From school knowledge to everyday life: Introducing an alert bell to upgrade the common sense

Sophie RENÉ de COTRET
Département de didactique, Université de Montréal
Montréal, Québec, Canada

and

Réal LAROSE
Département de didactique, Université de Montréal
Montréal, Québec, Canada

and

Manon LeBLANC
Département d'enseignement au primaire et de psychopédagogie, Université de Moncton
Moncton, Nouveau-Brunswick, Canada

ABSTRACT

One of the aims of school education is that students develop knowledge they will be able to use in their professional and personal life. However, it seems that school does not completely reach its goal. Too often, learned knowledge is not used when it should be. Actually, many research results illustrate the fact that well learned knowledge is not necessarily used outside its belonging discipline, for instance in a day-to-day context, even if it could be helpful. We assume that, in those cases, decisions are based on common sense instead of school knowledge, however the later was learned.

Developing a didactic of common sense, our research project has two goals: the first one is to better understand the dynamic between school knowledge and common sense knowledge involved in day-to-day situations. The second one is to design a device that will upgrade the common sense in order for it to mobilize relevant learned school knowledge when dealing with problems pertaining to real life situations. This paper will focus on the first steps of the research dealing with the second goal.

Keywords: School knowledge, Common sense, Didactic, Degrees of certainty, Rationality, Day-to-day situations.

1. INTRODUCTION

Our day-to-day action is more often than otherwise lead by common sense. As Guenancia & Sylvestre [1] say : "…*le sens commun pratique persiste toujours sous le savoir objectif – pour le savant aussi, le soleil se lève et se couche*…" (p.6). In this case, we can assume that this kind of expression is used because of its practical and useful aspect since the scientist very well knows this phenomenon is due to the rotation of the earth. But, in other cases, it happens that learned scholar knowledge is not used when it should be, and that common sense is instead.

Since school intends to educate citizens that will be able to use their knowledge in their professional life as well as in their personal life, it aims for learned school knowledge to be exported into day-to-day action. But, as many others, we have observed that this exportation strategy is not efficient or sufficient and we think that the problem should be looked at in another way. We want to inverse the strategy and find a way such that, in their day-to-day action, students refer to their learned school knowledge. The strategy is then a strategy of importation completing the exportation one conveyed by school.

The socio-didactical device we designed is aimed at teaching common sense to stop its action in order to refer to learned school knowledge. This teaching device is intended to equip common sense with an alert bell which may ring at the door of the citizen's scientific knowledge. In this article, we will focus on the didactical part of the socio-didactical strategy developed in our exploratory study.

In the first part of the paper, some observations of the non-usage of otherwise known knowledge will be presented. This phenomenon will then be interpreted within the contextual framework of common sense. The question of upgrading the common sense or, in other words, of helping the common sense to import scientific knowledge will be set. The experimental device conceived to do so, and finally some results of the trial of this device will be presented.

2. THE PROBLEM: THE NON-USAGE OF LEARNED SCHOOL KNOWLEDGE

On many occasions, we observed people that did not use their knowledge even though it would have been helpful to do so. Some research results also show that. For instance, in his study on relations between social representations and knowledge in economy, Legardez [2] gives this conclusion: "*Or, on constate* *que des savoirs scolaires sont bien enseignés et appris, mais qu'ils restent souvent des savoirs pour l'école et qu'ils sont peu "exportés" vers les savoirs sociaux "citoyens". Il semble que ces deux genres de savoirs appartiennent à deux mondes qui coexistent sans que des savoirs scolaires interfèrent rapidement et directement avec les savoirs du jeune citoyen.*" (p. 660)

This conclusion shows that it is not because students demonstrate they know something in a school context that they will be able to mobilize this knowledge in a day-to-day like context.

Another well known example comes from Kahneman & Tversky [3], who showed that, when faced with a problem in a non disciplinary context, people who are good in statistics make the same errors as *ordinary* people. According to their findings: "*it is apparent that sample size has no effect whatsoever on the subjective sampling distributions. Independent groups, faced with problems that differ only in sample size, produce indistinguishable distributions.*" (p. 439)

One can argue that since those examples concern problems submitted in a day-to-day like context, it is normal that the kind of rationality invoked should be that of everyday life. The two next examples will show that even in a scientific context, in another disciplinary field, it happens that learned knowledge is not used.

The first example comes from a research that tries to better understand the way graphics are interpreted by scientists whether those graphics are in the scientists' field or out of it. In his research, Roth (2009) [4] asked 21 physicists (15 professors, 1 post-doctoral student and 5 doctoral students) to interpret six structurally equivalent graphics, three in biology and three in physics. They were asked to make aloud inferences as much as possible. Results show that: "*If individuals are unfamiliar with some graph, they tend to seek connections with their everyday life world and experiences. Graph interpretations then are characterized by common sense and everyday language.*" (p. 35)

The fact that participants are solely referring to their common sense when interpreting a graph in biology, therefore ignoring the physics knowledge that could be used to improve their interpretations, gives evidence of a difficulty to use knowledge that could be helpful in interpreting a graphic in a discipline, in another one.

A research lead by Lemoyne & Gauthier [5] gives another example of the non-usage of a disciplinary knowledge outside of its field. In this case, mathematical knowledge on proportionality is not used when working in chemistry. In their study, Lemoyne & Gauthier gave some standard writings in chemistry related to Charles and Boyle-Mariotte law ($p_1v_1/t_1 = p_2v_2/t_2$) and some equivalent algebraic or arithmetic writings in mathematics to two mathematics classes and two chemistry classes of 15-16 years old students. Among others, students were asked to comment or to tell what the following writings meant and to formulate problems using those writings.

1) $\frac{p_1v_1}{t_1} = \frac{p_2v_2}{t_2}$

2) $\frac{ab}{c} = \frac{de}{f}$

3) $\frac{8\times 12}{6} = \frac{?\times ?}{54}$

The results show that the majority of students from chemistry classes refused mathematical writings arguing that they were in a chemistry course and did not see the link with the subject matter. "*L'analyse des conduites de ces élèves montre comment les représentations des écritures mathématiques sont dominées par celles développées en chimie, lorsque cette discipline est objet d'enseignement; cette dépendance résulte très souvent en des procédures inadéquates ou peu économiques de résolution de problèmes de chimie*" [5] (p. 81).

In other words, it seems that in their chemistry classes, students do not refer to their mathematical knowledge on proportionality even though it could be helpful to solve problems submitted to them.

Over all, those examples show two things. First, there exists a phenomenon of non-usage of a learned knowledge outside of its field and, second, since this does not occur only in day-to-day life, but also in other scientific fields, this can not simply be associated with the kind of rationality in play, whether it is scientific or of everyday.

Those observations raise an important teaching problem: what can be done so that school knowledge learned by students is used outside its learning field, for instance in day-to-day life? In order to answer this question, we choose to reformulate it in a common sense perspective: What can be done so that common sense imports learned school knowledge when it is relevant to everyday action?

3. THEORETICAL FRAMEWORK

To better understand the way we reformulate the non-usage problem, we need to define common sense. There are many definitions of common sense depending on the point of view in which the author stands. There is, though, a definition that seems to include elements presents in many definitions: "*[...] le "sens commun" est un savoir intuitif et immédiat sur ce qui est raisonnable de faire, un savoir qui est culturellement acquis au cours de l'éducation ou de la pratique quotidienne*" (Gueorguieva [6], p.1).

According to this definition, common sense is defined as *a knowledge*. This characteristic is retained by many authors (Jodelet [7], Moscovici [8], Schmidt [9], Daudelin [10], Gonseth [11]). This characteristic is important since we want to teach to common sense, and what can be taught is knowledge.

Also, common sense is recognized as being *intuitive* and *immediate*. We would add *opportunistic* to those qualifiers. In fact, Gonseth [11], describing a model of common sense, says that it is nourished by *ready-to-think* (*prêt-à-penser*) comparable to proverbs that can adapt themselves to the context and so can easily be contradictory. In the same spirit, Ntagteverenis [12] proposes that it is according to the constraints of the situation and to the interests in play, among others, that the social actor will be able to identify actions that fit or not in respect to the issue expected. It is in this way that we see common sense as being opportunistic.

Common sense is *linked to action*. It is a set of prescriptions for day-to-day actions. Also, the *social aspect* is fundamental to the common sense. As Jodelet [7] says, common sense knowledge is a social representation which is defined as : "*une forme de connaissance socialement élaborée et partagée, ayant une visée pratique et concourant à la construction d'une réalité commune à un ensemble social*" (p. 53).

Finally, even if this next element is not in the definition presented, it is important to say that the *validity* of common sense knowledge rests on the confrontation with reality and the confirmation of others (Daudelin [10]).

Having defined common sense, let's see how it is possible to help it refer to learned school knowledge. How can we upgrade common sense? To do so we call upon watchfulness.

4. RESEARCH METHODOLOGY

In order to upgrade the common sense, we have designed a socio-didactic device that should provide the student with an alert bell leading him to stop his spontaneous answer and look for a more relevant one. This device is based on the awareness of being victims of cognitive illusions (Piattelli-Palmarini [13]), just as we can be victims of optical illusions. It involves a phase in which students erroneously use common sense or reason inappropriately and are convinced that they are right, in other words, they experience a cognitive illusion; and a phase of destabilization so students become aware of their cognitive illusion and are encouraged to become more attentive and spot them.

The first step of our device is dedicated to the introduction of a new *ready-to-think* into the common sense repertory of students: "I can be trapped by a cognitive illusion." At end, we expect this *ready-to-think* will lead students to equip themselves with an alert bell, or a cognitive illusion detector.

Since we want to intervene with common sense to teach it a new knowledge, our strategy will use two levers, a didactical one for the teaching of the new knowledge and a social one to inscribe this knowledge into the common sense.

Our didactical strategy is aimed at the learning by students of a knowledge: the existence of cognitive illusion. We also expect them to become aware of the fact that they were victims of cognitive illusions, that they had the knowledge to give a better answer and that it could be otherwise if they became watchful. To achieve this awareness, we trap common sense with problems that call for bad answers with the certitude that these answers are good (trap problems). Then, we present the good answer in order to make students realize they have been victims of cognitive illusion.
After, the social lever is necessary in order to transform the collective awareness into a common sense experience. As a result, we hope a vigilance attitude will develop into the community studied as a common sense knowledge, an intuitive and immediate knowledge. We won't develop this part of the strategy here (to know more see René de Cotret & Larose [14]).

Experiment description

The didactical experiment has two parts. The first part of the experiment is dedicated to finding good trap and delusion problems. Trap problems have four characteristics: 1) they call for a bad answer, 2) subjects are certain the answer they give is good, 3) subjects have the knowledge to give a good answer, 4) these three first characteristics happen for a wide variety of subjects, they are not linked for instance with the school grade of the subjects. The difference between a trap problem and a delusion problem is that a delusion problem calls for a good answer. The other characteristics are almost the same: subjects are certain their answer is good, the reason they give the good answer is relevant and finally this happens for a wide variety of subjects. We use delusion problems in order to identify subjects that doubt every answer they give. It is important to identify such subjects because in those cases, we cannot say that the alert bell plays its role well since it is constantly ringing.

The second part of the experiment is to see if our device seems able to modify the attitude of certitude and then to improve the common sense by introducing a smart alert bell, that is an alert bell that does not ring all the time.

To find good trap and delusion problems, we submitted problems that seemed to have a good potential to a variety of persons: students aged from 13 to 18 years old, university students and professionals from two provinces in Canada. Those persons were asked to answer the problems and to indicate with a C or a U if they were certain (C) or uncertain (U) of each answer. When they were finished, we presented the solutions to the problems in order to see if those solutions seemed evident to them afterward. This aspect is important since we want people to recognize the fact that they are victims of cognitive illusions.

When we analyzed the answer, we considered a problem to be a good trap if the success rate was below 20 %, if the percentage of bad answers with certainty was over 65 % and if the solution, when given, seemed evident. On the other side, a delusion problem had to have a success rate with certainty of over 80 %. With those markers, we have been able to find a dozen trap problems and as many delusion problems. Here is an example of each type of problem.

A good trap problem: To attract customers, a merchant offers a 20 % discount on all his merchandise. If there is a 15 % tax, is it better for the customer that the tax be applied before or after the discount?

A good delusion problem: While organizing a party, you need 6 crates containing 12 small bottles each. At the store, there are only crates of 6 small bottles. How many crates of 6 small bottles do you need to buy?

After we found enough trap and delusion problems, we were able to do the second part of the didactical experiment devoted to see if our device seemed able to modify the attitude of

certitude and then improve the common sense by introducing a smart alert bell.
This experiment took the form of an exploratory study to evaluate the potential of the use of degrees of certainty on the development of an alert bell. These degrees have been developed to help students become aware of their own (un)certainty (Leclercq [15]; Leclercq, Denis, Jans, Poumay, & Gilles [16]). According to literature, the use of such degrees may help a student realize if he is confident or not with his answer, which is very important when you are a professional, for instance a surgeon (Boin, Mooser, & Tornay [17]). The degrees of certainty developed by Leclercq et al. [16] are presented below.

Degrees of certainty

If your certainty is between	Write
0 % and 25 %	0
25 % and 50 %	1
50 % and 70 %	2
70 % and 85 %	3
85 % and 95 %	4
95 % and 100 %	5

The exploratory study has two phases and involves two groups, that is an experimental group and a control group.

In the first phase, each group has to answer a questionnaire made with five trap and three delusion problems. The experimental group also has to indicate a degree of certainty for each answer. The correction is made in class for the two groups and an emphasis is put on the fact that we are all victims of cognitive illusions. Subjects are then invited to submit suggestions to avoid those illusions.

In the second phase, a new but similar questionnaire is given to the two groups and each participant must answer the questions and indicate his degree of certainty for every question. There is no correction in class, but the written solutions are given to the students.

The 167 subjects of the experiment came from four 9^{th} grade classes (13-14 years old) and four College classes (students about 18-19 years old). All those classes were in Montreal or nearby.

5. SOME RESULTS AND QUESTIONS FOR THE FUTURE

Our experimental device is organized in order for us to be able to compare the experimental group between phase 1 and phase 2 and the control group and the experimental group in phase 2.

The comparison of the experimental group between phases 1 and 2 allows us to see if subjects develop a doubtful attitude with the experiment, or in other words, do they doubt more in phase 2 when they normally should. Results to the trap problems indicate a small significant difference for trap problems between phases 1 and 2 for the experimental group ($t(90) = 3.04$, $p < 0.01$). The mean certitude in phase one is 4.19 and decreases to 3.97 in phase 2 showing a lower certitude or a bigger doubt, as we expected.
The comparison between the control group and the experimental group in phase 2 gives information on the power of the use of degrees of certainty to affect the attitude of certainty. It allows us to answer the following question: Is the experimental group more doubtful than the control group, in other words, have the students from the experimental group developed a better alert bell than the ones from the control group because of the use of the degrees of certainty? Results show a significant difference for trap problems in phase 2 between the control group and the experimental group ($t(164) = -2.47$, $p < 0.05$). The mean certitude of the control group is smaller (3.59) than the mean certitude of the experimental group (3.97), which indicates less certitude or bigger doubt for the control group.

This is not what we expected since we thought the use of degrees of certainty may have helped to develop a doubtful attitude or an alert bell. It seems that the doubtful attitude may be more influenced by the cognitive illusion itself than by the use of degrees of certainty. If that is the case, the eventual effect of the use of degrees of certainty is not apparent (to know more about this experiment, see René de Cotret, Larose & LeBlanc [18]).

This exploratory study has shown that our device may have an effect on the attitude of doubt of students, but further investigations are necessary. We need to explore if there is still an effect after a longer delay. It would also be important to evaluate the *realism index* (Boin et al. [17]) that takes into account both the degree of certainty and the success rate to every problem. In other words, not only does it give information on doubt and success, but also on the coherence of these two elements: is the subject doubtful when he should be, i.e. when he does not give a good answer and is he certain when he gives a good answer? Also, some interviews would be helpful to better understand the way students solve the problems and judge their certainty.

6. REFERENCES

[1] Guenancia, P. & Sylvestre, J.P. (2004). "Le sens commun : théories et pratiques". **Proceedings of the Colloque de Dijon, Centre de recherches Gaston Bachelard sur l'Imaginaire et la Rationalité**. Éditions universitaires de Dijon: Collection Écritures.
[2] Legardez, A. (2004). "L'utilisation de l'analyse des représentations sociales dans une perspective didactique. L'exemple de questions économiques." **Revue des sciences de l'éducation** 30(3), pp. 647 - 665.
[3] Kahneman, D., & Tversky, A. (1972). "Subjective Probability: A Judgement of Representativeness." **Cognitive Psychology** 3, pp. 430-454.
[4] Roth, W.-M (2009). "Limits to general expertise: A study of in- and out-of-field graph interpretation" In F.

Columbus(ed.), **Cognitive psychology research developments**, 1-38. Hauppauge: Nova Science.

[5] Lemoyne, G. & Gauthier, D. (1995). “Les rapports d’élèves du secondaire à des écritures mathématiques, dans ces classes de chimie et de mathématiques.” **Paper presented at the CIEAEM 47**, July 23-29, in Berlin, Germany.

[6] Gueorguieva, V. (2002). “Sept thèses sur le sens commun.” **Altérités**, 3. Available at: http://www.fas.umontreal.ca/anthro/varia/alterites/n3/gueorguieva.html [27 june 2009].

[7] Jodelet, D. (2003). **Les représentations sociales**. Paris: PUF.

[8] Moscivici, S. (2003). “Des représentations collectives aux représentations sociales : éléments pour une histoire.” In: D. Jodelet(ed), **Les représentations sociales**, pp. 79-103. Paris: PUF.

[9] Schmidt, A. (1990). **Ethnométhodologie : Regards sur un terrain interdit.** Diploma thesis diss., Université de Paris 8.

[10] Daudelin, G. (2001). “Penser la connaissance de sens commun dans la modernité avancée.” **The Canadian Review of Sociology and Anthropology** 38(3), pp. 293-308.

[11] Gonseth, M.A. (1993). “L’ordinaire et son ombre.” In: J. Haunard & R. Kaehr(eds), **Si… Regards sur le sens commun**, pp. 25-50. Neuchâtel: Musée d’ethnographie.

[15] Leclercq, D. (2003). **Un diagnostic cognitif et métacognitif au seuil de l’université**. Belgique: Éditions de l'Université de Liège.

[16] Leclercq, D., Denis, B., Jans, V., Poumay, M., & Gilles, J.-L. (1998). “L’amphithéâtre électronique. Une application : le LQRT-SAFE.” In: D. Leclercq (ed.), **Pour une pédagogie universitaire de qualité**, pp. 161-186. Belgique: Mardaga.

[12] Ntagteverenis, P. (2005). “Construction scientifique et construction quotidienne. La dimension syntactique du savoir commun et la question de l’objectivité.” **Sociétés** 89(3), pp. 83-97.

[13] Piattelli-Palmarini, M. (1994). “Leurres du jugement” In: C. Fischler (ed), **Manger magique. Aliments sorciers, croyances comestibles**, pp. 184-195. Paris: Autrement, Mutations/Mangeurs.

[14] René de Cotret, S. & Larose, R. (2006). “La didactique du sens commun : pour un retour dans la cité…” In: D. Tanguay(ed), **Raisonnement mathématique et formation citoyenne. Proceedings of the Colloque du GDM 2005**. Montreal: UQAM, pp. 47-59.

[17] Boin, A., Mooser, F., & Tornay, J. (2004). **Module EDU4. Épreuve d’examen d’entrée à l’université.** Fribourg: Université de Fribourg.

[18] René de Cotret, S., LeBlanc, M. & Larose, R. (2011). “Study of the Potential of the Use of Degrees of Certainty to Provide the Common Sense with an “Alert Bell”. ” In B. Sriraman & V. Freiman (Eds), **Interdisciplinarity for the 21st Century: Proceedings of the 3rd International Symposium on Mathematics and its Connections to Arts and Sciences, Moncton 2009**. Monograph 11 in The Montana Mathematics Enthusiast Monographs in Mathematics Education, Information Age Publishing, Charlotte, NC, pp.289-300.