ELSEVIER

Patient Education and Counseling 38 (1999) 61–67

PATIENT EDUCATION AND COUNSELING

A new approach for patient education: beyond constructivism

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Received 23 December 1997; received in revised form 10 July 1998; accepted 20 July 1998

Abstract

Over the last ten years, research developed in science education, especially at the University of Geneva, has demonstrated that education must be centered on interactions between the learner's conceptions and a systemic educational environment. Transposed to a medical knowledge, this new model, originally conceived by the authors and called the 'allosteric learning model', offers new ways of considering patient education. After criticizing the 'grand theories' of learning, mainly the latest ones called constructivist models, the authors suggest a new set of micromodels designed to explain thoroughly the functioning of the patient's thought process (questions, frame of references, semantic network,...) and his understanding of medical information on his own disease. For health care providers, these models also offer a series of new pedagogical approaches both efficient and original to regulate the act of education based on confrontation, mobilisation, integration, etc.
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Keywords: Conception; Patient's thought process; Learning process; Allosteric model; Didactical network

1. Introduction

The number of books being published with the word ''learning'' is large. Still, until very recently, learning has been far from the center of research in science education and more particularly in patient education. Indeed, only philosophers and psychologists had become involved in this field even though their query was more a general reflection on ''what is learning'' in terms of development of thought. To revitalize this somewhat bogged down approach, one has undoubtedly to understand ''how does one learn?'' and above all, the ''conditions, context, and the environment can facilitate or block learning''.

Learning in order to treat disease better, in the long term, is even more difficult. The family circle as well as the patient's life history block the learning of a disease and creates major difficulties for patient education.

The study of the conditions facilitating learning, or even of ''efficient'' pedagogical strategies, at any rate remains very crude. The various constructivist models say hardly anything, about the contexts or parameters of learning and provide few applications for educating patients. Constructivist models remain highly influenced by the idea of ''maturation''. Patients learn following a chronology related to the

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PII: S0738-3991(98)00108-6

succession of development stages; this chronology still remains nearly impermeable to processes that can facilitate learning. A mere handful of neo-constructivist researchers advance a few elements such as the activities of association [1–3] or cognitive conflicts [4,5].

It is true that when we use specific investigations to shed light on the factors facilitating learning, we find it is impossible to define a single type of favorable educative action. The situations or conditions for optimal learning are necessarily multiple. They also depend on the content of what is to be learned and the knowledge patients are capable of mobilizing. Learning mobilizes several levels of mental organization that, at first glance, seem disparate as well as a considerable number of regulation loops (feed-back). In order to go beyond the constructivist model, a number of micromodels have been created and gathered under the comprehensive term: *allosteric learning model* (''Allosteric'' comes from a metaphor with a protein function) [6–8].

A great potential for research can be developed along these lines. This review firstly tries to prove that it is difficult to advance a single model for educating patients. Learning encompasses a group of multiple and varied activities.

In this context, it thus appears useful to dissect a few procedures brought into play by patient learners in interaction with the content and contexts of specific learning. How do they gather the information in relation to a question? How do they handle it? How do they memorize it? How do they mobilize it? How do they put it into practice? And for how long? etc. At the same time, it becomes important to catalogue the principal parameters nurturing the act of learning. In particular, we will show that all these elements are independent. They overlap one another in an interactive system.

2. The limits of constructivist models

Learning is not, as most science teachers continue to think, the result of a simple process of transmission and reception. Unlike the effect of light on film, it is not the result of the impression left in patients minds by the sensorial stimulation from educating. Spontaneous accord between the patient's and doctor's ''mental structures'' through the doctor's good performance and patients careful listening is relatively rare.

In the doctor–patient relationship, the doctor most of the time thinks that he knows everything and, overall, that the transmission of his knowledge is sufficient to encourage patients to put into practice insulin injections for diabetics or self management plan for asthmatics. However, the doctor often forgets that the patient has his own knowledge as well as his life history related to his disease and treatment. The patient may have negative representations of his treatment which he will never put into practice (fear of insulin injection). For instance, an insulin injection can involve a leg amputation for some patients. This representation may come from the case of a neighbour to whom insulin injections have been necessary when infection has ended up in an amputation. Patient's notions and representations are so important that the unidirectional teaching of the doctor is useless and utopian.

In light of this pedagogical model's repeated failures and the limits of the behaviorist model, several constructivist models have been developed over the past fifty years [1,2,6–12]. All of them began with the principle that individuals possess their own way of thinking and even their own ''common sense''. The organization of learning, the acquisition of knowledge fundamentally proceed from activity on the part of the subject. Learning thus becomes a capacity for effective or symbolic material or verbal action, related to the existence of mental instructions arising from the action. These in turn arise from the active repetition of behavior. Among them, those consisting of representing realities, reconstructing them and combining them in thought, play a fundamental role.

Constructivist models seem rather crude for patient education. For Ausubel [2], for example, everything relates to making connections; this is facilitated by the existence of ''cognitive brides'' which render information significant in relation to a pre-existing structure. For this author, new knowledge cannot be learned unless three conditions are combined. First, more general concepts must be available, then progressively differentiate themselves during the learning. Second, a ''consolidation'' must come into play in order to facilitate the mastery of the knowledge at hand: new information cannot be introduced until preceding information has been mastered. Lastly, the third condition concerns ''integrative conciliation'', consisting of discerning the resemblances and differences between old knowledge and new knowledge, discriminating between them and even resolving contradictions.

Piaget [13] also supposes that ''subjects'' process new information according to previously acquired knowledge. They ''assimilate'' it, and in return, ''accommodation'' becomes necessary. The result is a transformation of initial knowledge in relation to the new circumstances. For him, it is a question of attaching the new information which is already known, of grafting it onto these notions by taking into consideration the ''outlines'' at the subjects's disposal.

When we observe patients in situations in which they are acquiring scientific knowledge, we observe that they group together a series of multiple, polyfunctional and pluricontextual activities. Learning mobilizes several mental organizational levels, which at first seem disparate, as well as a considerable number of regulatory loops. Trying to explain everything in a single theoretical framework seems nearly impossible—all the more so as the different constructivist models have been produced in extremely specialized fields.

For example, in the case of learning scientific concepts, everything does not depend on the cognitive structures as Piaget defined them. Subjects who have attained very developed levels of abstraction can reason out new content just as well as young children would! What is involved is not only an operating level, but what we call a global conception of the situation, simultaneously a type of questioning, a frame of reference, of signifiers, of semantic networks (including broader overall knowledge of the context and learning), etc. So many elements orienting the way of thinking and learning and about which Piagetian theory remains silent.

In the same way, the appropriation of knowledge does not happen exclusively by ''reflective'' abstraction. In scientific learning, it can at times distort, and indeed creates mutations. A new element rarely fits in with the contours of previous knowledge. On the contrary, it frequently represents an obstacle to its integration. To try to explain everything in terms of ''assimilation'' or ''accommodation'' is highly improbable. Overall, deconstruction should be envisaged hand in hand with all new construction. In order for learners to be able to grasp a new model or mobilize a concept, their overall mental structure must be transformed. Their framework of questioning is completely reformulated, their network of references largely re-elaborated. These mechanisms are never immediate. They pass through phases of conflict or overlapping. Everything is a question of approximation, concernment, confrontation, decontextualization, interconnection, rupture, alternation, emergence, stratification, stepping back and, above all, mobilization.

Let us use an example to illustrate the direction in which we are developing our research. When patients learn the nutritional behavior of an ordinary animal, learning consists exclusively of making connections between new knowledge and what they know or think they know (or even making connections between the new and what they already do). Patients already possess a frame of reference concerning nutrition. They know what ''eating'' means, ''what it's for'' and ''how it happens''.

For a large majority of patients, food is synonymous with pleasure, even success and wealth. Food refers to the family and social circle even to the ethnic circle. According to our studies, food can sometimes play a role of identity as well as a health image. Representations must be taken into consideration when a dietician teaches nutriment physiology, calorific and carbohydrates equivalences. It is even more important when the dietitian is prescribing a diet. Eating a certain type of food could be forbidden in different religions. Nutriments could have a magical effect or could be dangerous.

One or many questions can perturb patients. In order to learn, they will have to make their thought systems assimilate—in the Piagetian sense—new, less obvious information. If they need to, they will embrace this information if it does not seem totally pertinent. By this progression, they broaden and restructure their cognitive tools.

Motivation is not the only limiting factor. First of all, they must work out information far removed from their habitual ideas. Anything that cannot be decoded has no meaning for them, even if it does for the doctor. Learning also means they must make connections between different notions: food, calories, digestion, absorption. For questions presenting cognitive difficulty, they can no longer register all the information directly. They must set in motion a series of procedures to hunt for the information, process each element individually, then verify if: the learners become the agents of their own learning. They still must tackle various questions, like ''What does eating mean?'', ''Why must food be digested?'' and ''Why does some kind of food make people gain weight?'' Favorable learning conditions are those that further the patients' investment, that facilitate their questions, their search for, and their processing of information.

Learning becomes even more complex when it involves issues concerning genetics, genetics of populations, regulation, or even environment and health. In these cases, the learning of attitudes or values also comes into play [14]. They are even less easy to transform: to know does not mean an automatic modification in behavior.

3. Allosteric learning model

It is easy to see the complexity confronting any doctor to patients education. Learning takes nothing less than the coordination between knowledge—in the strictest sense of the word, strategic knowledge, metacognition and control over the whole. Our proposition is thus very pragmatic. It is not to produce a single additional model of the learner's cognitive processes. At this stage, it seeks rather to go beyond the limits of the constructivist models. To do this, we have attempted to elaborate and validate various micromodels [15]:

– on what learning means in various situations
– on the mechanisms at work
– on the conditions which facilitate learning.

This approach is now globally known as the allosteric learning model. Functionally speaking, these micromodels try to reconcile the paradoxical and contradictory aspects inherent in all learning. All mastered knowledge is at once the extension of previously acquired knowledge, which provides the framework for questioning, reference and meaning, and a rupture with it, at least by bending it or transforming it through questioning. Learners learn at once ''thanks to'', as Gagné writes, ''starting with'' (Ausubel) and ''with'' (Piaget), and at the same time, ''against'' (Bachelard) the functional knowledge in their ''heads''.

Successful learning is a change in conceptions (Table 1), which is never neutral for learners, is never a simple process.

It can even be considered an unpleasant one. The conceptions mobilized by learners lend those learners meaning, and any change is perceived as a threat. It changes the sense of our past experiences [16]. The conception as we have validated it, intervenes at once as an integrator and as a formidable resistor to any new knowledge contradicting the pre-established system of explanations. On top of that, learners must exercise deliberate control over their activity and over the process governing it, and this at various levels which we will try to list with examples.

Let us take a simple example which frequently occurs to our diabetic patients in order to explain the steps of the conception in Table 1. This example is a typical misunderstanding of a nutritional concept. Diabetic patients are compensating hypoglycemic events by eating cheese, believing that cheese contains carbohydrate because cheese is made of milk.

3.1. Problem (P)

Do you take cheese to compensate a hypoglycemia? Could a lack of sugar be treated by a piece of cheese?

3.2. Reference (R)

To answer, the patient refers to his knowledge and creates a link between cheese and milk since cheese is made from milk.

3.3. Mental process (M)

As milk contains carbohydrates and it is necessary to take them to overcome a hypoglycemic incident, it is highly probable that a piece of cheese may treat hypoglycemia.

Table 1

CONCEPTION = F(P.R.M.N.S.)
P (problem) is the set of more or less explicit questions that mobilize the conception, or lead to its implementation. It is the driving force behind all intellectual activity.
R (set of references) is the set of peripheral knowledge that subjects draw on to formulate their conceptions. In other words, learners rely on other conceptions they have already mastered to generate new conceptions.
M (mental processes) is the set of all intellectual processes or transformations controlled by the learners. These processes allow them to make connections between elements in their set of references, make inferences, and thus generate and use the conception. Specialists call them operatory invariants.
N (semantic network) is the interactive organization that has been set in place, arising from the set of references and mental processes. It gives a semantic coherence to the whole. In other words, it is the result of the interplay of all the relationships that have been established between the conception's main and peripheral elements. This process produces a network of meanings, and gives the conception a sense of its own.
S (signifiers) is the set of notions, signs and symbols necessary for the conception's generation and explanation.

3.4. Network (N)

Cheese is part of dairy products which are known in the equivalences of carbohydrates for diabetic patients. Diabetics must be careful with their diet.

Thus, cheese is certainly appropriate to overcome hypoglycemia in a diabetic patient. Cheese represents many family and cultural symbols. It is used to give strength to workers; it represents local farm produce. It is very healthy and certainly good for diabetics. The wrong representation comes from the fact that many diabetic patients think that cheese contains carbohydrates and can compensate hypoglycemia. However, cheese is produced only with proteins and fats of pressed milk and it is clear that cheese does not contain any carbohydrates and cannot be used to overcome hypoglycemia.

3.5. Signifers (S)

To represent or categorize food, we teach them using different colors and symbols. Energy is calculated through different units symbolized by: J, W, C, Kcal.

All acquisition of knowledge thus proceeds from the complex elaborational activity of patients confronting* new information with their mobilized* knowledge, then producing new meanings more apt at responding to the questions posed or what they perceive to be the stakes involved. Thus what we call active conceptual sites develop a sort of interactional structure with a preponderant role in the organization of new information and in the elaboration of the new conceptual network*.

4. An allosteric environment

Thus we must have in-depth knowledge of the learners' conceptions (Fig. 1). Far from being lim-

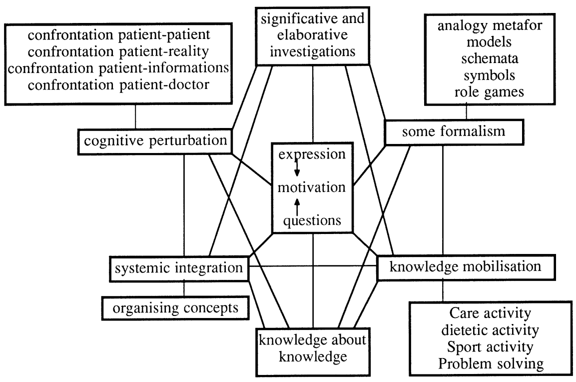

Fig. 1. The parameters of an allosteric environment.

ited to notional aspects, it must also include how learners formulate questions, their ways of reasoning, and in what forms meaning emerges for them.

At the same time, it is also a question of putting your finger on the situations, arguments and documents that can overlap with patients' representations to make them progress. A system of multiple interrelations must be set up between patient and the object of knowledge. The probability of patient discovering the whole set of elements capable of transforming their questions or furthering the construction of networks is practically zero (Fig. 1).

At the current stage of research, it is possible to pinpoint these elements in some specific subjects. A micromodel of the networks of parameters and constituent constraints can equally be advanced. Its objective is to decode, bit by bit, and in the light of specific knowledge, various types of learning in the form of a ''nuanced'' systemic and multi-stratified entity, where self-regulating loops and levels of integration are put to the fore.

At the beginning of any learning, a certain degree of dissonance* perturbing the cognitive network formed by mobilized conceptions is indispensable. This pertubation* creates tension, which disrupts or displaces the fragile balance that the patients' brains have put in place.

For instance, even if a patient knows that we cannot treat hypoglycemia with cheese, because he knows well that cheese does not contain carbohydrates, you can perturb him by asking: Are you sure? because cheese is made from milk which contains carbohydrates. This perturbation is going to reinforce his knowledge of diet since the patient will have to think in depth.

This dissonance creates progress; without it learners have no reason to change their ideas or way of doing things, and even less reason to be concerned with the exposition's theme. They must find an interest in it, a sense in the project or the knowledge at hand [17].

Patients will find an interest in acquiring this type of dietary knowledge in order to prevent hypoglycemia and be able to finish a race without any problems [18].

Later, patients must find themselves confronted with a certain number of significant elements (documentation, experimentation, argument) which challenge them and lead them immediately to take a step back, and to reformulate their ideas or debate them. In the same way, a certain degree of limited formalism (symbolism, picture, CHO table), some kind of thinking aids, must be integrated in their approach. We might add that a new formulation of knowledge does not replace the old unless patients find an interest in it and learn to make it function. At these stages as well, new confrontations with adapted situations, with selected information can be profitable in permitting the mobilization of knowledge.

Lastly, knowledge about knowledge is also desirable. It allows patients to situate the procedures, to step back from them, or to clarify the field to which the knowledge will be applied.

For each of them, our micromodels are as many tools for working out constraints, and forecasting situations, activities, and teaching practices favoring learning, as shown in Fig. 1 [19].

5. Conclusion

Through allosteric learning, the whole question of patient education becomes clearer. New functions for health care providers have thus been corroborated. Their importance lies no longer a priori in their lectures or theoretical demonstrations. The efficacy of their action is always situated in a context of interaction with the patients' conceptions and cognitive strategies. First and foremost, is their role in regulating the act of education, their capacity to engage the patients, to provide orientation or to impart aids in conceptualization.

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