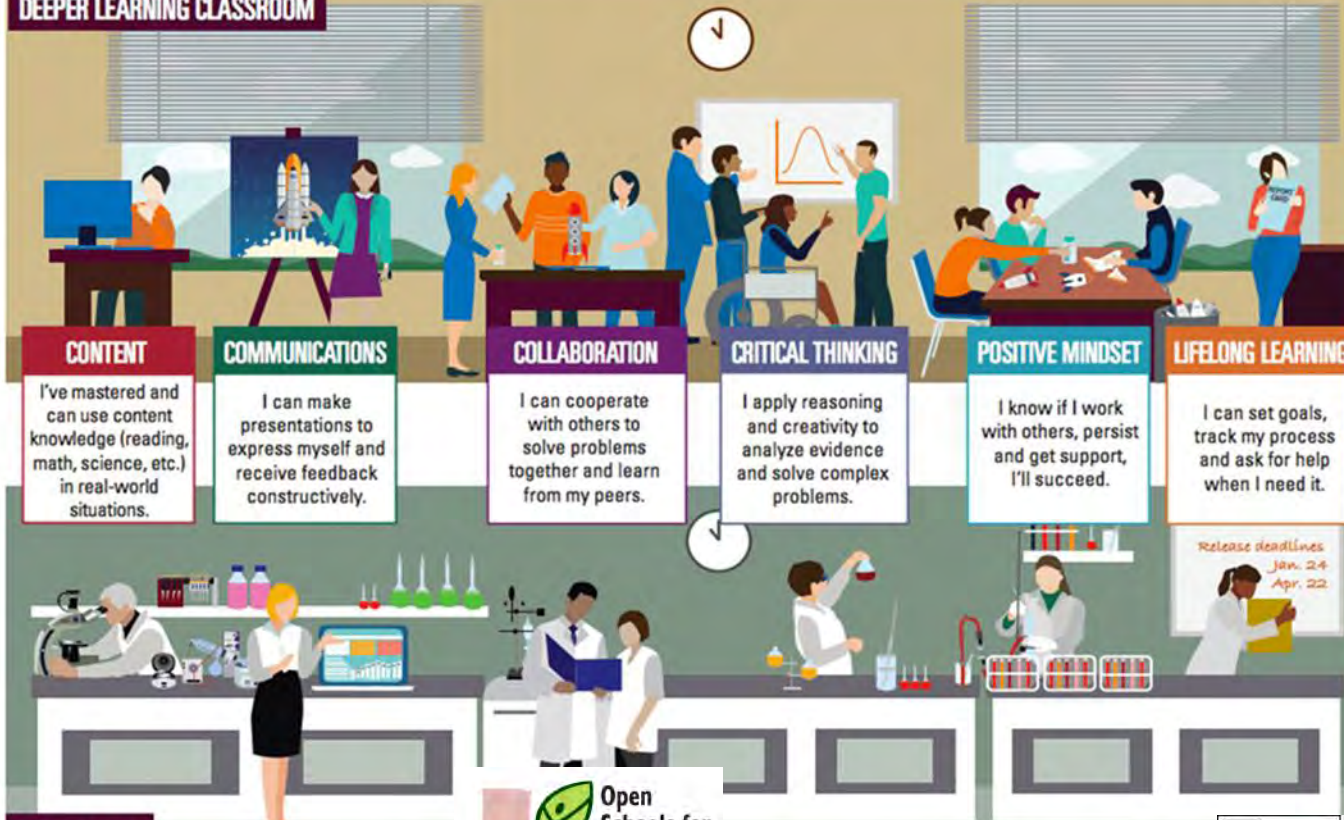
We should point to a **hybrid classroom** that builds on the strengths of **formal and informal teaching and learning strategies** in ways that can support **learning for all students**.



TRADITIONAL CLASSROOM



DEEPER LEARNING CLASSROOM



CONTENT

I've mastered and can use content knowledge (reading, math, science, etc.) in real-world situations.

COMMUNICATIONS

I can make presentations to express myself and receive feedback constructively.

COLLABORATION

I can cooperate with others to solve problems together and learn from my peers.

CRITICAL THINKING

I apply reasoning and creativity to analyze evidence and solve complex problems.

POSITIVE MINDSET

I know if I work with others, persist and get support, I'll succeed.

LIFELONG LEARNING

I can set goals, track my process and ask for help when I need it.

LAB

learning4all.org

#deeperlearning



From Community Building to improved Learning Outcomes



BUILDING YOUR ROADMAP FOR 21ST CENTURY LEARNING ENVIRONMENTS

A Planning Tool for Education Leaders



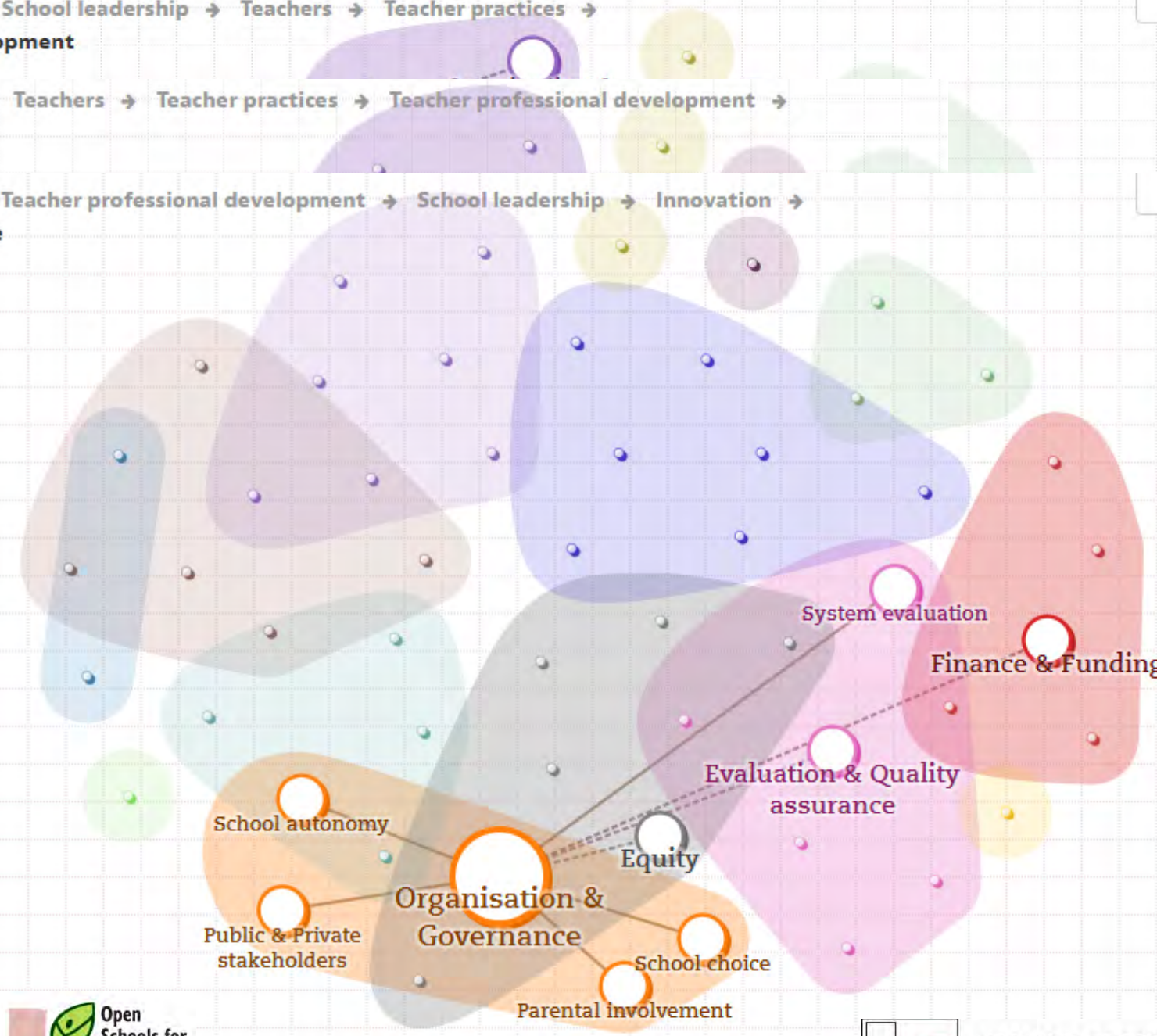
No matter where you are starting from, this flexible planning tool helps you chart a strategic path for transforming your school to meet the demands of today's students and their futures.

This free resource was created by Cable Impacts Foundation, the Partnership for 21st Century Learning, and the State Educational Technology Directors Association, with advice from dozens of experts and practitioners.

... → School autonomy → School leadership → Teachers → Teacher practices →
Teacher professional development

... → School leadership → Teachers → Teacher practices → Teacher professional development →
School leadership

... → Teacher practices → Teacher professional development → School leadership → Innovation →
Organisation & Governance

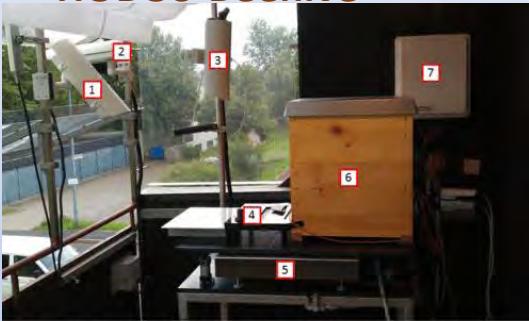


HOBOS

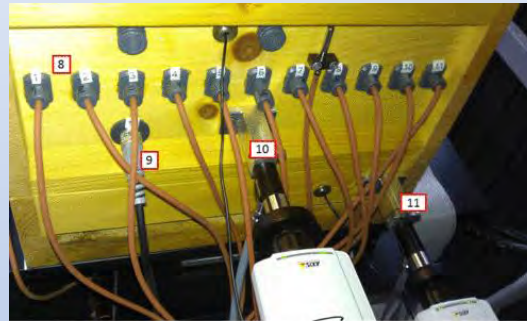
(HOneyBee Online Studies; www.hobos.de)



HOBOS-Beehive

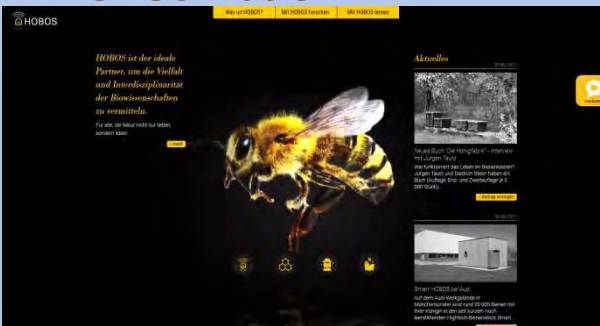


- 1. Kamera Stockeingang mit IR Beleuchtung
- 2. Kamera Garten mit IR Beleuchtung
- 3. Wärmebildkamera Stockeingang
- 4. Bidirektionale Lichtschranke am Flugloch
- 5. Stockwaage zur Erfassung des Gesamtgewichts
- 6. Zarge mit Sensorik
- 7. Datenlogger HOBOS Volk

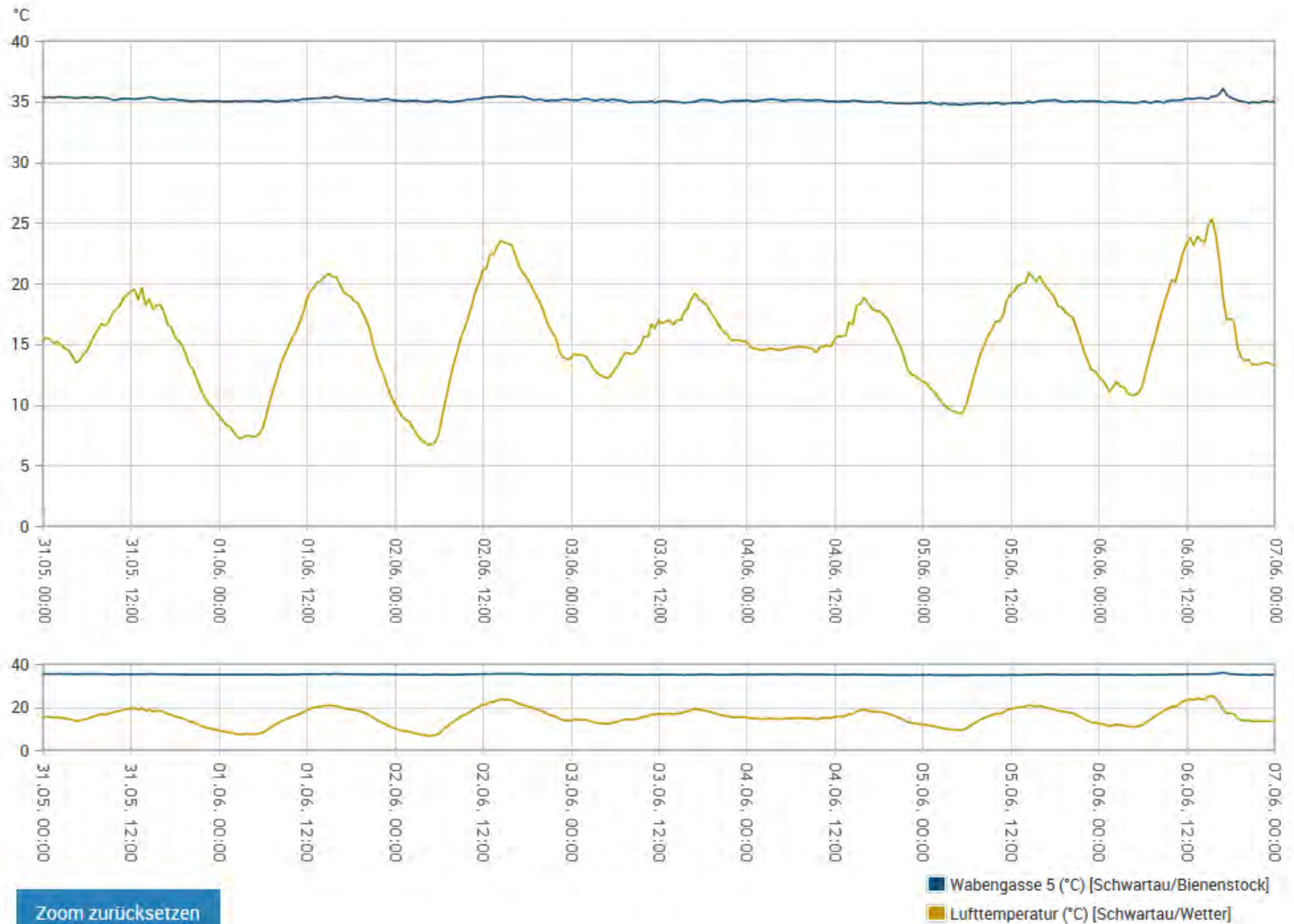


- 8. 13 x Temperaturfühler: 11 x zwischen den Rähmchen, 1 x Stock vorne, 1 x Stock hinten
- 9. Kombinerter Temperatur- & Feuchtefühler
- 10. Endoskopkamera Zarge mit Mikrofon
- 11. Endoskopkamera Boden mit Mikrofon

HOBOS Plattform




Tipps zur Funktionsweise



[Zoom zurücksetzen](#)

Schools network map



HELIX
Hellenic
Data
Service

Subjects

geology

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Earthquake Hackathon (HackQuake) Data

☆ 📄 EN


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[DATASET](#) # TOPICS © ACTIVITY STREAM

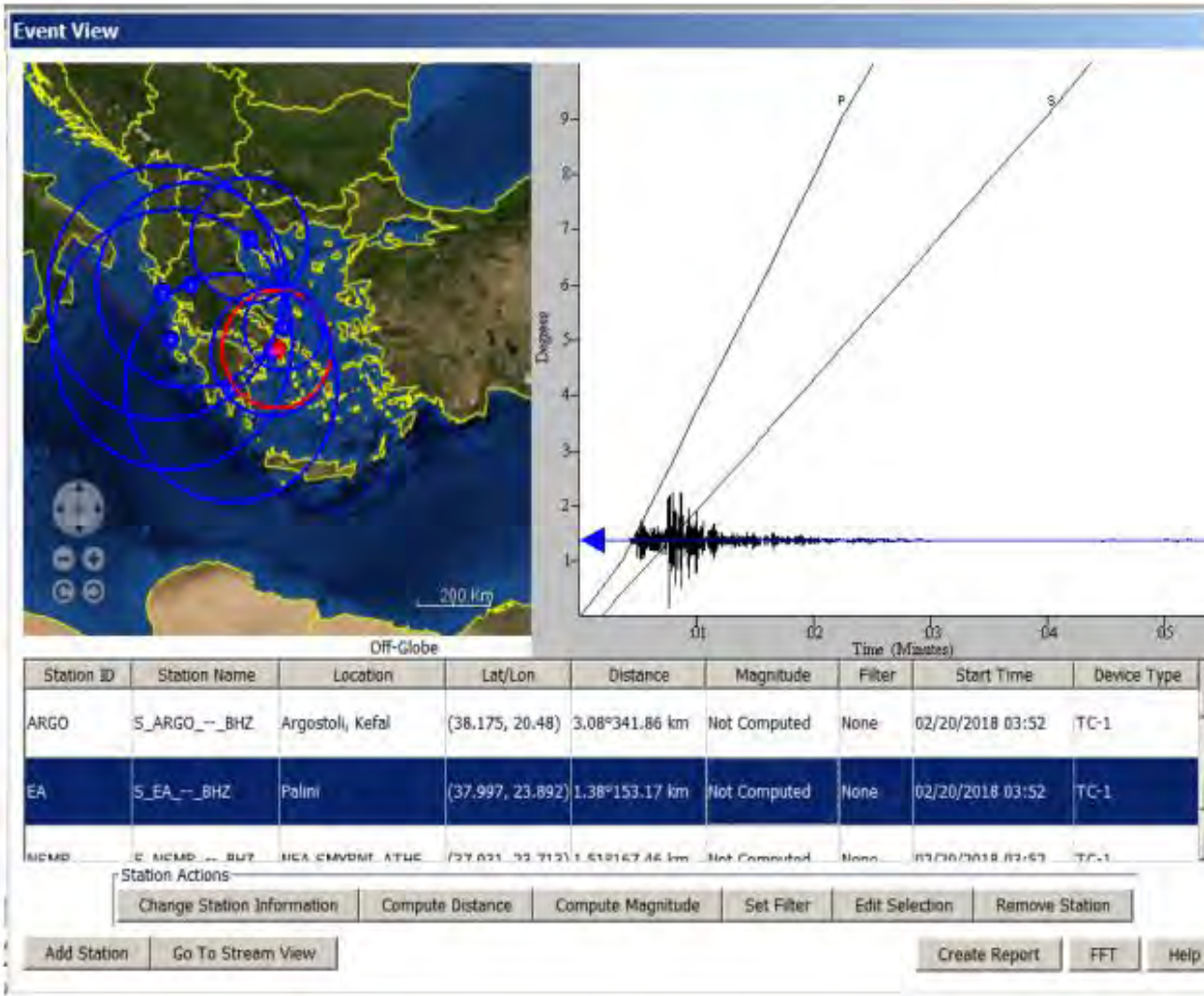
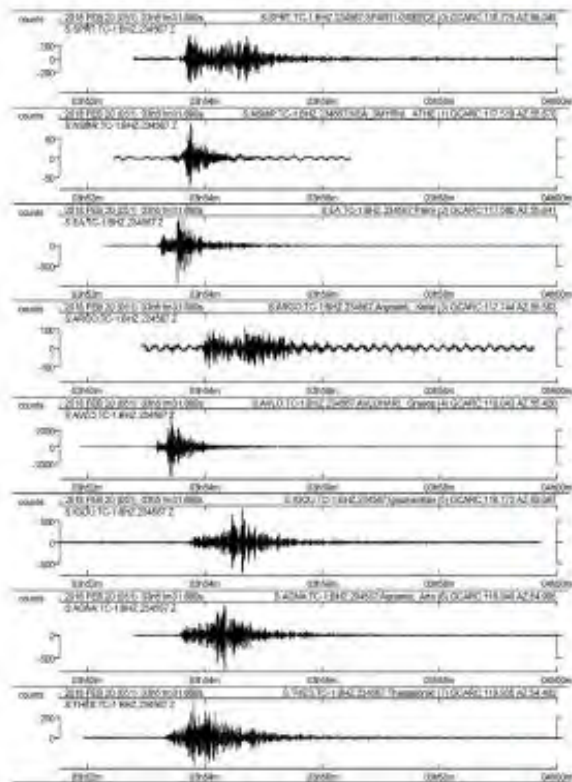
Σε αυτή την περιοχή της πλατφόρμας HELIX φιλοξενούνται δεδομένα από 5 μεγάλους σεισμούς, τα οποία θα χρησιμοποιηθούν από εκπαιδευτικούς και μαθητές για να αναπτύξουν μεθόδους έγκαιρης ειδοποίησης για σεισμούς. Η πρωτοβουλία αποτελεί μέρος της συνεργασίας του Γεωδυναμικού Ινστιτούτου, του Εθνικού Αστεροσκοπείου Αθηνών, του Ερευνητικού Κέντρου ΑΘΗΝΑ, του Οργανισμού ΕΕΛΛΑΚ και της Ελληνογερμανικής Αγωγής, στο πλαίσιο των έργων SNAC, OPENAIRE και OSOS.

This site of HELIX platform hosts data for 5 major earthquakes, which will be used by professors and students to develop early warning methods for earthquakes. This initiative is part of a collaboration between the Institute of Geodynamics, the National Observatory of Athens, Athens Research Center, GFOSS organization and Ellinogermaniki Agogi, in the context of SNAC, OPENAIRE and OSOS projects.

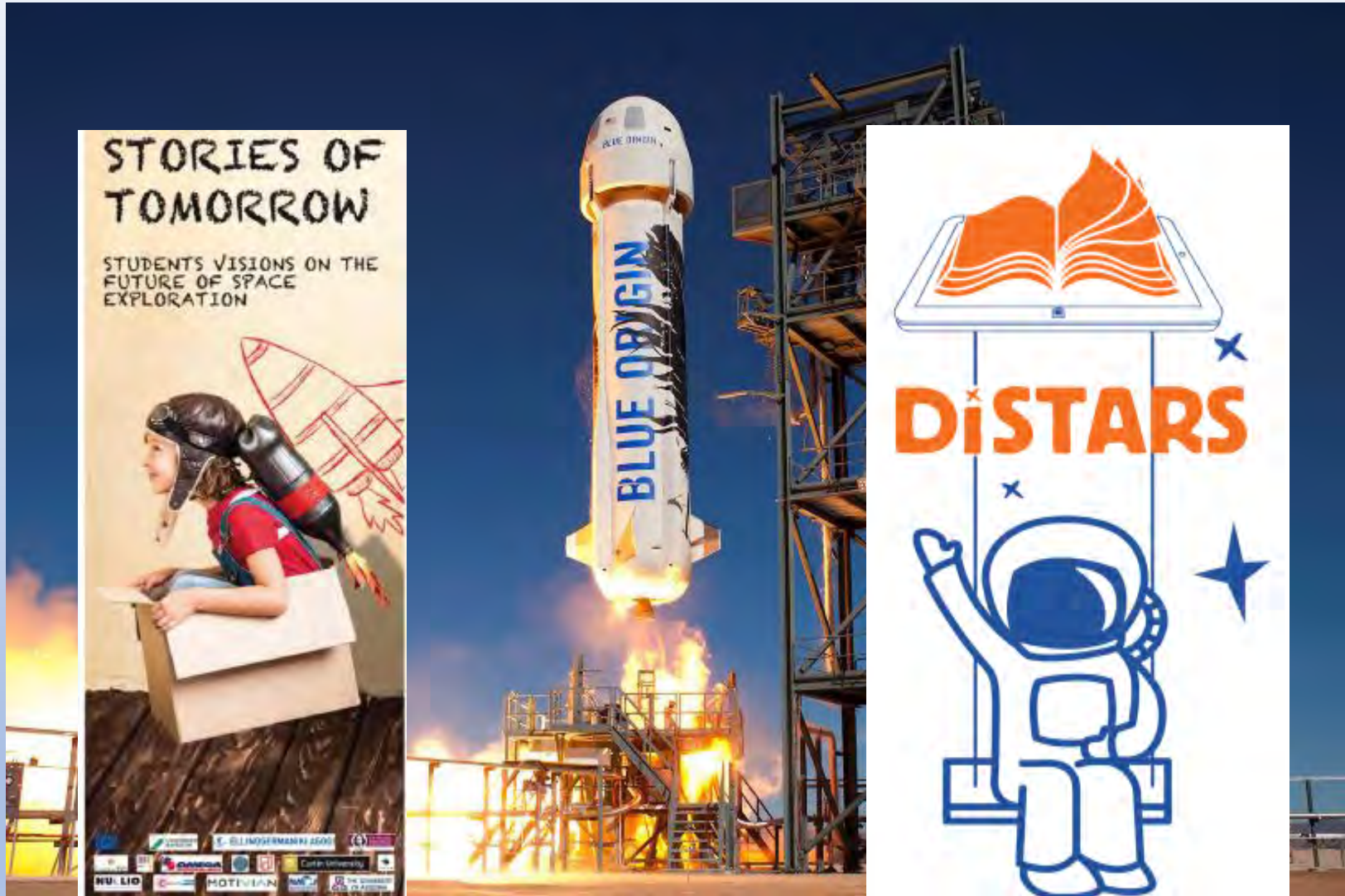
Data and Resources

 [earthquake_data.zip](#)
No description

[DOWNLOAD](#)



Space Missions

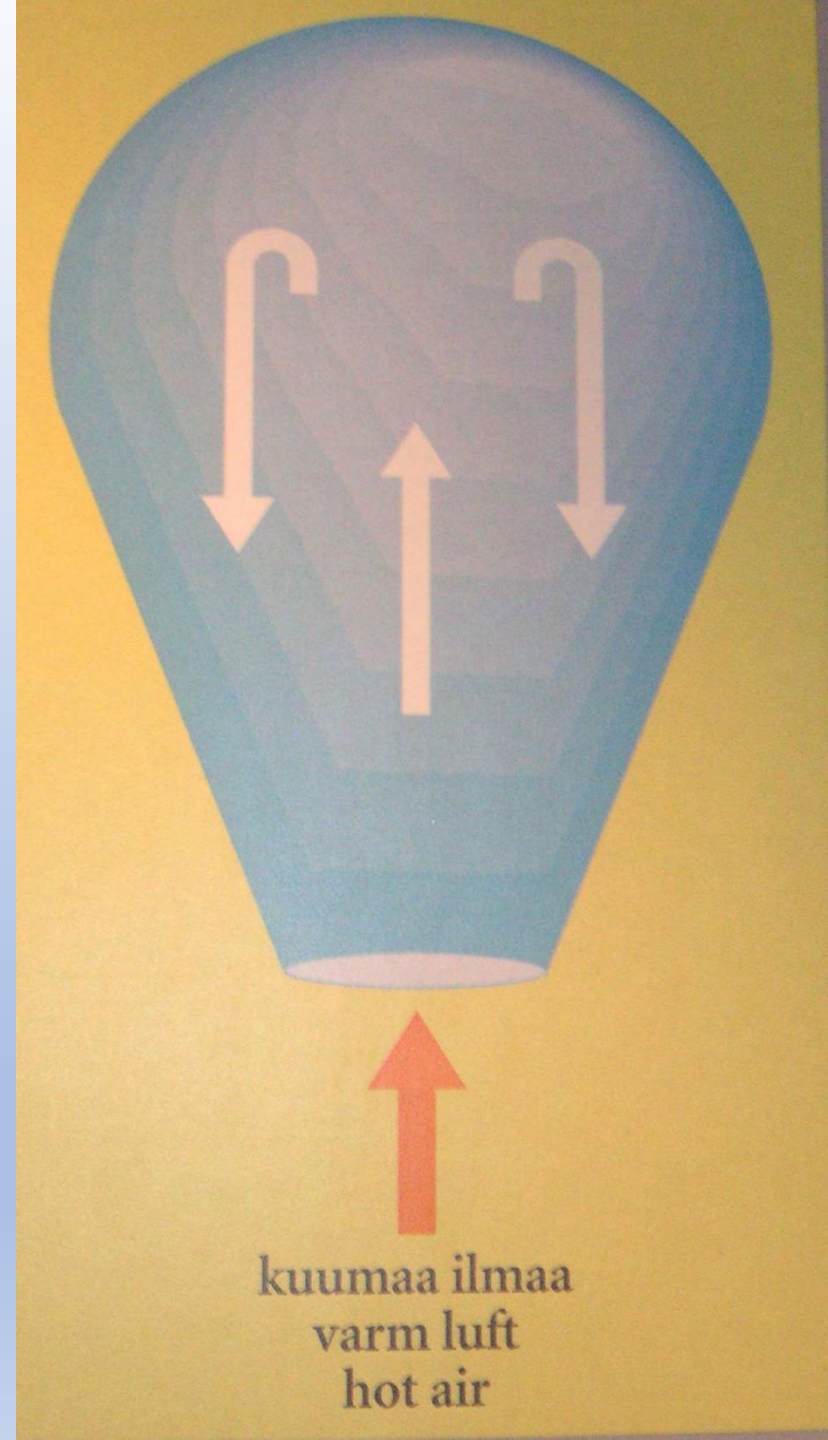




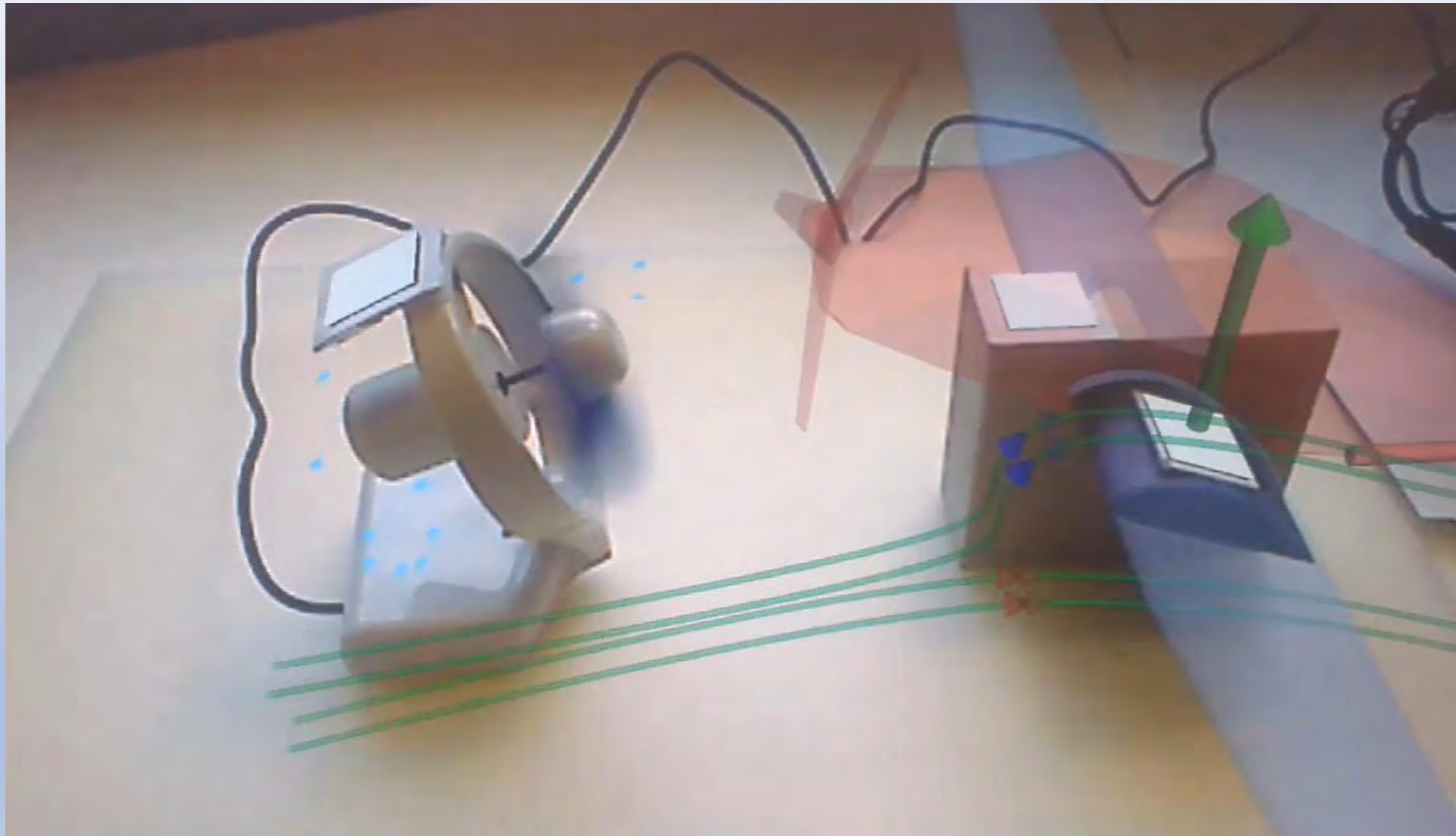
Languages and Cultures

CONNECT 2004-2008

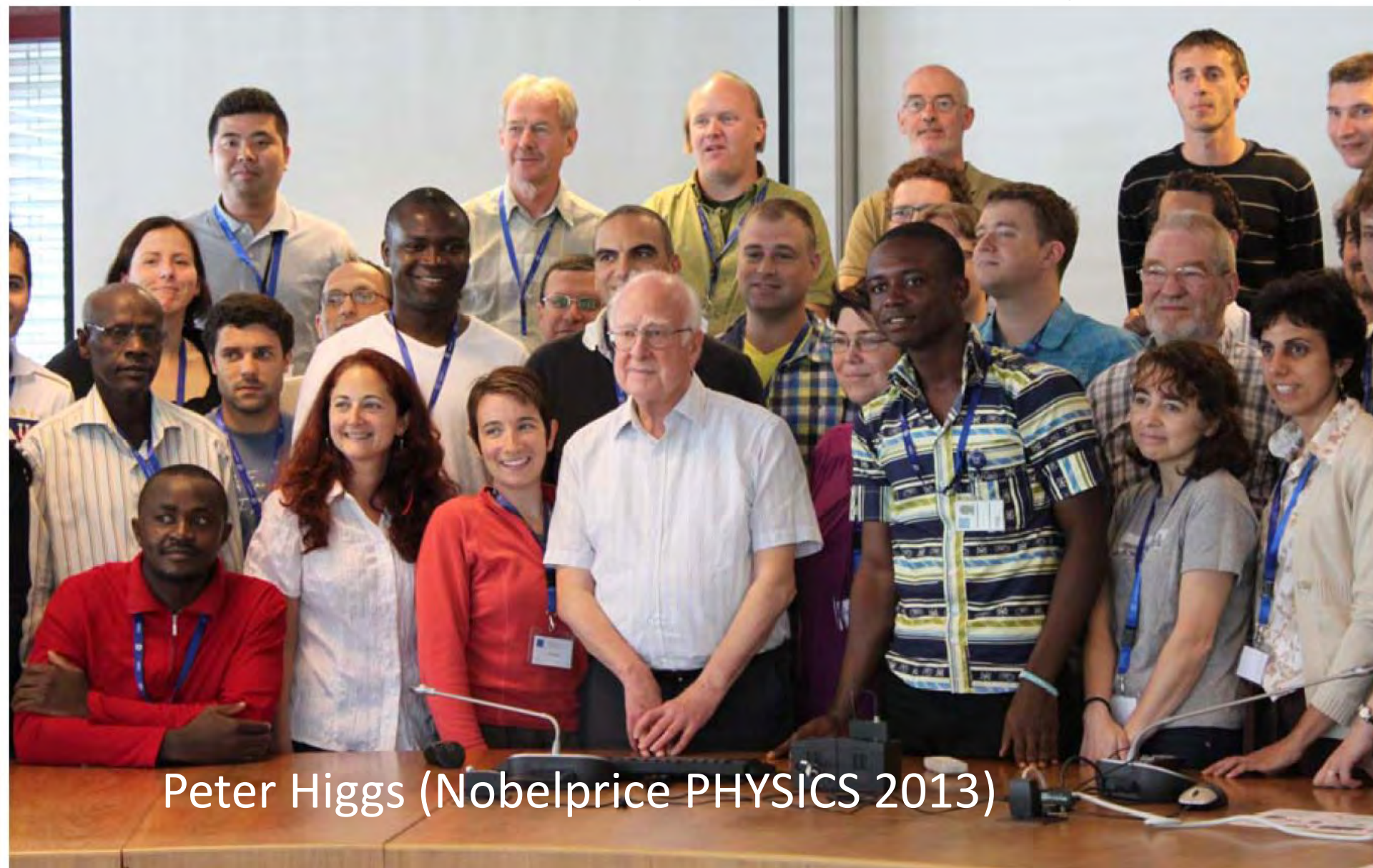




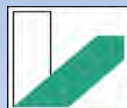
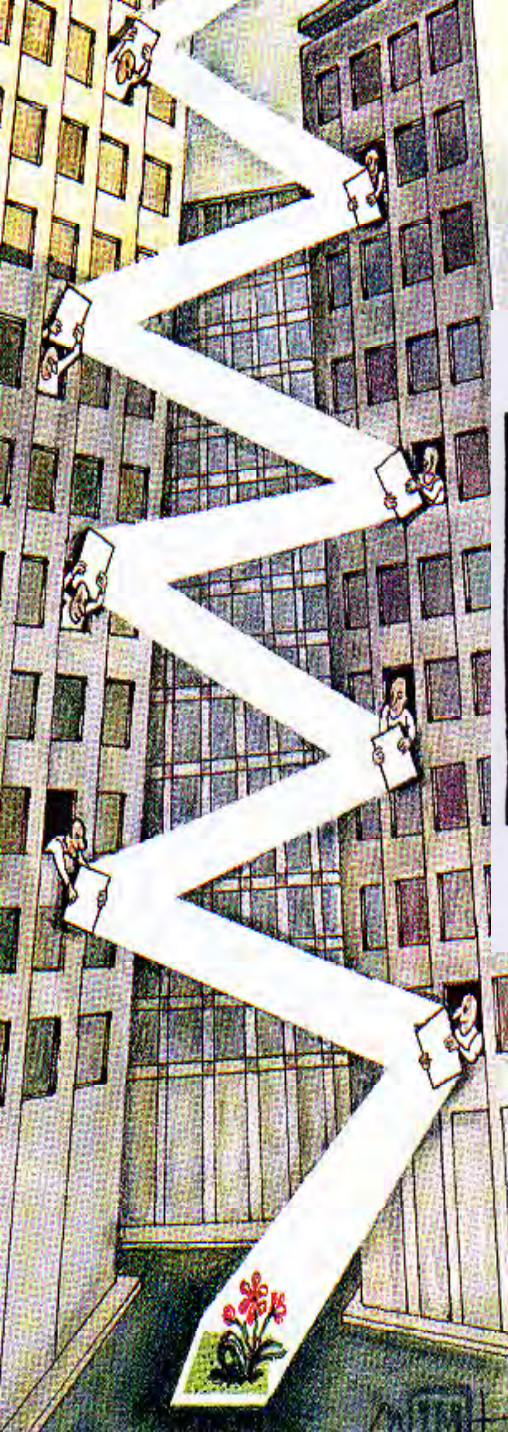
Augmented Reality: Why birds fly



HST-Professional Development, CERN, Geneva, July 2012



Peter Higgs (Nobelprice PHYSICS 2013)



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BAYREUTH



Developing a Self-Reflection Tool to Assess Schools' Openness

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TABLE 3 | Loading pattern of the OSOS SRT with its three actor solution and the corresponding items.

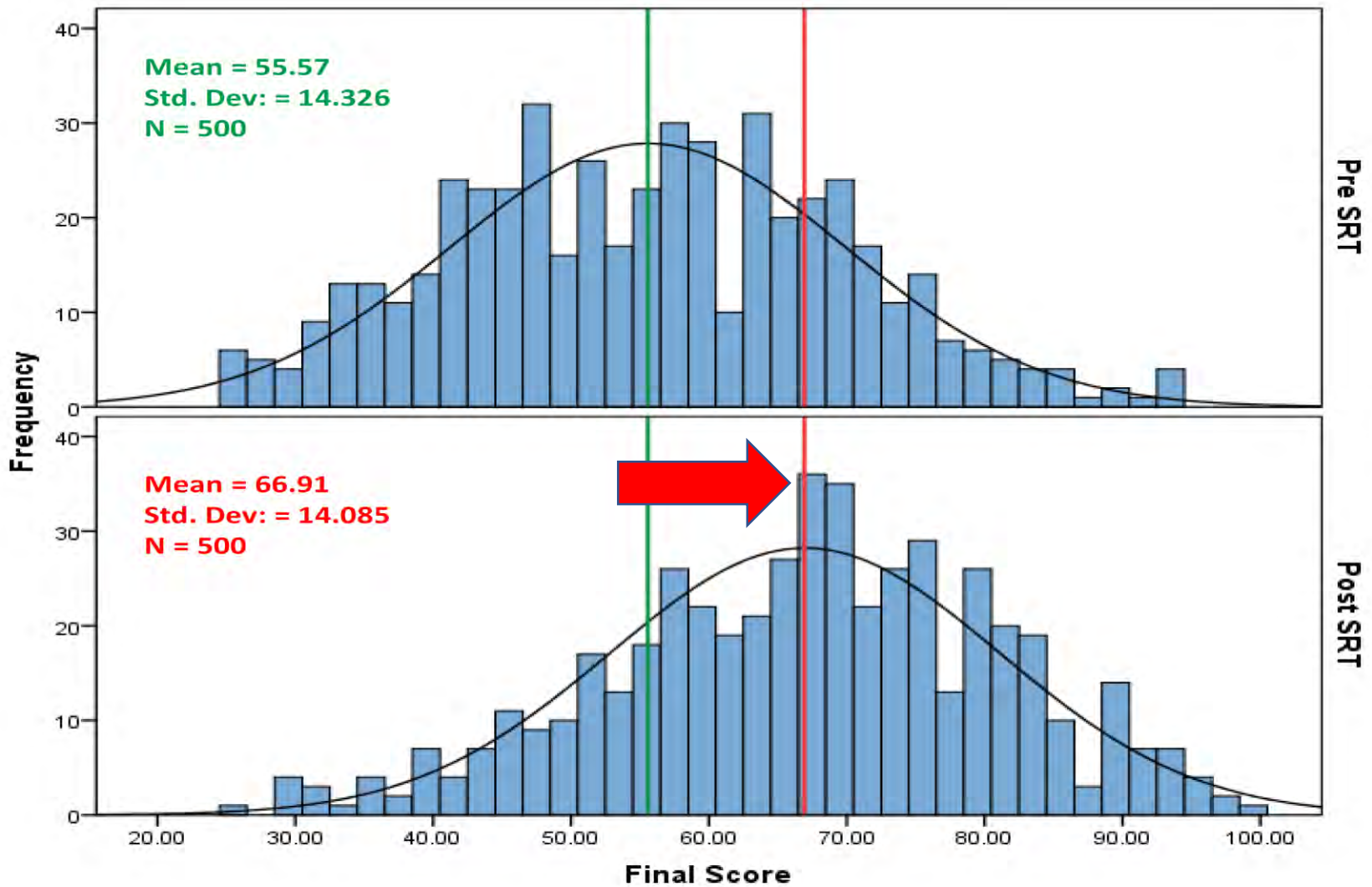
	P-level	TPD-level	M-level	Item
PL 4	0.749			Implementing projects
PL 1	0.738			School leaders' and teachers' shaping learning systems
PL 5	0.666			Parents and external stakeholders' involvement in school's activities
PL 6	0.659			Reflect, monitor, debate
PL 7	0.569	0.487		Learning processes adaptation
PL 3	0.533			Collaborative environments and tools (co creation, sharing)
PL 8	0.520	0.427		Established collaboration with local, national institutions
PL 2	0.400			Creating an inclusive environment
TPDL 3		0.725		Professional culture
TPDL 8		0.707		Use and reuse of resources
TPDL 6		0.662		Collaborative learning (mobility actions)
TPDL 7		0.661		Collaborative learning (ICT Competences)
TPDL 2		0.585		Setting expectations
TPDL 1		0.573		Teacher awareness and participation
TPDL 4		0.567		Professional competencies, capacity building, and autonomy
TPDL 5		0.546		Leadership competence
ML7			0.745	Learning processes adaptation
ML 2			0.733	Coherence of policies
ML 6			0.728	Reflect, monitor, debate
ML 4			0.702	Education as a learning system
ML 8			0.603	Communication and feedback mechanism
ML 5			0.580	Responsible research, reflective practice, and inquiry
ML 1			0.536	Vision and strategy
ML 3			0.484	Shared vision and understanding

PAF; Kaiser-Meyer-Olkin measurement = 0.034;
 Barlett's test of sphericity (chi square = 2498.83; $p < 0.001$)



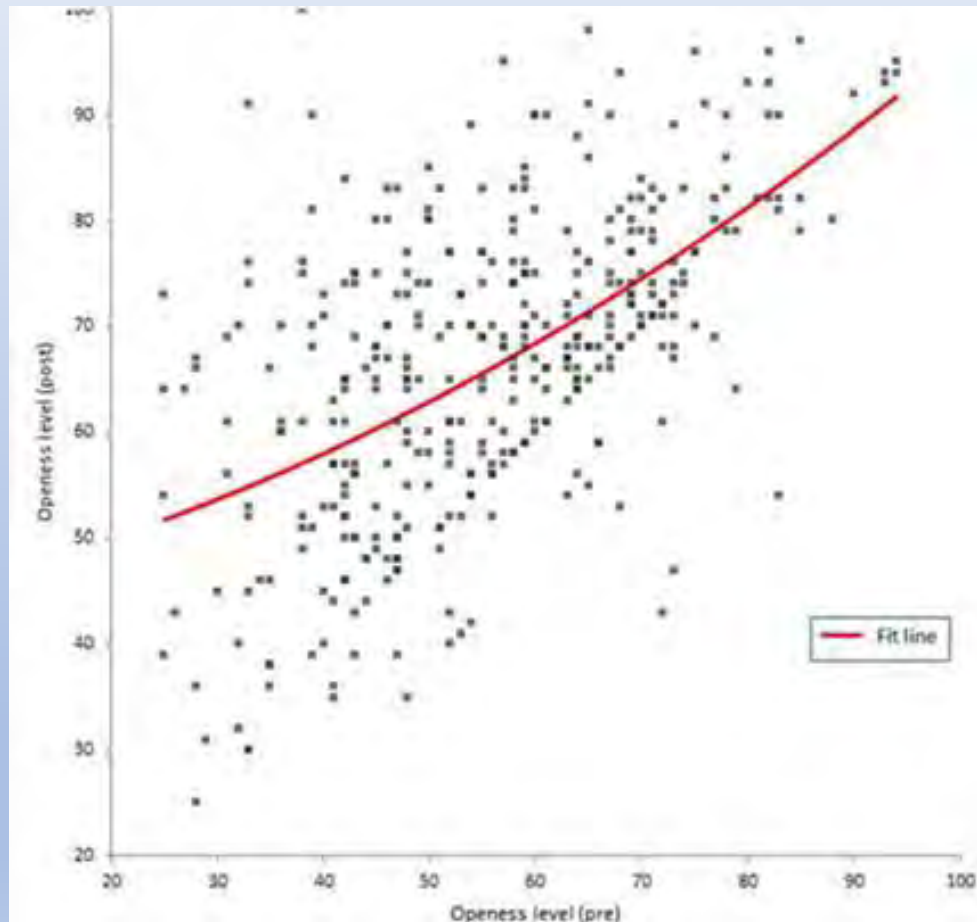
TABLE 1 | The eight items in each one of the three levels of openness, 24 task specific statements in total.

Management level	Process level	Teacher's professional development level
Vision and strategy Coherence of policies Shared vision and understanding Education as a learning system	School leaders and teachers' shaping learning systems Creating an inclusive environment Collaborative environments and tools (co creation, sharing) Implementing projects	Teacher awareness and participation Setting expectations Professional culture Professional competences, capacity building and autonomy
Responsible research, reflective practice, and inquiry Motivation mechanisms Plans for staff competences Communication and feedback mechanism	Parents and external stakeholders' involvement in school's activities/projects Reflect, monitor, debate Learning processes adaptation Established collaboration with local, national institutions	Leadership competence Collaborative learning (mobility actions) Collaborative learning (ICT Competences) Use and reuse of resources



Impact Assessment

Openness



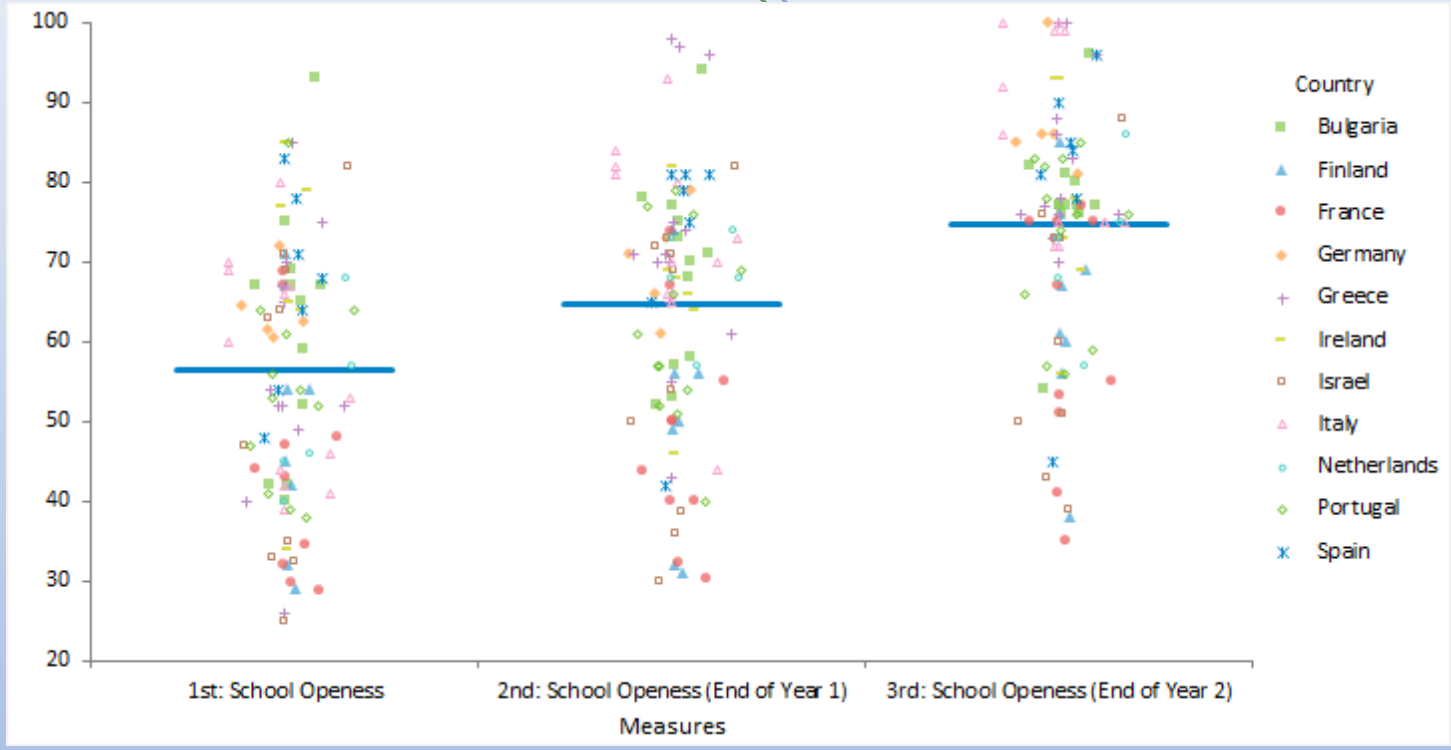
Open Schools' performance in openness – following the clustering/mentoring approach (data from 500 Schools). Such school Hubs create communities of practice with other less-advanced schools supporting them in the adoption of the open school culture. The data demonstrate significant growth in openness (about 10% on average) while the growth is much higher for less advanced schools (goes up to 45%) in a one-year intervention.

School Level of Openness

ENABLED	CONSISTENT	INTEGRATED	ADVANCED
<p>Schools that are at an initial stage of incorporating educational innovation in the classroom and beyond</p>	<p>Schools that have achieved a certain level of innovation and openness through specific measures, educational ICT tools, best practices, CPD, but they still consist isolated cases without a network of other schools and external partners to facilitate the process</p>	<p>Schools that have achieved a high degree of innovation and openness and they have already established cooperation with community stakeholders and other external partners</p>	<p>Schools that are considered rather extreme cases of schools that offer a glimpse to the open school of the future</p>

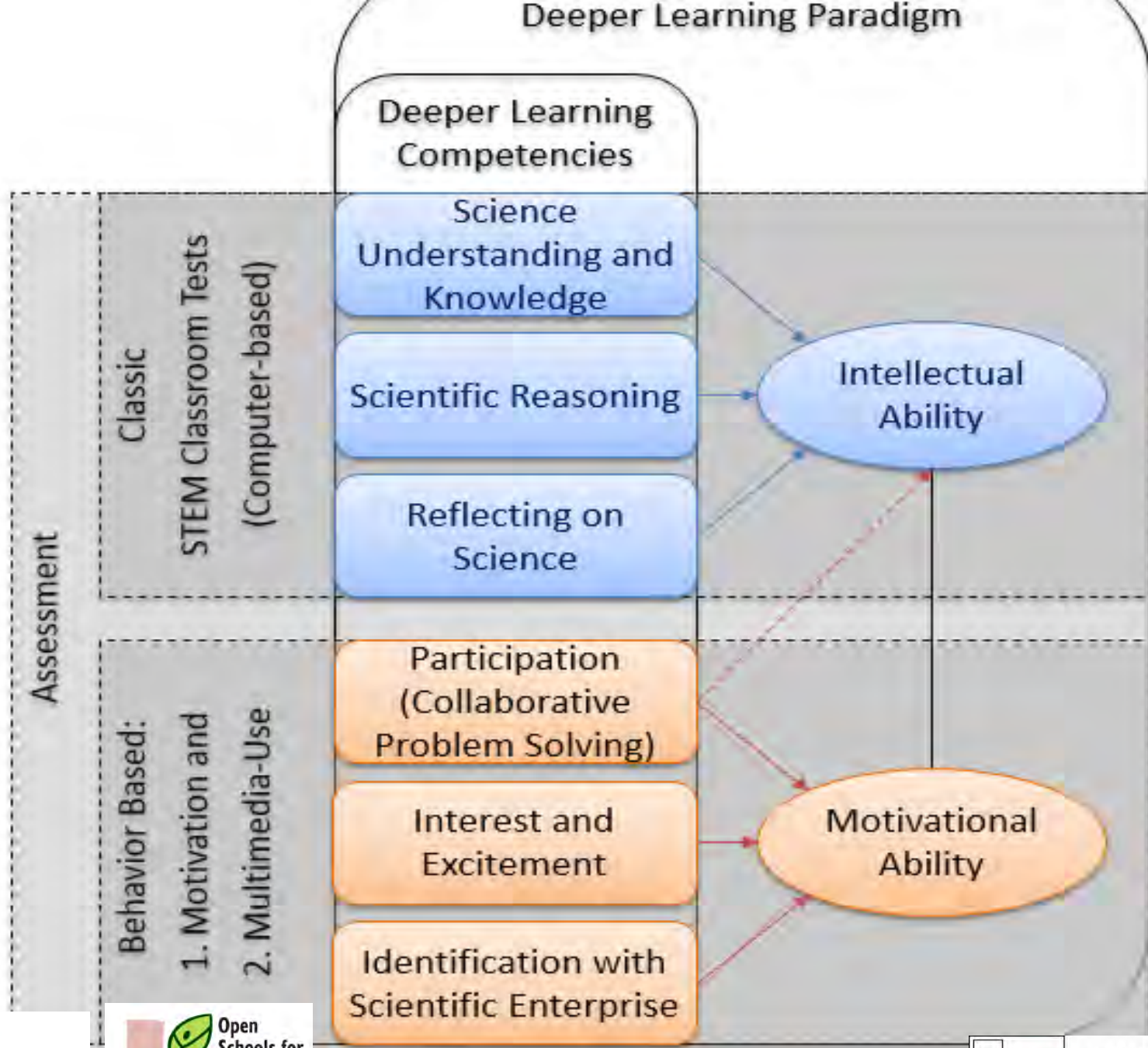
Impact Assessment

Openness



100 Open Schools' performance in openness: The graph shows the initial scores of the participating Schools (left), their scores after one year (center) and after two years (right) of adoption of the proposed Roadmap.

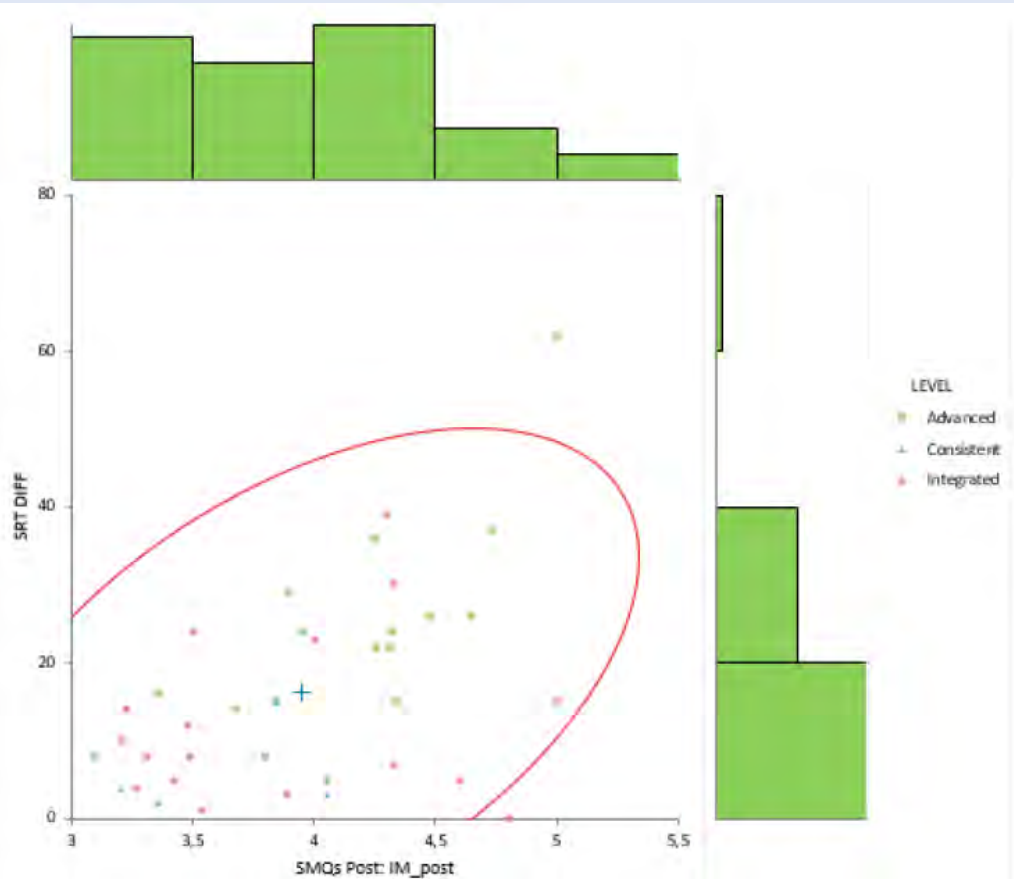
Deeper Learning Paradigm



Effects on Students

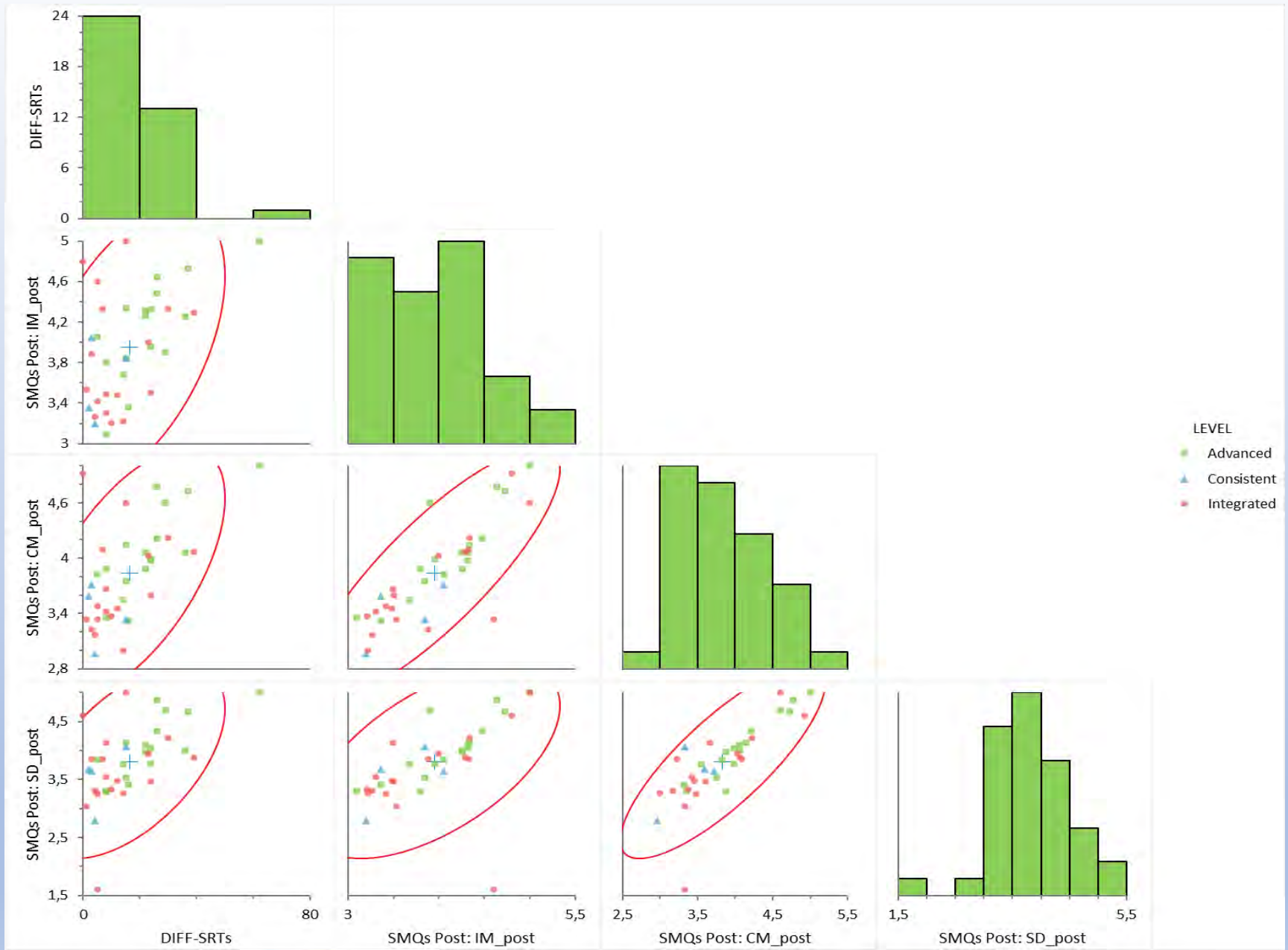
- Does PD lead to changes that have a positive impact on students?
- Can the impact of PD with self-reflection on students be measured?
- Does PD with Self Reflection foster students' Science Motivation?
- Or General School Motivation?

Students' Science Motivation and Interest



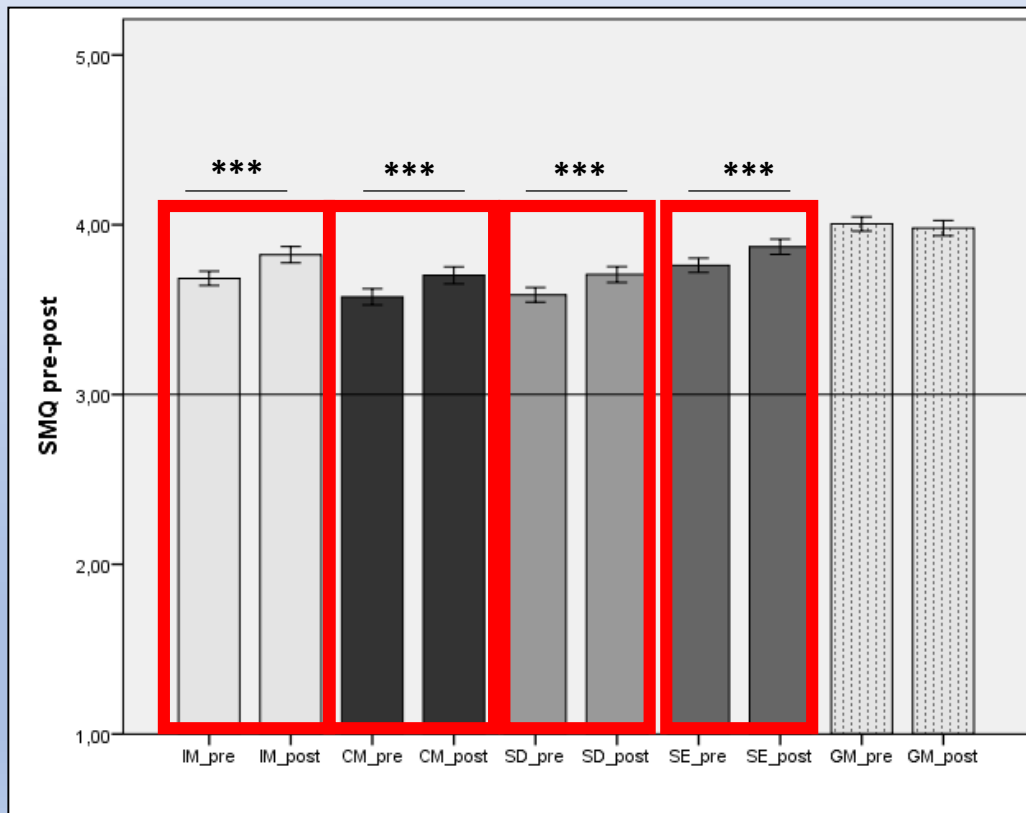
The graph demonstrates that the increased SRT scores of the school Hubs has significant impact on the increase of students' interest in science.

N= 1642 students



Students' Science Motivation and Interest

Science Motivation sub-scales pre-and post-test whole project
(*=significant differences). Matched participants



- Intrinsic Motivation sub-scale is very high, which indicates a high satisfaction.
- Intrinsic motivation, Career Motivation, Self-Determination and Self-Efficacy showed significant differences between pre- and post-test and could be raised from the beginning to the end of the project
- This is an amazing improvement in the students science motivation
- Grade motivation showed no differences between pre- and post-test, what indicated that these issues couldn't be influenced from the project

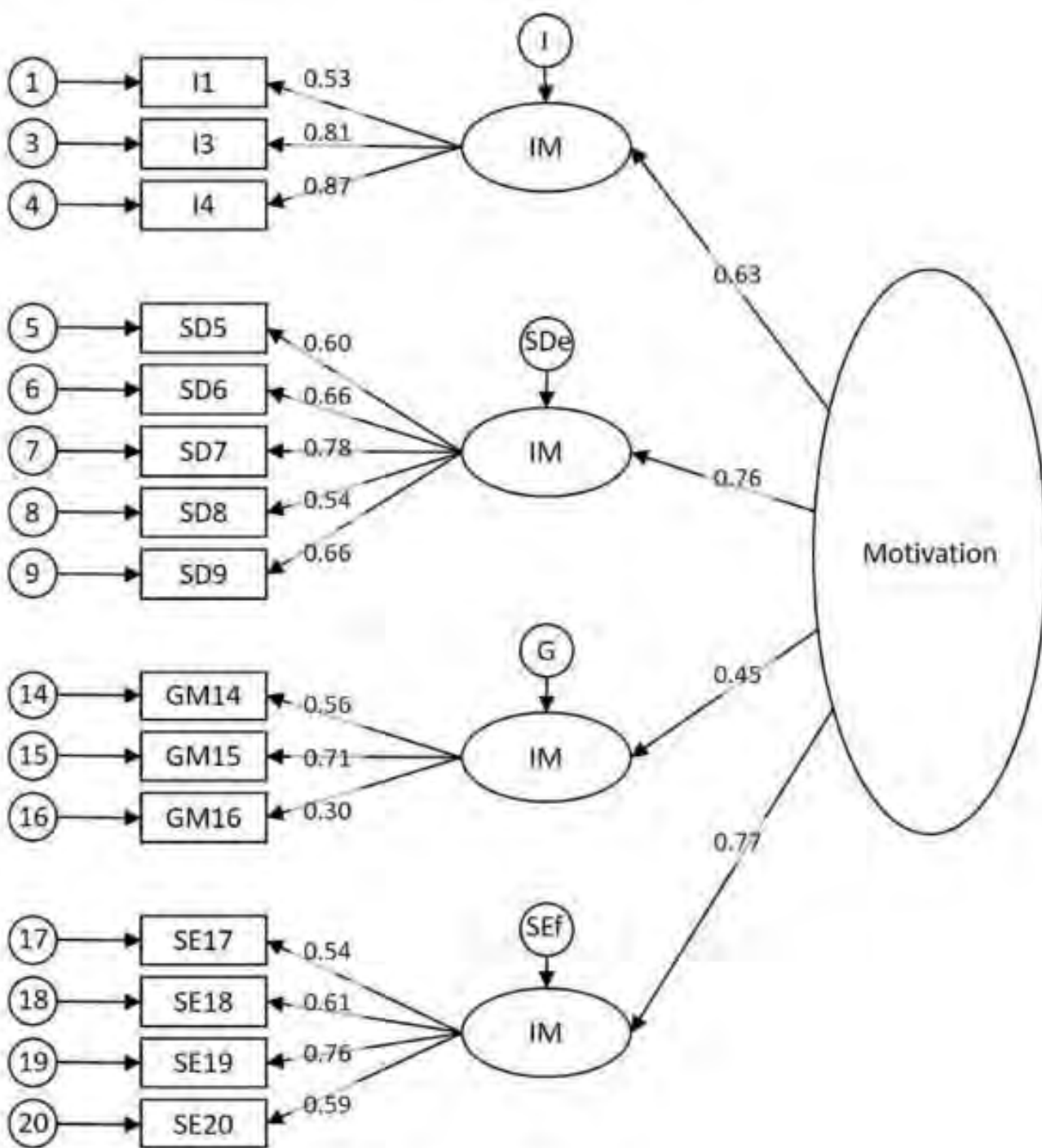
Science Motivation Rotated Factor Matrix^a

	Factor				
	1 CM	2 GM	3 SE	4 IM	5 SD
SM CM8 T1	,804				
SM CM7 T1	,797				
SM CM6 T1	,724				
SM CM9 T1	,708				
SM CM10 T1	,705				
SM GM24 T1		,774			
SM GM21 T1		,706			
SM GM23 T1		,700			
SM GM22 T1		,662			
SM GM25 T1		,542			
SM SE17 T1			,760		
SM SE16 T1			,713		
SM SE19 T1			,636		
SM SE20 T1			,607		
SM SE18 T1			,606		
SM IM5 T1				,667	
SM IM1 T1				,649	
SM IM2 T1				,577	
SM IM3 T1				,505	
SM IM4 T1	,420			,490	
SM SD14 T1					,719
SM SD11 T1					,637
SM SD12 T1					,538
SM SD15 T1					,473
SM SD13 T1					,466

School Motivation Rotated Factor Matrix^a

	Faktor			
	1 SE	2 GM	3 IM	4 SD
SchoolMot SE18 T1	,717			
SchoolMot SE17 T1	,702			
SchoolMot SE20 T1	,662			
SchoolMot SE19 T1	,537			
<i>SchoolMot SD9 T1</i>	,458			
SchoolMot GM14 T1		,796		
SchoolMot GM15 T1		,745		
SchoolMot GM16 T1		,546		
SchoolMot IM4 T1			,762	
SchoolMot IM3 T1			,736	
SchoolMot IM1 T1			,556	
SchoolMot SD7 T1				,825
SchoolMot SD5 T1				,721
SchoolMot SD6 T1	,421			,459

(Conradty & Bogner 2021)



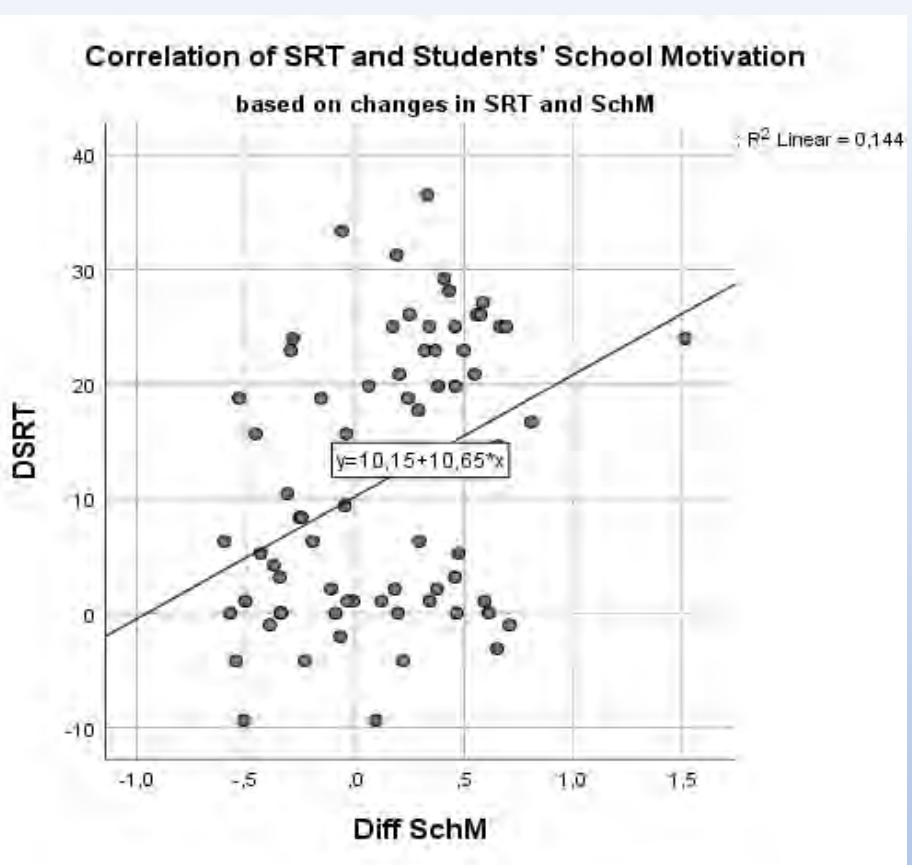
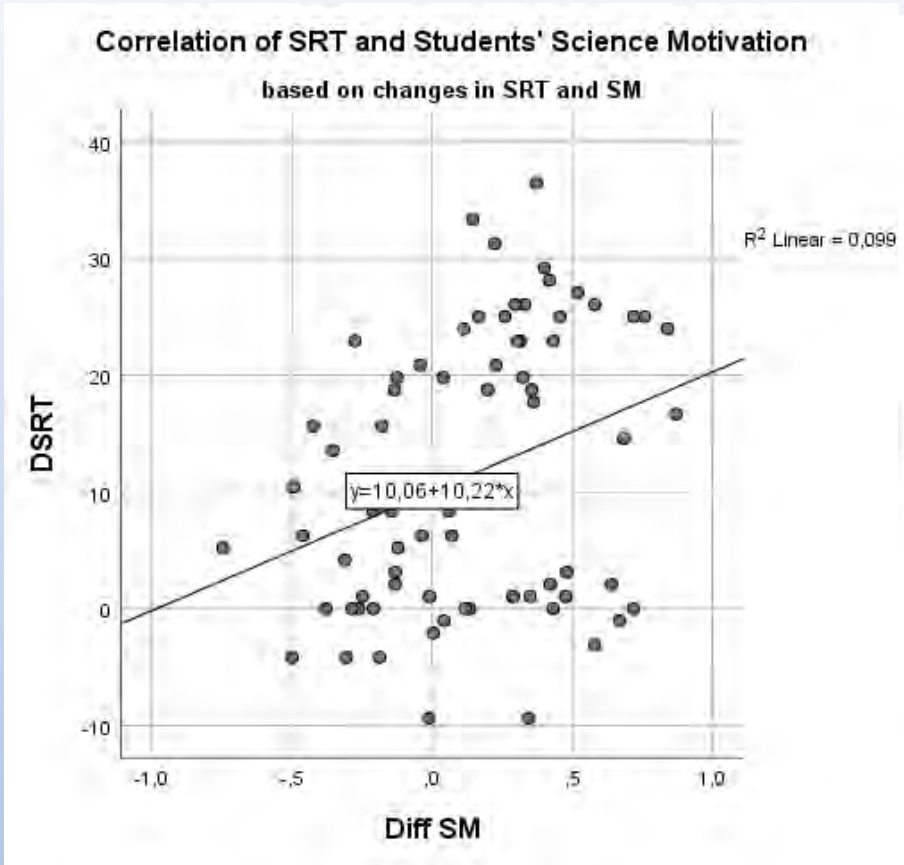
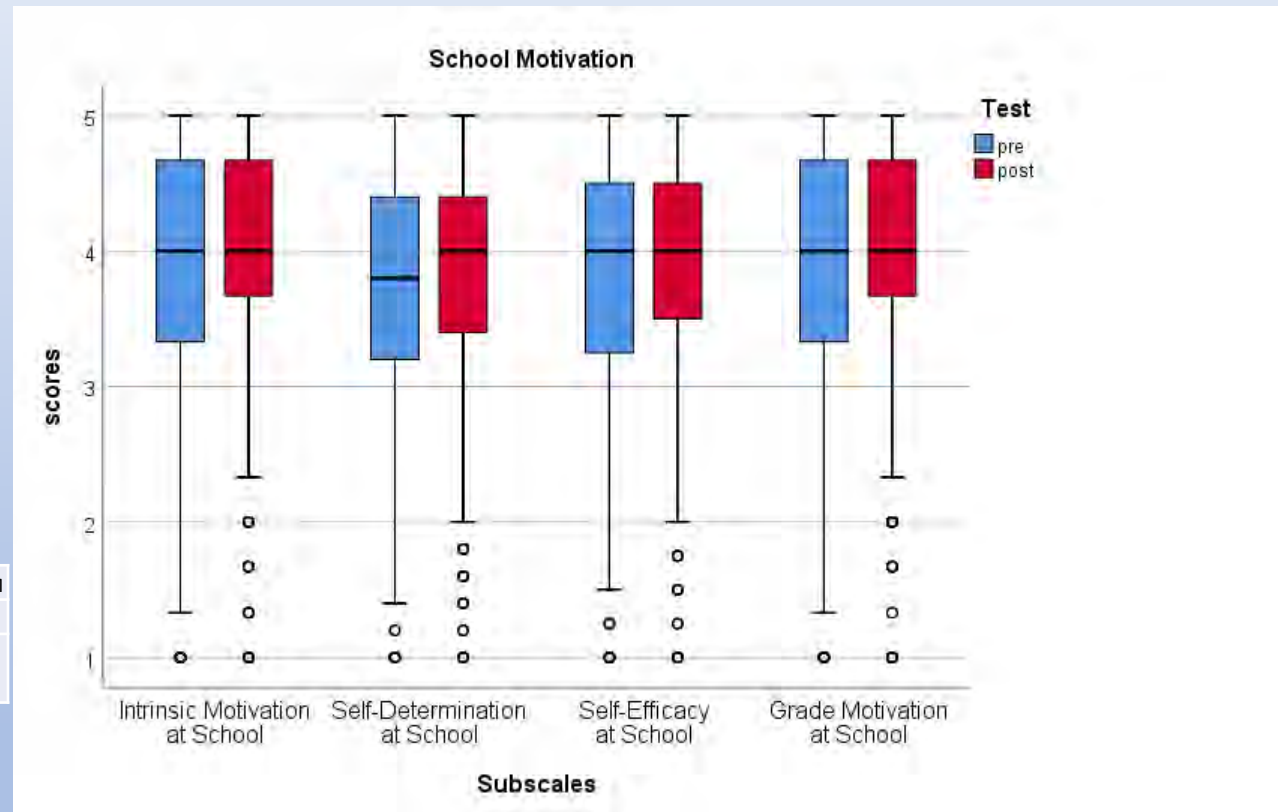


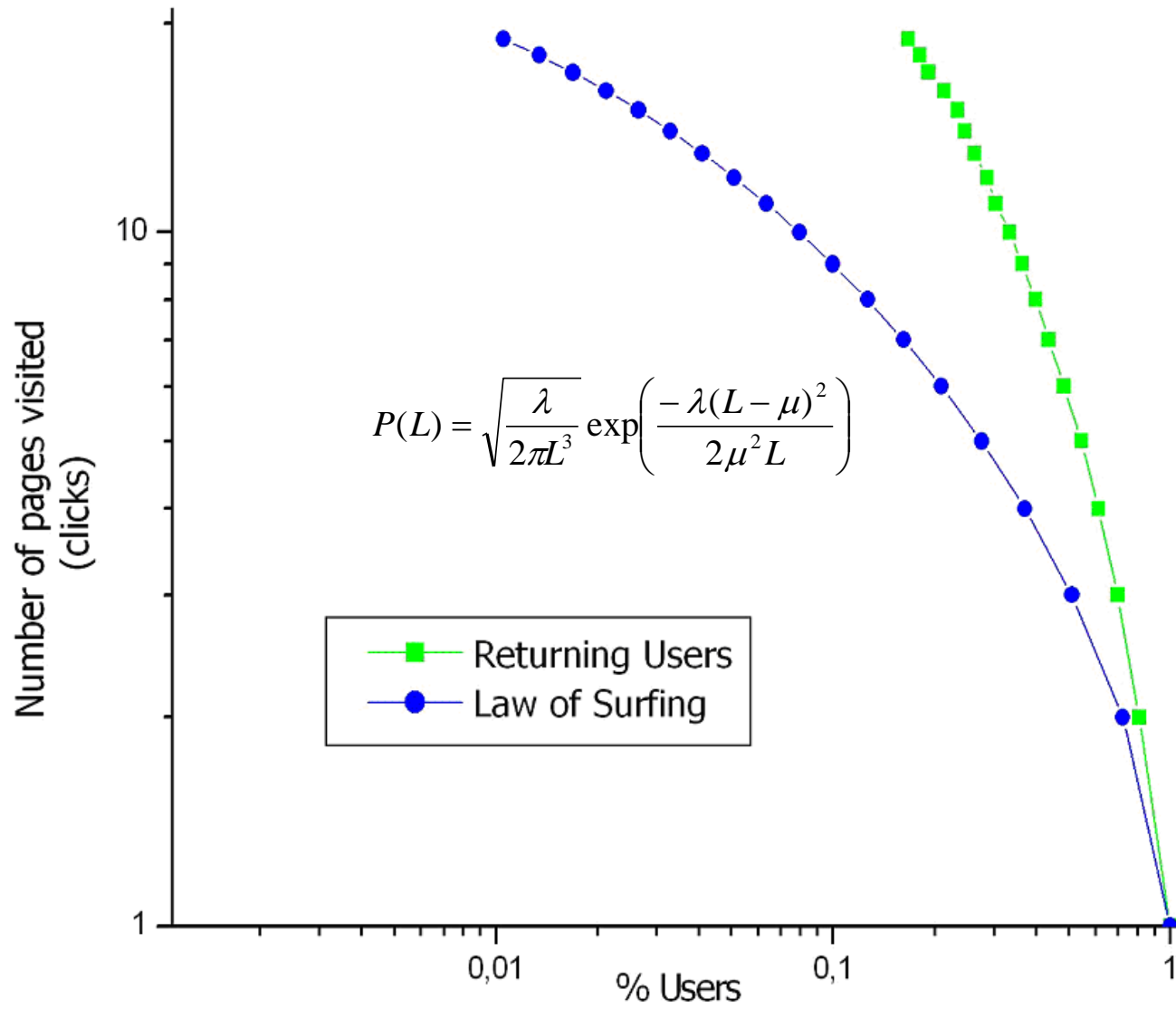
Figure 4: Scatterplot of SRT Changes and Students' Science Motivation Changes or School Motivation Changes

Changes over time: School Motivation



Wilcoxon-Test

	School IM	School SD	School SE	School GM
Z	-7,437 ^b	-7,182 ^b	-9,142 ^b	-5,241 ^b
Asymptotic sig. (2-sided)	,000	,000	,000	,000



Cut the red tape

In the article ‘the world’s biggest educational technology experiment in history’, the OECD’s education director had claimed:

‘Empower teachers to make the most of digital advances,’ to ‘test out different digital learning solutions, and understand how technology can be used to foster deeper student learning,’ to ‘think creatively about their role as facilitators of student learning, and how technology can support them in doing so, and how they can combine their expertise as a profession.’

Consequence: The pandemic response would cut the ‘red tape’ to open up personalized learning and other new digital formats enabling students to take individual ownership of their learning.

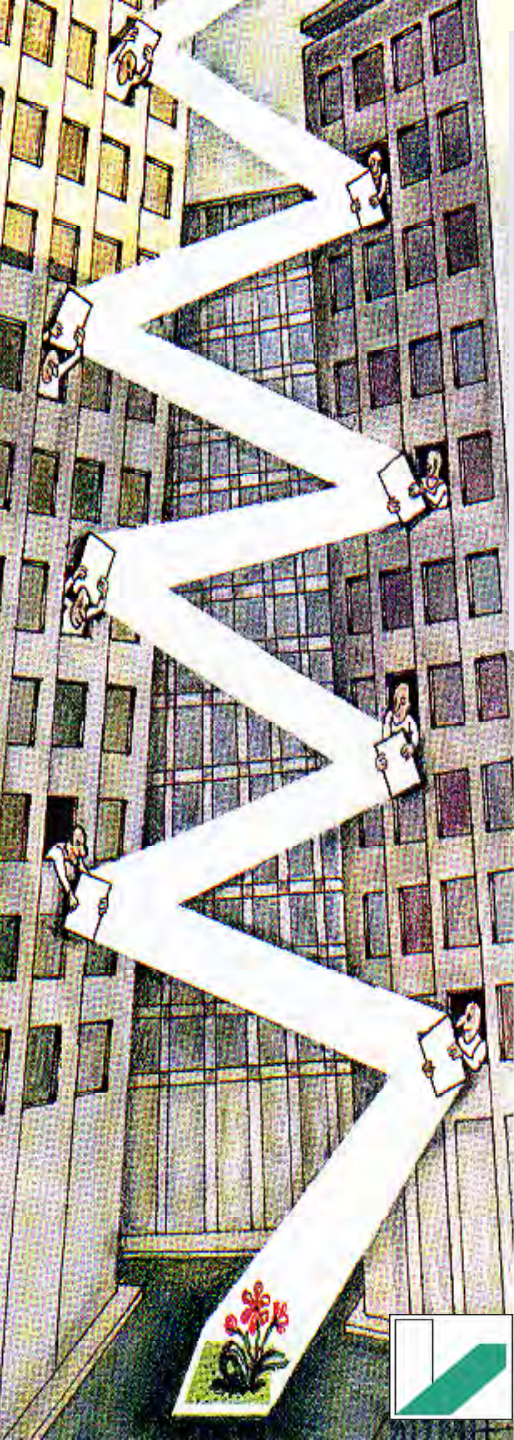
Taking forward the practitioner-led change at a European level

At the level of individual teachers this implies getting four things to happen:

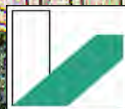
- 1) Individual teachers need to **become aware of specific weaknesses in their own practice**. In most cases, this not only involves building an awareness of what they do but the mindset underlying it;
- 2) Individual teachers **need to be motivated to make necessary improvements**. In general, this requires a deeper change in motivation that cannot be achieved through changing material incentives. Such changes come about when teachers have high expectations, a shared sense of purpose, and above all, a collective belief in their common ability to make a difference to the education of the children they serve;

Taking forward the practitioner-led change at a European level

- 3) Individual teachers **need to gain understanding of specific best practices**. In general, this can only be achieved through the demonstration of such practices in authentic settings and
- 4) Individual teachers **becoming champions for practitioner-led change and evangelizing to peers about the positive effects empowered self-improvement** can have in both teaching ability and the subsequent learning outcomes that are transferred to the student.



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