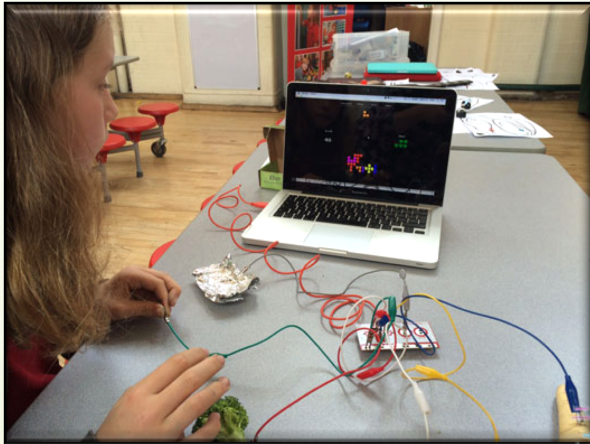


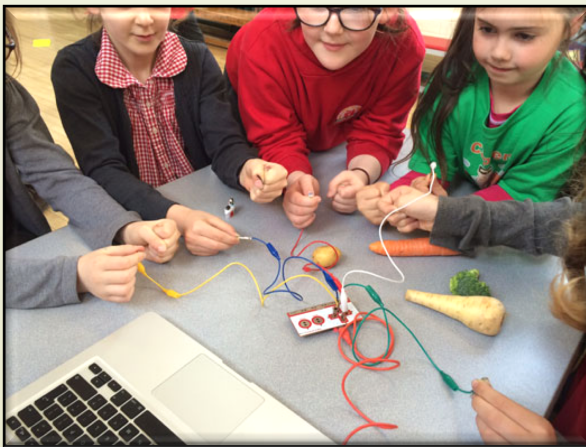
Analyzing the Attitude of Students Towards Robots when Lectured on Programming by Robotic or Human Teachers

Introduction

CONTROLLED COLOR RANGE
COMPLETE RGB GAMMA
CMYK TOLERANCE

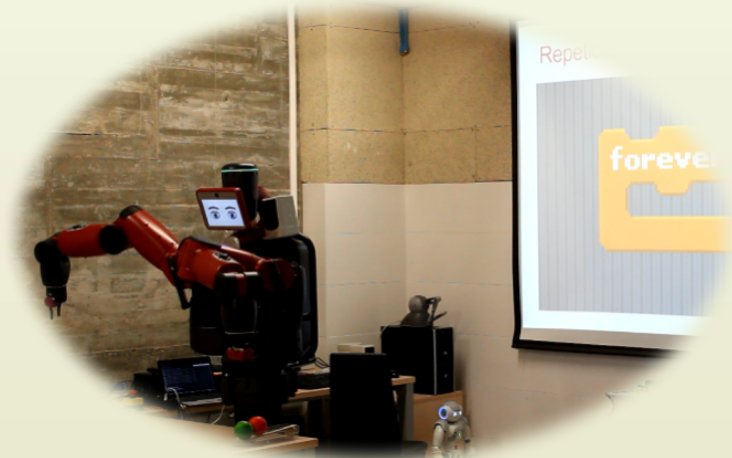
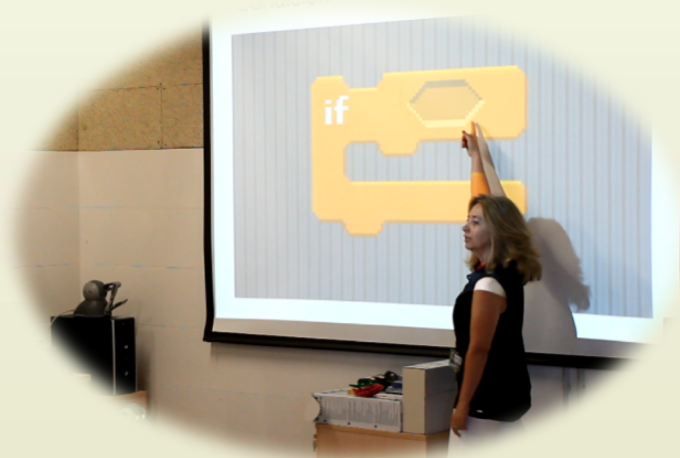
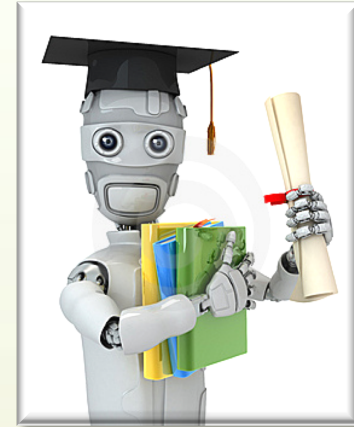
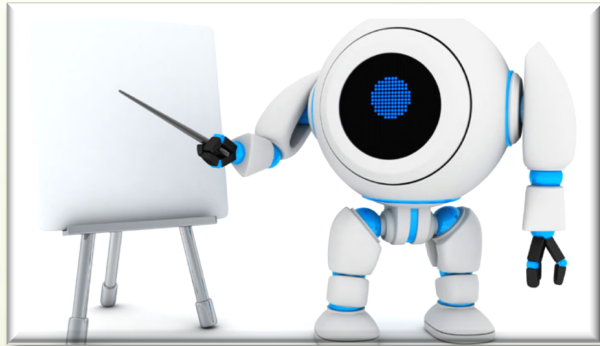


Computational
science
thinking
computer
computing
humans
systems
computers
solve
problem
think
problems
scientists
computational
think
problems
solve
problem
think
problems
scientists
computing



Introduction

CONTROLLED COLOR RANGE
COMPLETE RGB GAMMA
CMYK TOLERANCE



Introduction



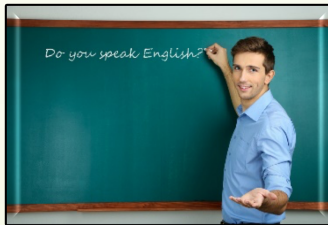
Negative Attitudes
towards Robots
Scale (NARS)



Robot Anxiety
Scale (RAS)

Experiment

CONTROLLED COLOR RANGE
COMPLETE RGB GAMMA
CMYK TOLERANCE



Human Teacher

- Programming teacher
- >10 years experience
- University level



Robot Teacher

- Industrial robot
- Two arms with seven-degree-of-freedom
- Torso topped by a head

Experiment

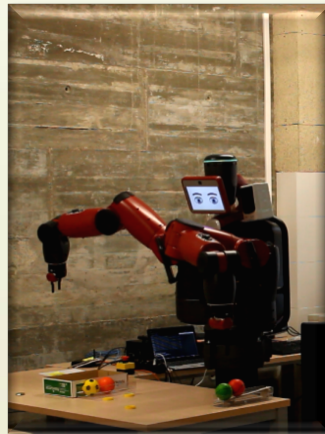
CONTROLLED COLOR RANGE
COMPLETE RGB GAMMA
CMYK TOLERANCE

Brief
lecture

Teachers
explain
exercise

Students
make
exercise

Students fill
questionnaire



Experiment

CONTROLLED COLOR RANGE
COMPLETE RGB GAMMA
CMYK TOLERANCE



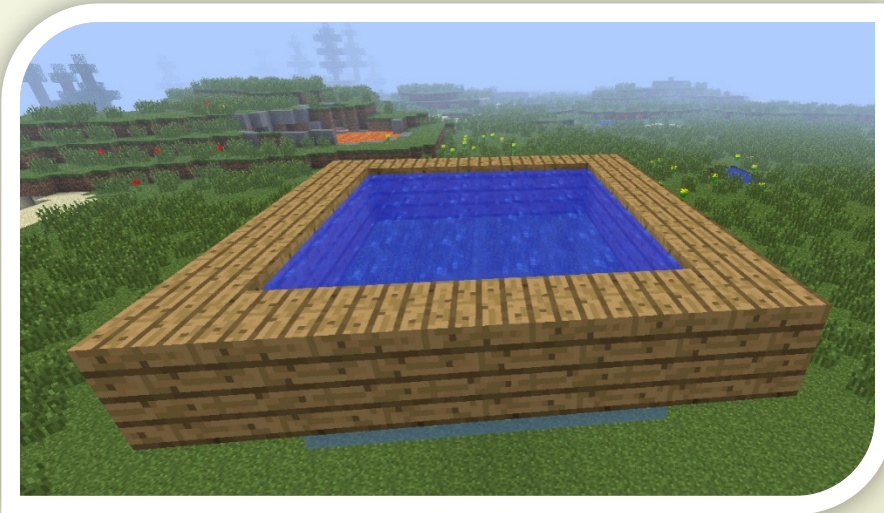
Experiment

CONTROLLED COLOR RANGE
COMPLETE RGB GAMMA
CMYK TOLERANCE



```
add water to swimming pool
add floor to swimming pool
add wall to swimming pool
```

```
if position = center
  repeat 9
    forever
      if
```



Data analysis

210 students

- 114 with robot teacher
- 96 with human teacher

Levels

- Primary 1 (6-9 years)
- Primary 2 (10-13 years)
- Secondary (13-17 years)

Data analysis



Negative Attitudes
towards Robots
Scale (NARS)

Interaction with Robots

Social Influence of Robots

Emotional Interactions with Robots



Robot Anxiety Scale
(RAS)

Communication with Robots

Robots' Behavior

Robots' Discourse

Data analysis

CONTROLLED COLOR RANGE
COMPLETE RGB GAMMA
CMYK TOLERANCE

Frequency distribution for NARS Items
(NS= Not Sure; NA= Not Answering)

Item	ALL STUDENTS			
	No	Yes	NS	NK/NA
I1	24.8	50.0	22.9	2.4
I2	53.8	29.5	9.0	7.7
I3	56.7	21.0	21.4	1.0
I4	72.4	9.0	15.7	2.8
I5	87.6	4.8	5.7	2.0
I6	77.1	9.0	11.0	2.9
I7	61.4	17.1	19.0	2.4
I8	29.5	32.9	34.4	7.9
I9	26.2	48.1	21.4	4.3
I10	45.7	23.3	25.2	5.7
I11	27.1	43.3	23.8	5.7
I12	8.1	68.6	19.0	4.3
I13	17.1	48.6	29.0	5.2

Frequency distribution for RAS Items (N=Nothing;
al= a little; S=Something; Q=Quite; AL = A Lot)

Item	ALL STUDENTS				
	N	al	S	Q	AL
I14	30.5	28.1	24.3	8.1	9.0
I15	54.8	20.0	11.0	6.2	8.1
I16	30.1	28.1	18.1	12.9	11.0
I17	29.6	19.0	19.0	17.1	15.2
I18	31.5	19.5	22.9	9.0	17.1
I19	18.1	13.3	17.6	27.1	23.8
I20	20.5	22.9	24.8	17.6	14.3
I21	27.1	22.4	22.4	10.0	18.1
I22	28.1	24.3	20.5	12.9	14.3
I23	19.6	15.2	20.0	21.0	24.3
I24	25.3	20.5	19.0	13.3	21.9

Data analysis

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Results of the comparison of average values for the group that has a human teacher and the one that has Baxter for NARS Items

	Levene Sig	N _H	N _B	X _H	σ_H	X _B	σ_B	t	ρ
Item 1	0.328	96	114	1.01	0.788	1.04	0.733	-0.318	0.751
Item 2	0.408	96	114	0.60	0.852	0.75	0.935	-1.168	0.244
Item 3	0.733	96	114	0.61	0.838	0.71	0.849	-0.821	0.413
Item 4	0.735	96	114	0.47	0.794	0.44	0.828	0.241	0.810
Item 5	0.726	96	114	0.19	0.529	0.20	0.613	0.111	0.911
Item 6	0.412	96	114	0.36	0.796	0.42	0.797	-0.512	0.609
Item 7	0.088	96	114	0.80	0.878	0.45	0.813	2.996	0.003
Item 8	0.186	96	114	0.07	0.824	1.13	0.901	-0.497	0.620
Item 9	0.827	96	114	1.11	0.780	0.97	0.825	1.264	0.208
Item 10	0.593	96	114	0.93	0.976	0.89	0.963	0.342	0.810
Item 11	0.092	96	114	1.13	0.866	0.99	0.800	1.167	0.244
Item 12	0.005	96	114	1.22	0.699	1.16	0.560		0.401
Item 13	0.094	96	114	1.19	0.850	1.25	0.738	-0.610	0.542



Results

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Interaction with Robots

87-89% do not feel very nervous just standing in front of a robot .

Social Influence of Robots

47-48% are not especially worried about the future role of robots in our society.

NARS

Emotional Interactions with Robots

43-48% feel comforted being with robots that have emotions.



Results

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CMYK TOLERANCE

Communication with Robots

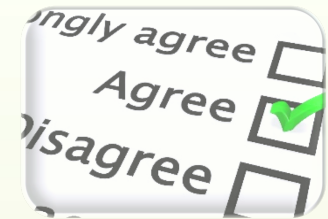
Students seem not to be worried about the behavior of robots during a conversation.

Robots' Behavior

Younger students seems to worry when they are interacting with robots.

Robots' Discourse

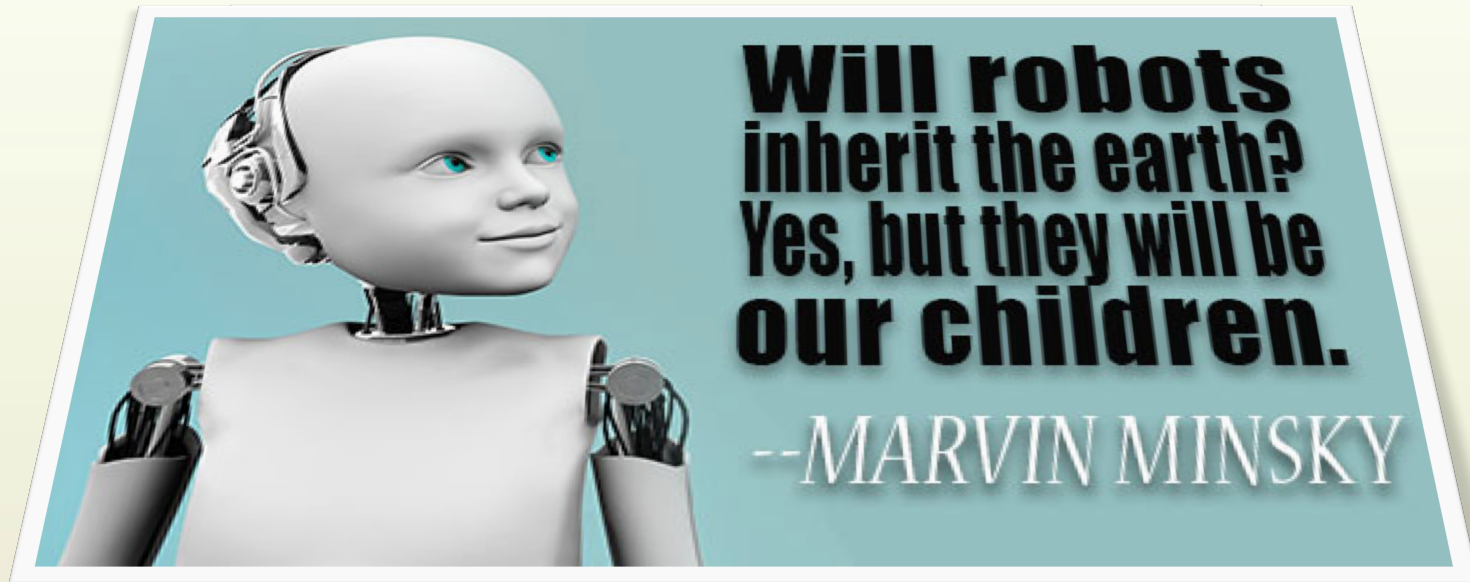
Younger students are more worried about talking properly with robots than older ones.



RAS

Conclusion

CONTROLLED COLOR RANGE
COMPLETE RGB GAMMA
CMYK TOLERANCE



Conclusion

CONTROLLED COLOR RANGE
COMPLETE RGB GAMMA
CMYK TOLERANCE

