



Impact of “Relation with Learning” on Scientific Conceptions and Knowledge among Gymnasium Pupils¹

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Abstract

According Balacheff and Clement models, knowledge (K) and conceptions (C) interact mutually. Clement seems to define conceptions as a set of items fueled by values, practices and knowledge while Balacheff defines knowledge as a set of situated conceptions. Moreover, Chevallard and Charlot make the hypothesis that learning requires a factor commonly underestimated: the “relation with learning”.

This study surveys the impact of the relation with learning on the evolution of scientific conceptions and knowledge among learners. It intends to test the Charlot and Chevallard hypothesis as well as the Balacheff and Clement models in order to identify a possible interaction between knowledge and conceptions.

We surveyed a population of gymnasium pupils (n = 47) about blood circulation. One questionnaire enabled to determine a set of relation with learning profiles. Besides, two questionnaires were distributed one month before the learning sequence (phase 1), then two months after the learning sequence (phase 2) : one questionnaire for identifying the conceptions, the other one for measuring the knowledge level.

Our results show clearly that the two factors are correlated: utilitarian profile (U) and pleasure profile (P) both improve in the short run the evolution of the scientific conceptions and knowledge. The knowledge evolution and the conceptions evolution are rather similar during the sequence we have surveyed. These data do not disconfirm the interactionnal hypothesis between C and K inside the set circumscribed by Balacheff and Clement. On the other hand our data do not allow so far to assure whether conceptions constitute a set of knowledge or not.

These data are relevant to shed light on the learning process and emphasize the necessity to integrate the “relation with learning” into Giordan’s allosteric model claiming to transform the initial conceptions of the learners.

1. Introduction

There are two major models dealing with the relationship between conceptions and knowledge: Clement’s KVP model [1] and Balacheff’s Structural model [2]. In the KVP model, conceptions (C) result from the interaction between scientific knowledge (K), values (V) and social practices (P). K refers to scientific knowledge identified on a specific topic; P stands for practices from which conceptions are analyzed; and V refers to social values. Moreover, Clement defines “conceptions” (relative to a scientific topic) as a set of “situated conceptions” (i. e. relative to a specific situation). Balacheff’s model comes from Vergnaud’s researches [3]. In this model, conceptions and knowledge belong to a same set. K is seen as a set of conceptions, while a set of knowledge gives a concept. A link between K and C is postulated but no researches have studied this link.

Beside this, Charlot [4,5], Caillot [6,7], Chevallard [8] have investigated the “relation with knowledge and learning” of learners, which is the relation with the world, with other peoples and with oneself confronted to needs of learning. From a theoretical point of view, this concept allows a new vision on didactical situations. Indeed, the relation with learning can reveal the conception of knowledge from

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the learner's point of view. It means that one cannot enter in the learning without mobilizing at the same time the relation he has with learning.

Our research surveys the connection between "relation with learning" and scientific conceptions and knowledge among pupils: in other words, do scientific conceptions and knowledge of pupils interact with the "relation with learning" profiles?

2. Methodology

2.1 Surveyed sample:

Our study focuses on two classrooms of 45 gymnasium school pupils (12 years old). Data were gathered according to diagnostic assessments by collecting initial conceptions and initial knowledge 2 months before the learning training (phase 1). The same kind of data was then collected one month after the learning training (phase 2). The learning training concerns blood circulation: It corresponds to structured inquiry methods as described by Bell [9] and is commonly used by teachers in France.

Initial and second conceptions were collected from schemas and opened questions such as "Draw where the blood in your body is and explain what it is used for" and "Draw the interior of the heart and explain what it is used for". Initial conceptions have been collected before initial knowledge. Relation with learning was collected before the initial conceptions and knowledge.

Initial and second knowledge were collected from specific closed questions such as "What is blood circulation and what is it used for?", "What are the differences between rich or poor in O₂ and CO₂ blood?", "What is the heart and what is it used for?", "How is organized the heart and how do the different parts of the heart work?"

The relation of learning was collected from specific questions as proposed by Charlot [5], Montandon and Osiek [10].

2.2 Data processing:

Results are gathered in double-entry tables indicating the correlation between conceptions and knowledge and their relation with learning. Table 1 and 2 show this correlation at phase 1 (before the learning training). Tables 3 and 4 show individual evolution path from phase 1 (before learning training) to phase 2 (after learning training) compared with the relation of learning. Table 1 show how many pupils were surveyed and table 4 gives various percentages. Pupils were classified according to their relation with learning as described by Montandon and Osiek [10], leading to the following profiles:

- R (educational system is rejected);
- T (Tourist: pupils go to school only for fun);
- I (Intermediate: school is viewed as useful and pleasant);
- U (utilitarian: school is viewed as useful for their future);
- P (pleasure: learning is a pleasure independently of its usefulness).

As for the scientific elaboration, five levels have been defined:

- NR means "no response";
- F refers to false scientific propositions;
- S corresponds to a non efficient formulation (the physiological function is not known);
- EL- refers to a scientific vocabulary that is not completely elaborated but the physiological function is explicated;
- EL+ corresponds to a more elaborated and precise scientific vocabulary coupled with a physiological function correctly explicated.

3. Results

3.1 Relation with learning and initial conceptions or knowledge

First of all, the results (Table 1) show that the majority of pupils reach the elaboration level S for their initial conceptions (22) and initial knowledge (28). Moreover, EL- is mostly represented among initial conceptions compared with initial knowledge.

Furthermore, the main profile of the relation with learning is the Utilitarian profile (41 = 19 for initial conceptions + 22 for initial knowledge). The Pleasure profile is second with 21. The other profiles reach about the same amount: R (10), T (12), I (14).



Relation with learning	Initial Conceptions (T1)					Initial Knowledge (T1)					Total
	NR	F	S	EL-	EL+	NR	F	S	EL-	EL+	
Rejection (R)	1	1	2	1		1	1	3			10
Tourist (T)		4	1	1		2		4			12
Intermediate (I)		1	6				2	5			14
Utilitarian(U)		2	10	7		1	5	12	4		41
Pleasure (P)		1	3	6			1	4	5	1	21
Total of pupils		9	22	15		4	9	28	9	1	

Table 1: Comparison between the “relation with learning” and initial conceptions or knowledge (phase 1), expressed in number of pupils.

3.2 Relation with learning and individual evolution path

Results (Table 2) show that 16 pupils have improved their conceptions from phase 1 to phase 2 while the conceptions of 3 pupils only have declined. The initial conceptions do not change for 14 pupils. Similar figures have been obtained for the evolution of knowledge: 23 have improved, 3 have declined and 10 do not change.

Now, if we consider the improvement of conceptions and knowledge (Table 3, phase 2+) and if we compare with the percentage (Table3, phase 1), it appears that Utilitarian profile comes first (50% and 43% respectively), followed by Pleasure profile (25% and 26% respectively). When the conceptions do not change (Table3, phase 2), Utilitarian profile is declining in favor of pleasure profile and intermediate profile. When the conceptions decline, Rejection profile and Touristic profile obtain about the same number of answers. When the knowledge improves, a similar result can be noted: Utilitarian and Pleasure are the main profiles. When the pupils keep the same conceptions, Rejection (30%) and Pleasure (30%) are the main profiles. Only Utilitarian profile is observed for pupils in decline.

	Conceptions (T2)					Knowledge (T2)				
	NR	F	S	EL-	EL+	NR	F	S	EL-	EL+
NR (T1)						1T/1U		1T		
F (T1)		1T	1R	1T/2U		1U	1R/1U/1P	1I/1U/2P	3U	1I/2U
S (T1)		2R	1T/3I/3U/1P	1I/2U/1P	1I		2U	2R/1I	2T/2I/3U/1P	3P
EL- (T1)			1T	2U/2P	4U/3P				2P	1U
EL+ (T1)					1P					

Table 2: Comparison between the “relationship with learning” and individual evolution path of conceptions and knowledge (from phase 1 to phase 2), expressed in number of pupils.



Relation with learning	Conceptions				Knowledge			
	T1	T2+	T2s	T2-	T1	T2+	T2s	T2-
R	11	6	0	50	10	0	30	
T	13	6	14	50	12	13	10	
I	15	12,5	21		14	17	10	
U	40	50	36		43	43	20	100
P	21	25	28		21	26	30	

Table 3: Improvement (phase 2+), stability (phase 2s) or decline (phase 2-) of conceptions and knowledge relatively to the “relation with learning”, expressed in percentage of pupils.

4. Discussion-Conclusion

Studying the “relation with learning” shows (see table 1) a distribution of pupils between the different profiles. Utilitarian profile is dominant (19 pupils i.e. 40%), followed by P profile (21%) then I profile (15%), T profile (13%) and R profile (11%). We can note that 11% of pupils reject the school and learning: it seems more than in other countries. Further study should confirm this result but our parallel study on this subject seems note it.

If we add U+P+I profiles (denoting pupils that take learning as their main objective), we obtain about 75% of pupils with a positive relation with learning.

The comparison between the “relation with learning” and initial conceptions or knowledge shows that U and P profiles reveal an elaboration of conceptions and knowledge S/EL- although I profile reveals only a S-type elaboration. Weak level of elaboration (F) is dominant among T profile, although weak elaboration can be observed among U, P and I profiles too.

According to these results, it seems that a correlation exists between the relation with learning profiles and the level of elaboration of conceptions or knowledge: U/P profiles have a better elaboration of conceptions and knowledge.

Now, if we compare the individual evolution path with the “relation with learning” (tables 2 and 3), we can note that most of pupils who improved C and K belong to U/P profiles. On the other hand, pupils whose C and K have not improved or have declined belong to the other profiles.

Consequently, Utilitarian (U) and Pleasure (P) profiles are the best profiles to enter in an elaboration of conceptions and knowledge, hence in learning.

Finally, his research shows that evolution of conceptions and knowledge is tightly linked with the “relation with learning”. This result must be taken into consideration in the didactical situations.

Moreover, the comparison between C and the “relation with learning” on one hand and K and “relation with learning” on the other hand seems rather similar. The differences observed are not significant in the sample we studied. So these results do not disconfirm Clement and Balacheff models, claiming that C and K belong to a same set where they interact.

By way of conclusion, our results provide evidence in favor of Giordan’s allosteric model [11,12,13], by claiming that the transformation of conceptions – in order to make the learning more efficient – must take into consideration the “relation with learning”.

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