Title

THE EFFECTS OF A FACILITATOR IN THE PERFORMANCE OF A HETEROGENEOUS WORKING GROUP: A SERVICE-EDUCATION EXPLORATION IN TECHNOLOGY EDUCATION

Myths & Misunderstandings

1. Science and technology are gender-prone

2. Science and technology are subjects which are comparatively more difficult to learn

3. Science and technology are 'risk-laden' activities

Background of the School

1. A typical grammar secondary school, aided by HKSAR
2. Prestigious in the teaching and learning of science and technology in the Territories
3. Commitment of the whole school in promoting science and technology---a mission of the School
4. Holder of a Guinness World Record;

   Owner of registered science inventions

Purpose of Study

- To investigate the effectiveness and efficiency of a facilitator on the performance of production of science products in a heterogeneous working group
- To identify the important attributes(generic skills) of a facilitator
- To clarify myths and misunderstandings about science and technology

Significance of Study

- Significant positive effects on teaching and learning when applied to science and technology domain (mentoring system)
- Develop the theory of heterogeneous working group further ('train-the-trainers' program)

Experimental Design

Two random groups of subjects are formed to undergo a controlled experiment. The group receiving the additional treatment will be termed as "experimental group" while the Group having no additional treatment is termed as "control group"

Experimental Design

- Two groups of families were arranged to join the workshop; one group in AM session and the other group in PM session
- Ambassadors were provided to the groups in the AM session
- The two groups in both sessions were treated the same except the presence of an ambassador in the AM session for each family

Learning Taxonomy

B. Bloom

THREE main learning domains:

- Cognitive
- Psychomotor
- Affective

Cooperative Learning & Social Pedagogy

- Emphasizes the group dynamics and interactions of the learners in a learning group
- Learners can achieve something and attain higher level of learning through co-operative learning that they cannot obtain on their own

Cooperative Learning

- A philosophy which indicates a way of dealing with people which respects and highlights individual members' abilities and contributions
- A methodology that employs a variety of learning activities to improve students' understanding of a subject by using a structured interactive approach
- Fosters the creativity, problem-solving ability and high-order thinking of the learners

Diagram I

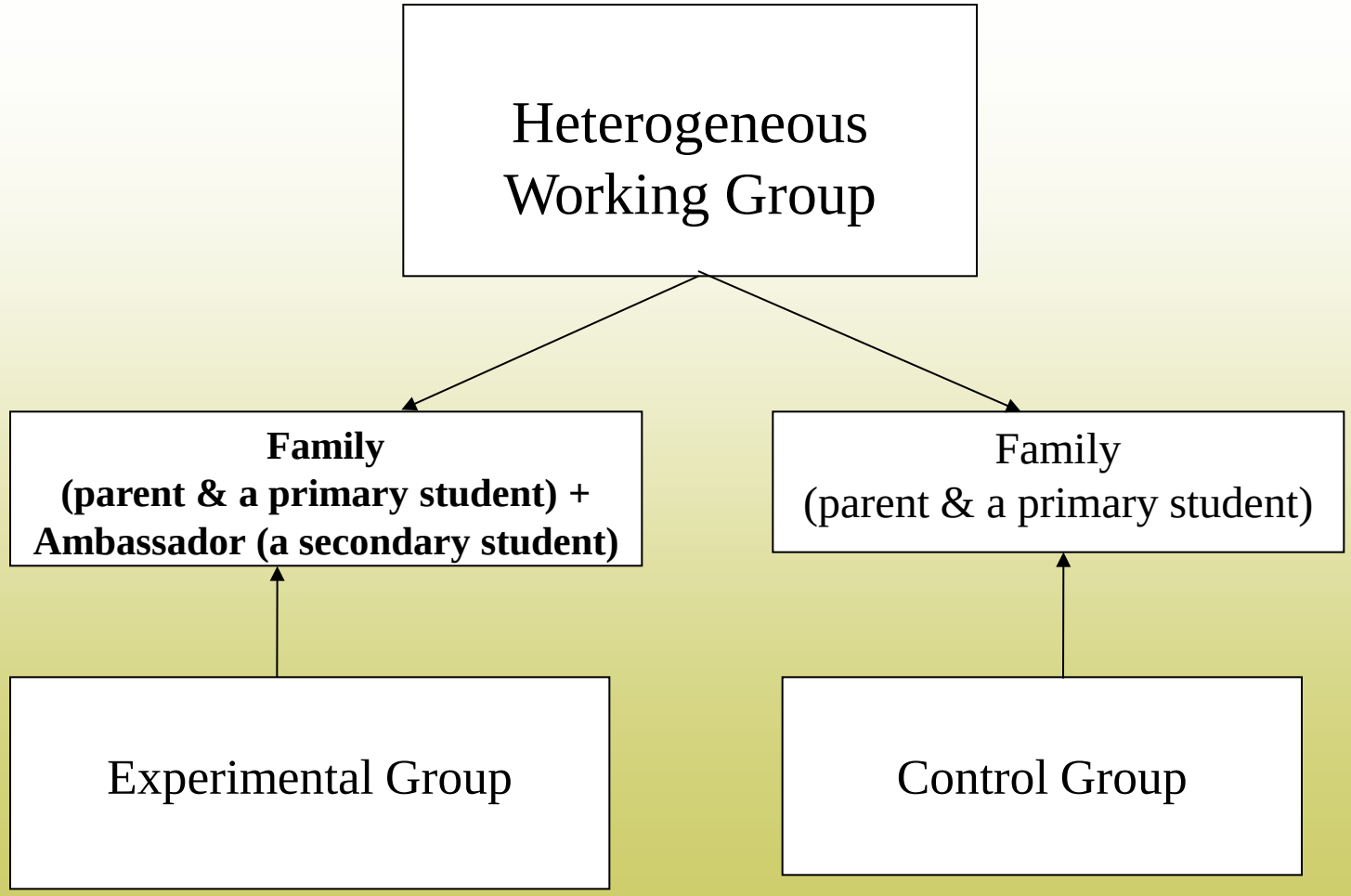

Heterogeneous
Working Group
Family
(parent & a primary student) +
Ambassador (a secondary student)
Family
(parent & a primary student)
Experimental Group
Control Group

Diagram II

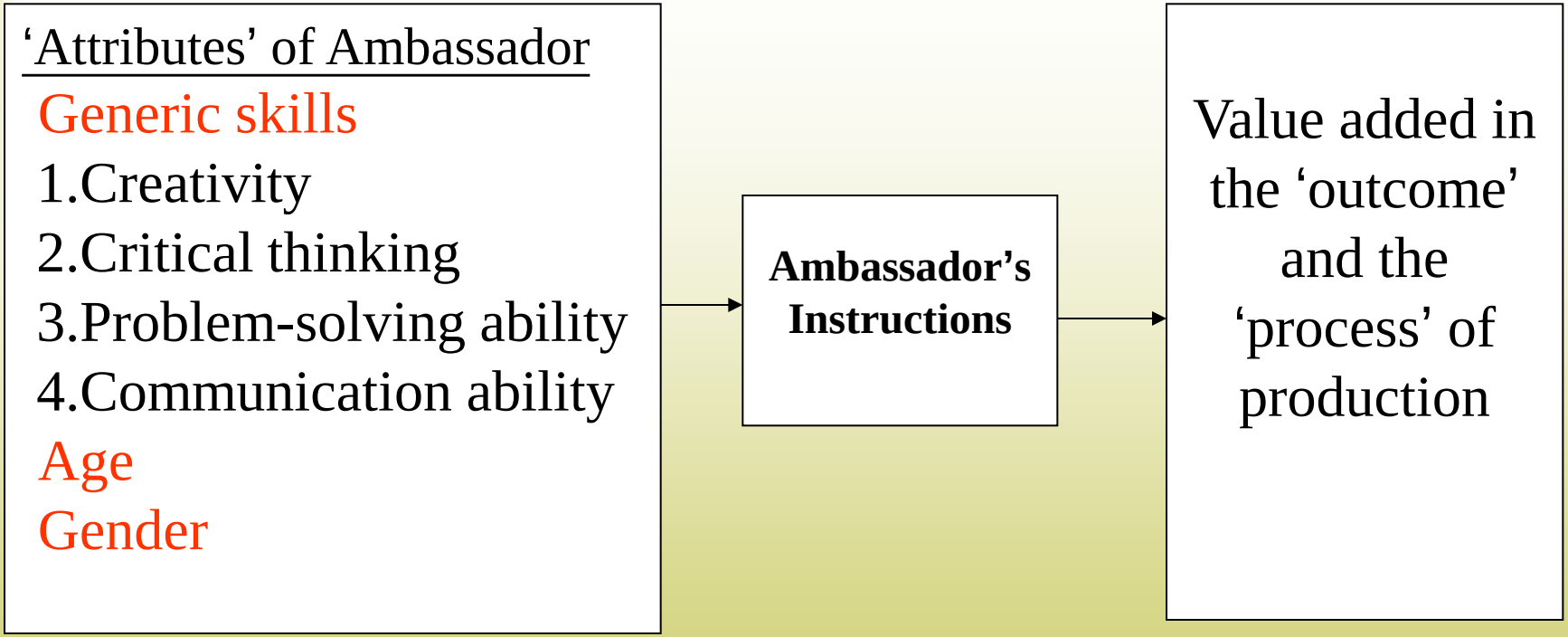
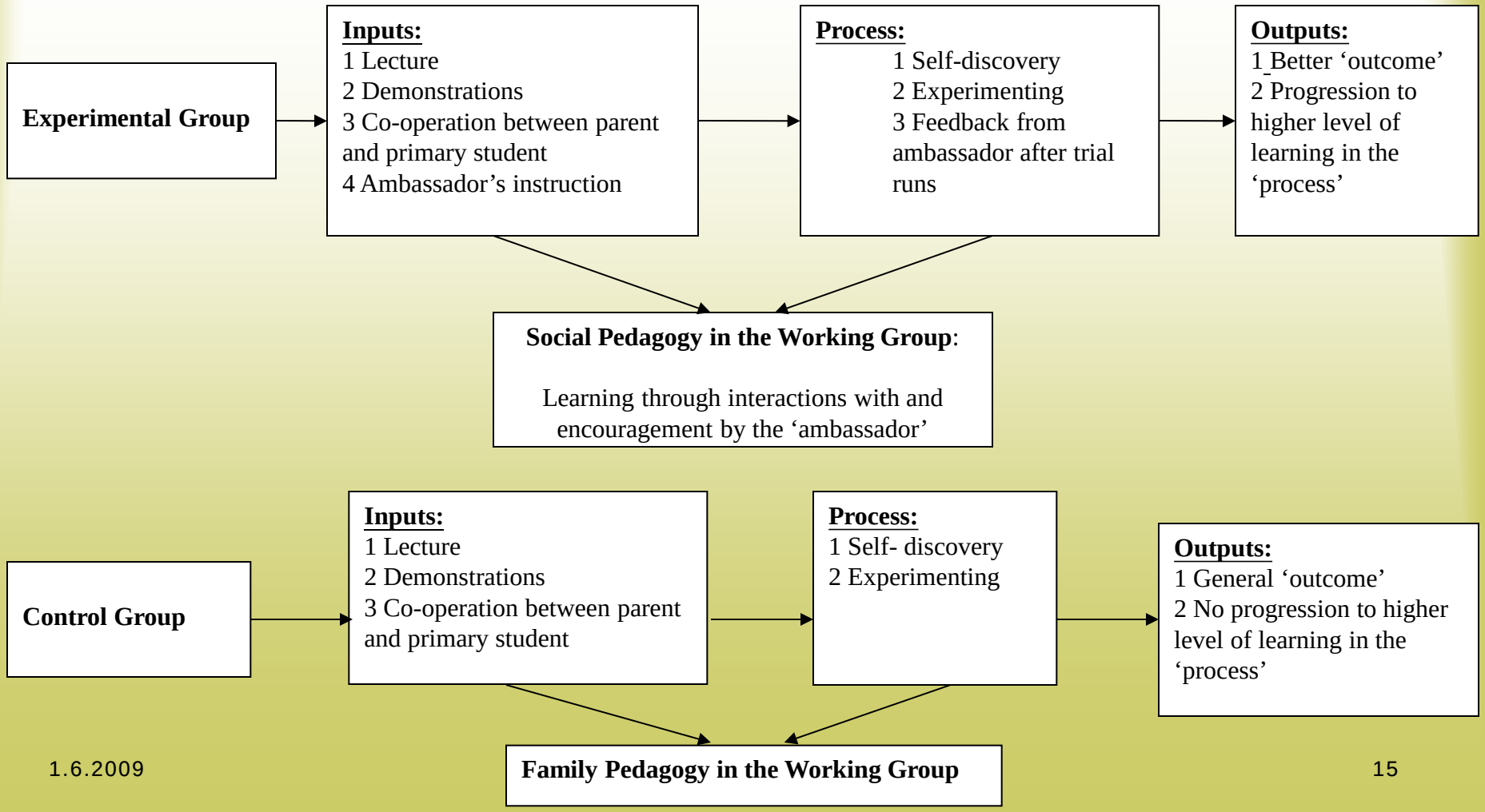

‘Attributes’ of Ambassador
Generic skills
1.Creativity
2.Critical thinking
3.Problem-solving ability
4.Communication ability
Age
Gender
Ambassador’s Instructions
Value added in the ‘outcome’ and the ‘process’ of production

Diagram III


Experimental Group
Inputs:
1 Lecture
2 Demonstrations
3 Co-operation between parent and primary student
4 Ambassador's instruction
Process:
1 Self-discovery
2 Experimenting
3 Feedback from ambassador after trial runs
Outputs:
1 Better 'outcome'
2 Progression to higher level of learning in the 'process'
Social Pedagogy in the Working Group:
Learning through interactions with and encouragement by the 'ambassador'
Control Group
Inputs:
1 Lecture
2 Demonstrations
3 Co-operation between parent and primary student
Process:
1 Self- discovery
2 Experimenting
Outputs:
1 General 'outcome'
2 No progression to higher level of learning in the 'process'
Family Pedagogy in the Working Group

Summary

1. The facilitators helped to raise the performance of the heterogeneous working group in the competition (value added to the outcome)

Summary

2. The facilitators increased the effectiveness and efficiency of the production of products (i.e. helped solve the technical problems and finish the product faster)

Summary

3.The facilitators enabled the heterogeneous working groups to practise the important generic skills (3C: Creativity, Communication and Critical thinking, and Problem-solving) and attain higher level of learning

Conclusions

- Peer supports are significant
- Heterogeneous working group of this kind is feasible and workable especially in the production of science and technology products
- Generic skills, especially the 3C (Creativity, Communication skills and Critical thinking) and Problem-solving ability can be enhanced
- Attributes of the trainers are crucial in a heterogeneous working group

Lingnan Dr. Chung Wing Kwong Memorial Secondary School
The 5th Hong Kong Science and Technology Workshop
Student Ambassadors Questionnaire Analysis

				Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4	Mean	Rank
GENERIC SKILLS	Communication Skills (C1)	1.	I can communicate well with participants.	1.2%	6.0%	60.4%	32.5%	3.24	1
	Creativity (C2)	2.	I can advise participants to think over different designs for flying.	1.2%	9.6%	59.0%	30.1%	3.18	4
		3.	I can hint participants to try different ways to fly the airplane.	1.2%	7. 2%	65.1%	26.5%	3.17	6
	Critical Thinking Skills (C3)	4.	I can assist participants to apply the flying principles.	0%	13.3%	56.6%	30.1%	3.17	6
		5.	I can advise promptly the participants about safety measures.	1.2%	7.2%	60.4%	31.3%	3.22	2
	Problem-solving Skills (C4)	6.	I can help participants solve technical problems.	0%	8.4%	62.7%	28.9%	3.20	3
		7.	I can help participants finish products faster.	0%	12.0%	63.9%	24.1%	3.12	7
		8.	I can help participants to gain better opportunity to win.	2.4%	24.1%	43.4%	30.1%	3.01	8
SATISFACTION	Self-actualization	9.	I can make participants happy for joining the workshop.	0%	2.4%	66.3%	31.3%	3.29	3
		10.	Acting as ambassador is a good opportunity for me to serve the community.	0%	9.6%	60.2%	30.1%	3.20	5
		11.	Acting as ambassador helps me to learn how to co-operate with others.	0%	8.4%	51.8%	39.8%	3.31	1
		12.	Participants find me a good facilitator.	2.4%	14.5%	51.8%	31.3%	3.12	8
		13.	Acting as ambassador gives me great satisfaction.	0%	6.0%	65.1%	28.9%	3.23	4
	Commitment	14.	I like to act as technology ambassador.	2.4%	9.6%	44.6%	43.4%	3.29	3
		15.	Acting as ambassador can increase my interests in learning technology.	1.2%	10.8%	59.0%	28.9%	3.16	6
		16.	I am willing to act as ambassador next time.	2.4%	12.0%	54.2%	31.3%	3.14	7

Recommendations

- Two levels of training
  i) mentoring system
  ii) 'train the trainers' programs

- Quality trainers
  'Train the trainers' programs focusing on the ASK dimensions (Attitudes, Skills and Knowledge) be recommended

Research Methods

- An experimental design
- Validated structured questionnaires (pilot test and administration)
- Quantitative analysis
  - t-test
  - Correlation matrix analysis
  - Factor analysis

Attainment of Learning Level

Rotated Component Matrix (a)

Item No.	Variable	Component		
		1	2	3
17	will take science as concentration in secondary school	.783		
18	will ask parents to subscribe technology magazines	.760		
12	know more about technology	.737	.346	
14	improve self confidence	.732		
13	improve the ability to make the product	.723		.414
15	like to join the similar workshop more	.504	.465	
6	better communication with parents		.790	
8	better understand teacher demonstration		.784	
16	feel happy with parents after joining the workshop	.442	.586	.355
9	complete the product faster			.854
10	increase chance to win			.770
11	learn happier		.473	.599
7	help to solve technical problem	.323	.402	.515

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 5 iterations.

Table 14 (Students, AM Session)

Attainment of Learning Level

Rotated Component Matrix (a)

Item No.	Variable	Component		
		1	2	3
7	help to solve technical problem	.783		
9	complete the product faster	.725		
10	increase chance to win	.723		
8	better understand teacher demonstration	.719		
6	better communication with parents	.668		
14	improve self confidence		.802	
13	improve the ability to make the product		.758	
12	know more about technology		.661	
15	like to join the similar workshop more		.612	.419
16	feel happy with parents after joining the workshop		.554	
11	learn happier	.325	.515	
18	will ask parents to subscribe technology magazines			.764
17	will take science as concentration in secondary school			.737

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Table 15 (Students, PM Session)

Attainment of Learning Level

Rotated Component Matrix (a)

Item No.	Variable	Component				
		1	2	3	4	5
17	solve technical problem	.863				
18	understand more about the demonstration	.839				
19	complete the product faster	.829				
16	better communication	.790				
20	improve the chance to win	.638				
21	learn happier	.606	.328			
23	improve the ability to make the product		.856			
22	know more about technology		.805			
24	increase the interest to produce technology work		.784			
25	improve self confidence		.733		.312	
26	like to join the similar workshop more	.319	.625		.385	
30	clearly explain how to make			.782		
27	clearly understand the problem			.775	.321	
29	deeply understand the product			.716		
28	actively hint the main points to note			.690	.400	
31	provide the technical support			.646		
34	cooperation positively				.843	
33	encourage to try different methods			.347	.808	
32	friendly and patient				.719	
35	lesser age difference					.857
36	same sex					.749

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 7 iterations

Table 16 (Parents, PM Session)

Attainment of Learning Level

Rotated Component Matrix (a)

Item No.	Variable	Component			
		1	2	3	4
25	improve self confidence	.831			
26	like to join the similar workshop more	.792		.332	
23	improve the ability to make the product	.784	.353		
24	increase the interest to produce technology work	.740	.398		
22	know more about technology	.613	.426		
19	complete the product faster		.793	.321	
17	solve technical problem	.379	.781		
18	understand more about the demonstration	.440	.713		
21	learn happier	.436	.679		
20	improve the chance to win		.642		
16	better communication	.503	.598		
30	clearly explain how to make		.333	.745	
38	actively hint the main points to note	.369		.697	
29	deeply understand the product	.350		.697	
31	provide the technical support		.498	.682	
27	clearly understand the problem	.333		.670	
33	encourage to try different methods		.342	.646	
34	cooperation positively			.610	.446
32	friendly and patient	.326		.411	
35	lesser age difference				.841
36	same sex				.762

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
A Rotation converged in 10 iterations.

Table 17 (Parents, AM Session)

Learning Taxonomy

B. Bloom

THREE main learning domains:

- Cognitive
- Psychomotor
- Affective

Cognitive Domain

- Knowledge
- Comprehension
- Application
- Analysis
- Synthesis
- Evaluation

Psycho-Motor Domain

- Imitation
- Manipulation
- Precision
- Articulation
- Naturalization

(R. H. Dave)

Affective Domain

- Receive
- Response
- Value
- Conceptualize values
- Internalize values

(Bloom, Masia, Krathwohl)