

Knowledge statements and belief statements: how do their differences matter for Science Education?

ATHANASSIOS RAFTOPOULOS

Department of Psychology
University of Cyprus
Cyprus
raftop@ucy.ac.cy

ABSTRACT

In this paper, I examine first the way knowledge-statements and belief-statements are questioned in ordinary language. The former are questioned by “how do you know?” questions, while the latter are questioned by “why do you believe?” questions. The answers to these questions are different. In the former case, one replies by providing the reasons that justify their being in position to know, whereas in the latter case, one replies by adducing the evidence for their statement. Then, I explore the epistemological repercussions of the difference in ordinary usage between the verbs ‘to know’ and ‘to believe’ and, drawing on these, I discuss the implication for science teaching.

KEYWORDS

Why-questions, knowledge-statements, belief-statements, epistemic status of scientific theories

RÉSUMÉ

Dans cet article, j'examine d'abord comment les types connaissance-déclarations et croyance-déclarations sont remises en question dans le langage courant. Les premiers sont remis en question par les questions « Comment savez-vous? », tandis que les deuxièmes sont remis en question par les questions « pourquoi croyez-vous ? ». Les réponses à ces questions sont différentes. Dans le premier cas, on répond

en donnant les raisons qui justifient leur étant en mesure de savoir, alors que dans le deuxième cas, on répond en produisant les éléments de preuve pour leur déclaration. Alors, j'explore les conséquences épistémologiques de la différence dans l'usage ordinaire entre les verbes 'savoir' et 'croire', et, s'appuyant sur elles, je discute les implications pour l'enseignement des sciences.

MOTS-CLÉS

Pourquoi-questions connaissances-déclarations, croyance-déclarations, statut épistémique des théories scientifiques

INTRODUCTION

The problem of the epistemological adequacy of high school students is a constant theme of research in Science Education in the last fifteen years. The term “epistemological adequacy” signifies the degree of understanding on the part of the students of the various epistemological aspects of scientific theories, which include both the epistemological status of the scientific statements and the nature of scientific method or methods.

One of the problems related to the students' epistemological adequacy concerns the students' ability to understand the distinction between scientific hypotheses or statements that are well entrenched in a scientific community, and, consequently constitute knowledge in the sense that their truth is indisputable, and the scientific hypotheses that are working hypotheses and thus, are beliefs rather than knowledge. The linguistic expressions of the former constitute knowledge-statements, whereas the linguistic expressions of the latter constitute belief-statements

The problem is further accentuated by the fact that students usually tend to believe that the current, at least, scientific theories are indisputable and true, which entails two things. First, that they fail to understand that scientific theories, owing to their empirical nature, are always eventually proved to be wrong, at least in some of their aspects, as the History of Science abundantly suggests. Second, the students fail to understand, on the one hand, that within the framework of each theory there are statements with different epistemic status, and that, on the other hand, a theory that eventually became well entrenched in a scientific community was initially a simple working hypothesis among many alternative hypotheses and whose truth was under debate.

Although I strongly reject the view that that taking recourse to common language may help us solve philosophical problems, I think that in this case such recourse may help educators explain the difference between knowledge and belief-statements. The reason is that there is a strong distinction between the manner we use the two sorts of statements in every day language. Being a part of common language practice this

distinction is, or can become, clearly understood by students and, therefore, can be used as a springboard for extending this understanding to the scientific realm.

In the first section of this paper, I discuss Austin's (1946/1974) analysis concerning the distinction between knowledge-statements and belief statements. In the second section, I present Belnap and Steel's (1976) theory of 'why questions' as modified and extended by Van Frassen (1980). I adopt Van Frassen's modification because they render clearer some important aspects of Austin's ideas. In the third section, I elaborate on the epistemological consequences of the aforementioned distinction. In the fourth section, finally, I discuss the repercussions of this distinction for Science Education.

AUSTIN'S THEORY

Austin (1946/1974) in his paper 'Other Minds', while discussing what happens when ordinary people are questioned "how do you know that this happens?" or "how do you know that this is true?", notes that there is a marked difference between the use of the verb 'to know' and the use of the verb 'to believe'. If one wills to examine a knowledge-statement (that is, a sentence of the form "I know that P", where 'p' expresses a proposition about a specific state of affairs), they ask the question "how do you know this?". If, on the other hand, one wills to examine a belief-statement (a sentence of the form "I believe that p"), they ask the question "why do you believe this?". In the first case, the reply assumes the form "for such and such reason", while the proper reply to the second sort of question has the form "because such and such happens". The replies to questions concerning knowledge-statements usually purport to make known the ways in which the persons who utter the statement put them in a position to be able to claim that they know, or equivalently, the reasons why the persons who utter the knowledge-statement are entitled to claim that they know that p (in other words, they justify the fact that they can know by explaining the ways in which they are in position to know that p.) The replies to questions concerning belief-statements, on the other hand, belong to a different type. One answers such questions by providing the reasons that made them believe that p is the case and not by explaining why they are in position to believe that p.

As Austin notes (85-86), however, there are cases where to a question concerning a knowledge-statement the reply consists of the reasons due to which one knows that p (as one would have done in replying to a question concerning a belief-statement); in this case the reply assumes the form "I know this because . . .". It does not consist in the ways in which one is in position to know that p, or, equivalently, it does not consist of the reasons that entitle them to make a knowledge-statement, which is the usual form of replies to questions concerning knowledge-statements; it does not assume, in other words, the form "I know this for such and such reason".

Austin attempts to overcome this difficulty by distinguishing between knowledge-statements whose truth we can prove (and for which we reply to questions doubting them by providing the proof), and knowledge-statements where even though we know that p , we cannot prove it and we reply to questions doubting them with a general, non specific answer of the form “I know it from, or because of ...”. For example, when one asks us, “how do you know that this person is Socrates?”, we reply “from his nose, or, because of his nose” even though we cannot become more specific about the reasons that make us know. Replies of the form “I know this *because of* ...” to this second sort of knowledge-statements, even though they have the form “I know this *because* ...” differ significantly from the replies to questions concerning belief-statements whose form is “I believe this *because* ...”) despite the fact that ‘because’ occurs in both of them. The reason is that the latter are more specific.

In the next section, I am going to present Belnap and Steel’s (1976) theory of why-questions as developed by Van Frassen (1980) in order to bring to the fore the epistemological underpinnings and consequences of Austin’s distinction between knowledge-statements and belief-statements in ordinary language.

BELNAP/VAN FRASSEN'S THEORY AND ITS EPISTEMOLOGICAL CONSEQUENCE

According to Belnap and Steel and Van Frassen a “why question”, as is expressed by a question within a specific framework, is characterized by three factors:

- a) the topic P_k ,
- b) the contrast class $X = \{P_1 \dots P_i \dots\}$,
- c) the relation of explanatory relevance R .

The general form of a ‘why-question’ Q is $Q = [P_k, X, R]$. A sentence A is relevant to the question Q if A has R with the pair $[P_k, X]$. A sentence B is a direct answer to Q if and only if there is a sentence A that is related to $[P_k, X]$ with R , and B is a sentence that is true if and only if $\{P_k: \text{for every } i \neq k \text{ not } P_i, \text{ and } A\}$. B is true if A is true, A satisfies R , and only one member from the contrast class is true. Sentence A is the core of B because B , which has the general form “ P_k , in contrast to the other members of class X , because A ” can be truncated to “because A ”.

The topic of a question is the state of affairs that the inquiry concerns (for example, that it is raining today), that is, the state of affairs about which we are asking something such as, for example, why is it raining when we wish or an explanation of this fact. The contrast class comprises all the alternative states of affairs that could have occurred instead of P_k , for example, instead of raining today it could be sunshine, or it could be snowing etc. The relation of explanatory relevance R , which depends on the intention

of the person who poses the question, (that is, on what exactly that person wants to know) determines what is considered to be a relevant answer to the question (for example, when one is searching for a causal explanation of the rain today, the relation R determines which one of the four Aristotelian causes is the cause they are looking for.) The requirement that R determines the relevance of the reply introduces a pragmatic factor in the analysis of “why questions”, which will prove very useful we will discuss the various uses of knowledge and belief-statements.

Let us examine the application of this theory of “why questions” in the case of belief-statements. Let us consider the question “why does S believe that Y_k , where Y_k is a state of affairs. Given this question, we observe that the topic P_k is the sentence “S believes that Y_k ”, the contrast class X consists of all the sentences P_i “S believes that Y_i ”, where $i \in [1 \dots k \dots]$. That is, X consists of all the possible “believe states” in which S could be in circumstances that differ from those that led S to believe that Y_k . When, finally, one questions a belief-statement, the relation of explanatory relevance R determines what exactly is that they wish to know. They may, for example, wish to learn the reasons that led S to form this specific belief, that is, the belief that Y_k is true (that that person over there is Socrates, for instance). Or, they may wish to learn the evidence on the basis of which S is in position to believe that Y_k . Or, finally, they may wish to know how is S in a position to believe that Y_k (because, for example, S is a good friend of Socrates, or because somebody else, who is reliable enough, told S that that person over there is Socrates).

TWO DIFFERENT USAGES OF “BELIEVE” AND “KNOW”

Bearing in mind the foregoing discussion, let us return to Austin’s analysis. In introducing the distinction between the usages of ‘believe’ and ‘know’, Austin (ibid., 78) remarks that there is a significant difference between questioning a belief-statement and questioning a knowledge-statements. We ask “how do you know that?” and “why do you believe this”, but not “why do you know that?” and “how do you believe that?” When one asserts a belief, the existence of this belief is not in doubt, in the sense that we cannot claim that the belief claim is not legitimate, but when one asserts knowledge, the legitimacy of the statement can be questioned.

Austin (ibid., 68) thinks that this difference stems from the fact that when we say “I believe that” or “I am sure about that” we are describing our internal mental states, but when we say “I know that” we are not doing simply this but something more than that, to wit, we also make a definite statement about the way the world is. That is to say, a knowledge-statement extends its scope beyond internal mental states to the world. This difference is reflected in the fact that a belief-statement is always accompanied by a contrast class, which enables “why-questions”. This class comprises all alternative

and relevant belief states in which one could be; one believes that it is raining, but they could also believe that it is sunshine, that it is snowing etc. In knowledge-statements, in contradistinction, the contrast class is absent and this why we cannot ask, “why do you know that?” let us discuss these differences in some detail.

The use of “believe”

Let us endorse Austin’s view that “I believe”, “I am certain”, etc., refer to mental states. If a statement of the type “S believes that Y_k ” refers to one of S’s mental states, given the circumstances under which S is led to believe Y_k , there is a whole class of alternative mental states that could have been formed in the mind of S were the circumstances different, and in which S would believe that Y_i and not Y_k is the case. This class of alternative mental states constitutes the contrast class that ‘why questions’ presuppose, rendering them legitimate questions of believe-statements.

Here is an example. Let us suppose that S_1 asks S_2 of what species is a bird standing on a branch of a tree in front of both S_1 and S_2 . S_2 , given the evidence of her senses and her knowledge about birds, replies “I think it is hawk.” Under different circumstances, if, for example, the bird were a sparrow, S_2 would have answered something else owing to the fact that S_2 would have been in a different belief state. The important thing to note is that S_2 in giving a specific reply intends to act on her interlocutor in a certain way, namely, to make S_1 understand that he, S_2 , answers “I believe it is a hawk” because S_2 has some evidence to that effect but for some reason or other this evidence is not conclusive; if it were, then S_2 would have replied “I know it is hawk”.

Given this usage of belief-statements, consequently, when we are asking S to tell us the reason S believes that p, that is, why is S in this specific mental state, we are asking “why do you believe this?”. This usually means that we wish to determine whether the information conveyed by S is reliable in view of the fact that the bird could be of some other species (this is what ensures the existence of the contrast class), in which case the answer would have been different. To determine the reliability of the information, we need S to provide us with the available evidence on which S’s belief-statement is based. Let us underline at this juncture the fact that what is in doubt and, therefore, what the question is about, is not whether S is in a mental state in general but that S is in this specific mental state. That is, the question is about the relation of S’s mental state with its content.

The question addressed to S “why do you believe that p?” suggests that perhaps S ought not to believe that p. We would never say, in contradistinction, that S ought not to know that p, had S answered “I know this is p”. In the same way, it would not be correct usage of the language to say that S should believe that p, while it is correct to say that S should know that p. This is due to the fact that the usage of ‘ought’ with belief-statements and the usage of ‘should’ with knowledge-statements is related to

the existence of a contrast class necessarily accompanying belief-statements and the lack of such a class in the case of knowledge-statements. Let us suppose that S knows about birds what the average person knows about them, If we ask S what is the bird species standing on the branch, S will use all the available evidence and will form a belief. If S had more or less knowledge, or if the bird belonged to some other species that is more or less known to S, S would have formed another belief. If someone who disagrees with S about the species of the bird tells S that S ought to believe that the bird is something else, this is a correct usage of the relevant terms exactly because the existence of the contrast class makes it possible that S could have formed another belief.

In view of the relation between knowledge-statements and “should”, and belief-statements and “ought”, we can draw the conclusion that the verb ‘to know’ has a different weight from that of the verb ‘to believe’. When we use “to know” we are at the limits of the language and its usage is inextricably related to the language’s constitutive rules. If we do not use it properly, we abolish the linguistic game. If we wish to use it correctly, we have no degrees of freedom. When we say, “I know that this bird is a hawk”, this means that I did not have the option to choose some other answer because the evidence was conclusive. Paraphrasing L. Carroll, its conclusiveness grasps you from your sleeve and you cannot escape the inevitable conclusion, which is why there is no degree of freedom and no class from which to choose. The verb “to believe”, on the other hand, is safely used in the linguistic game and the degrees of freedom it enables allow its relation with a contrast class of possible replies. One could say for example “I believe it is a hawk, but under other circumstances it could have been a sparrow.” If you try this locution substituting “to know” to “to believe” you will see that it does not sound right.

It is worth insisting on this point. The expression “you ought not to know that Y_k ” presupposes that there are alternative possibilities that you should know and that one of these, namely, Y_k is true. This, however, does not make sense. Either you know that Y_k or you do not know it. It is not possible to know that Y_k if Y_l is true. The expression “you ought not to believe that Y_k ”, however, suggests that you should be in another mental state related to Y_k . This is a correct way of speaking, since we can believe something even if it is wrong (remember that we cannot know something if it is false).

Consider the following comparison: “You do not know this.” This is a legitimate way of speaking. “You ought not to know this.” This is an illegitimate expression.

In these two cases the scope of the negation is different. In the first, the scope of the negation is the verb “to know”, whereas, in the second, the scope of the negation is the “ought”. This difference is cast out in the following way. In the first case, what you have in your mind is wrong and, therefore, you do not know it. If the second case constituted a legitimate way of speaking, this would mean that even though you know

p, you ought not to know it. The rejection of the knowledge statement, however, is based on the fact that p is false, in which case you do not know p and, consequently, we cannot say “you ought not to know p”. This restriction does not apply to belief-statements, since they may be false even though you believe that they are true, and this is why it is legitimate to say “you ought not to believe p”.

The usage of “know”

These last considerations have already brought us within the realm of knowledge-statements. The outcome of our discussion is that while in the context of belief-statements a contrast class necessarily exists, things differ with knowledge-statements, which entails that we cannot question a knowledge-statement using a why- question. Instead, we question knowledge-statements by asking “how do you know this” questions.

Suppose that we utter the statement “I know this bird is a hawk”. In this case, one might ask us “how do you know that this is a hawk?” If we reply that we know it from its hooked beak, they may object that this is certainly not enough because many bird species have hooked beaks. The problem now is how much “enough” is enough for one to be in position to make a knowledge claim. Austin answers this objection by noting that enough is enough, which means that we do not have to examine all the properties of the bird in order to be able to say that we know it is a hawk. Enough means enough to show that it cannot be something else, that there is no room for an alternative exclusive description. When we use “to know”, we do not leave open any possibility for an alternative answer. This is why to say “I know it but I may be wrong” violates the constitutive rules of language determining the usage of the verb “to know”.

Epistemological consequences of the distinction

In the beginning of our discussion, we accepted Austin’s view that sentences of the type “I believe that p” are descriptions of subjective, internal, mental states of the agent that expresses this sentence. The reader will have already observed, however, that the subject of the analysis of the belief-statements is not restricted only to the fact that an agent is in a certain mental state (“I believe that p”), but also the fact that this state has a content, namely that p is true. For this reason, I did not analyze the mental state of S “I believe that p” as such independent of its content but also with respect to the cognitive relation of S with p, the evidence, for example, that allows S to form this belief. This is imposed by the fact that the contrast class, which is necessary for the analysis of why-questions, is determined by the kind of the relation between S and the content p.

Thus, we can say that the subject of the analysis is the relation “belief (as a mental state)-content of this state”. This relation can be examined in many different ways. Let

us suppose that S expresses the belief that this bird is a hawk. Let us also suppose that we know that this bird is a hawk. If we ask S why does she believe that the bird is a hawk, we do not do it because we dispute the information conveyed but because we wish to know the reasons that led him to form this belief; in other words, we inquire as to S's evidence that the bird is a hawk. We may do it for various reasons, say, to find out whether S has read her zoology book. In these cases, the emphasis is on the side of the mental state, since we are asking about the way the belief was formed. Thus, the contrast class consists of all the various beliefs of the form "o S believes that Y_i ", for various values of i.

Another way to question a belief-statement is when we doubt about the validity of the information it carries, namely, that p is true. Returning to our recent example, when S tells us that she believes this bird is a hawk but we disagree because we believe that it is an eagle and we wish to resolve the difference, or we question her because we wish to be certain that S is careful enough in her observations so that we could trust her, we ask S "why do you believe that this bird is a hawk?". In this case, the contrast class consists of the various Y_i , that is, the various species of birds that this particular bird might be. Here, we are interested only in the content of the belief and it seems that the relation "mental state-content" breaks down. To the extent that this relation is abolished, the illocutionary force of the verb 'to believe' is lost and what remains is its pure descriptive force. As we shall see later on, the illocutionary force of the verb "to know" is also lost and, consequently, the difference between knowledge-statements and belief-statements severely weakens, and this explains why in both cases we pose why-questions.

Another interesting case is when we are not interested solely in the value of the information conveyed by a statement, the content of the mental state, but, in addition, we wish to persuade S that she is wrong by saying "you ought not to believe that p" and change her mental state by substituting some other to its place. There are many other possibilities, but I think what we have said is enough to render clear what I mean by saying that when we question a belief-statement what is under scrutiny is the pair "mental state-content" and that, depending on the context, the emphasis of the question can be transferred from the one end of the pair to the other. All the above are sub-cases of the general question "why do you believe that p" where the relevant answer is determined by the relation of the explanatory relevance, that is, by the intentions of the person who asks the question.

As have seen, we do not generally question a knowledge-statement by asking "why do you know that p?" but by asking "how do you know that p?" and this is a consequence of the fact that in knowledge-statements the contrast class that characterizes belief-statements is absent. Although I have alluded to the reasons why this is so, I have not explained yet why the contrast class disappears in the case of knowledge-statements,

To answer this question, one must analyze the transfer in meaning and illocutionary force that takes place when we move from belief-statements to knowledge-statements. Austin (ibid. 100) claims that while we say “on my part, I believe that p” or “in my view, I believe that p”, we do not say “in my view, I know that p”. Also, when one says “I believe that p” we may accept or reject the claim, but we cannot do exactly the same with knowledge-statements because when one says “I know that p” we cannot accept or reject this claim in the same way we can accept or reject a belief-statement. Austin tries to elucidate this difference by drawing a parallel with the locutions “I intend irrevocably to do it” and “I promise to do it.” If one promises us something, we have the right to depend on the promise. In the same way, when one says “I know that p” and we trust them we are epistemologically entitled to claim that we, too, know that p: the right to say “I know” is transferable. Thus, when someone asserts that they know p, they are committed to a far greater degree than when they claim that they believe that p. This commitment is an important rule of the linguistic game and adequate users of the language have built the relevant expectations.

Austin underlines an emphasis transposition when we pass from belief-statements to knowledge-statements. In belief statements, the illocutionary force of the relation “mental state-content” emphasizes both the relation and the reasons that made S to hold this relation (let us recall Wittgenstein’s view that a belief-statement is a mental state that refers to something beyond itself). On account of the non-conclusive character of the evidence, S is on his part certain that p is the case, but it is entirely in our responsibility to accept or reject the statement.

In knowledge-statements, however, the illocutionary force of the relation “mental state-content” is such that the emphasis is much more on the content, that is, a state of affairs. The evidence is such that it allows S to state something that is much more about the world than something about one of S’s mental states concerning the world as well. In other words, there is a marked transposition from a subjective belief (which is why the “on my part” and “in my view” find a suitable place) to an objective fact (where the previous expressions have no proper place).

For the same reasons, when one says that they know something, if we accept their credibility, we do not have the right to choose not to accept their statement. Of course, we can reject it because we think they are unreliable, but this choice is different from the previous one. Consider the following comparison. We can both think that S is a reliable person and believe that the bird is not a hawk even though S asserts that “I believe this bird is a hawk”. We cannot, however, believe that S is reliable and reject S’s statement “I know this bird is a hawk”; In this case, we have to take the assertion as a fact.

Let us grant that “to know” and “to believe” function differently in language. What is, then, the explanation of their differences? I think that the differences stem from the

different role that evidence plays in each case. When we say “I believe” the evidence on which we base our assertion is not conclusive, but when we say “I know” then the evidence is strong enough to allow us to make a knowledge statement. This means that when we assert that we know, we leave the space of possibilities and of our subjective beliefs and enter a new space, to wit, the world where objective facts reside. Only when we have evidence enough to be able to make the transition, are we allowed to use the verb “to know”.

It follows that we can form a belief under any circumstances; a belief may have different sorts of support from the facts. In contradistinction, we cannot be in a state of knowledge under any conditions; only when the reality pulls us from our sleeves are we allowed to do so. This is why it does not make sense to ask whether S is capable of having a belief, but it makes perfect sense to ask whether S is capable of knowing. This explains why we can ask S who makes a knowledge-statement “how do you know this?” but we cannot ask S who makes a belief-statement “how do you believe this?”.

If S does not have in her disposal conclusive evidence, this does not deprive her of the right to form a belief. If she does so and we judge that the evidence does not support her belief, we can say “but this is feeble evidence and, thus, you ought not to believe that p”. Had S claimed that she knows that p, then she bears the responsibility that we are obliged to accept the adequacy of the evidence on which her statement is based, given that we think S is reliable. If it turns out that P is false, we will not say “you ought not to know” but “you did not know”.

The question “are you in position to know?” which is, usually, what we ask when we question a knowledge-statement, is equivalent to the question “how do you know?” Thus, questioning a knowledge-statement usually assumes the form “how do you know that p?”.

Up to this point, I have tried to lay before the reader the reasons for which we are asking “why do you believe this?” and “how do you know this?” Austin’s view that we question differently knowledge-statements from belief-statements, however, faces a serious challenge. The problem is that although we usually question a knowledge-statement asking “how do you know this?”, sometimes the answer to this question does not have the form “I know it from . . .” but the form “I know it because . . .”. This, however, is the answer suited to why-questions, which as the reader recall, are questions concerning belief-statements and not knowledge statements. This entails that why-questions can also be assigned to knowledge-statements and this undermines the arguments I proffered above. Attempting to meet the challenge, Austin says that we use “because” as an answer to a “how do you know question?” when we wish to explain the reasons for which we are in position to know something. This retort, however, sidesteps the problem by restating it rather than solves it.

I think that the situation not only can be salvaged, but, also that its treatment offers

valuable insights concerning the relation between belief and knowledge which, as we shall see in the last section, have some important repercussions for science teaching. To address the problem, I apply the theory of why questions and use its specific condition, namely that what enables why-questions is the existence of a contrast class. Let us compare the contrast class that enables a question of the type “why do you think that p?” to the contrast class implicated in a why-question addressed to a knowledge statement.

As far as belief-statements are concerned, the contrast class consists of the various mental states in which S could be with respect to a certain topic, say, the topic of the weather now; S could believe that it rains, that it has sunshine, that it is snowing, etc.. That is to say, it consists of sentences of the type “o S believes that P_i ”, where $i \in \{1 \dots k\}$. This entails that an answer to this question offers the evidence on which S forms the belief that that, say, P_k , is the case. So, S might say “I believe this because of such and such reasons”, where the reasons are the salient evidence. When we reply with “I know it because . . .” to a question addressed to a knowledge-statement, however, the relevant contrast class consists of the different ways in which S could have come to know P_k , since these different ways are the topic of the question. The answer, therefore, consists in the ways S came to know that P_k (I know it because I was good in zoology, or because I once had a hawk, etc). It follows that the because-answer is equivalent to a from-answer and, thus, it can be legitimately given as an answer to questions addressed to knowledge-statements.

The factor that determines what exactly we wish to know when we ask a question is, of course, the explanatory relevance relation R. If what I have said thus far is correct, it follows that when we question belief-statements and knowledge-statements, R is different. What differentiates R in the two cases is the different illocutionary forces of the verbs “to believe” and “to know”, which are part of the meanings of the two verbs in language, and the wider context of the discourse.

However, we have not fully solved the problem of the because-answers to why-questions that are addressed to knowledge claims. This is so because the analysis above may allow us to claim that on certain occasions a because-answer is equivalent to a how-answer, but this is not always the case. There are circumstances under which the abovementioned analysis cannot be applied adequately. In these cases, a “how do you know” question is answered by a “because . . .” answer that does not offer the reasons by means of which S thinks that she is in position to know, but by offering the evidence on which S bases her reply. When S is asked “how do you know that this is a hawk”, she may very well reply by saying “I know it because it has this specific hooked beak”. This, as we have seen, however, is the proper way to answer the question “why do you believe this bird is a hawk?” and not the question “how do you know this is a bird?”.

In this case, the topic of the question addressed to S “how do you know P_k ;” is P,

that is, the kind to which the bird belongs, and the contrast class consists in all possible P_i where $i \in \{1, \dots, k, l, \dots\}$, that is, in all possible kinds that the bird could belong. At the same time, the contrast class of the question “why do you believe P_k ,” remains the same, that is, the set of all propositions “ S believes P_i ”, where $(i \in \{1, \dots, k, l, \dots\})$. What transpires is that in both cases the answer to both questions is the same, namely “because ...”.

In these cases, S answers the question “how do you know that P_k ?” by presenting the salient evidence when S thinks that the explanatory relevance relation in the context of the discussion determines that the person who asks the question wishes to know why P_k and not some other value for P is true. An occasion like this may arise when we are convinced that some knowledge-statement is true and we wish have an explanation of the state of affairs that the statement presents. If S states that she knows it will rain tomorrow and she convinces us on that, it is possible that we would like to know why it is going to rain tomorrow as opposed, say, to snow. S , to answer this question and satisfy our need, should present the causes of the rain tomorrow. In this case, the link “mental state-content” breaks down. The verb “to know” having played, through its illocutionary force, its role to convince us that this is what is going to happen tomorrow leaves the scene and cedes its place to the statement “ P_k is true”, as opposed to the knowledge-statement “I know that P_k is true”. In this new scenery, the only possible question is “why P_k ?”, to which S answers by providing the relevant evidence.

When the verb “to know” loses its special illocutionary force in the language, what is left is its descriptive role; it describes a state of affairs that occurs. Therefore, when the transposition from a “how do you know that P_k ?” question to a “why P_k ?” question takes place, the distinctive function of the verb ‘to know’ in language is lost, what remains is its descriptive function. Recall, however, that the distinctive function of the verb ‘to know’ in language is exactly what we set out to investigate in the first place. In this sense, the fact that there are deviations in which the verb does not play its distinctive role does not threaten my analysis concerning the way its distinctive function, when it is operative, works. We have only to add to the analysis that there are cases in which the verbs “to know” and “to believe” function in roughly similar ways because there are no differences in the illocutionary force of the two verbs.

We can restate the above as follows. In the abovementioned case, we are not interested in S 's mental state, whether it be a knowledge or a belief- state, but in its content, that is, that P_k is the case. One could say that S 's knowledge-statement has lost its illocutionary force and what remains is its descriptive function, in which case the only remaining issue is whether P_k is true or not. Since the link “mental state-content” breaks down, what remains to face our doubt is the pure content. The space of the various alternative possibilities concerning the occurring state of affairs that the usage of the verb ‘to know’ had made disappear from the discourse reappears. This reinstates

the contrast class and renders possible the ‘why’ question; the “how do you know that P_k ?” question is transformed to the “why is P_k true?” question.

REPERCUSSIONS OF THE KNOWLEDGE-BELIEF DISTINCTION FOR SCIENCE EDUCATION

The analysis that I have offered brought forth the main difference between knowledge-statements and belief-statements, which is that the questions concerning knowledge-statements usually assume the form “how do you know?” by means of which one is interested in knowing the reasons that allow the person that makes the knowledge claim to be able to claim that she knows. These reasons consist in a series of mental states. Questioning belief-statements, on the other hand has the form “why do you believe this?”, in which case one is interested in knowing the physical evidence that rendered possible the knowledge claim. That is to say, one wishes to know why the person who makes the belief-statement believes that p is the case, as opposed to some other state of affairs. Thus, what is under scrutiny is the content of the belief-statement, whereas in knowledge-statements what is scrutinized is the epistemic justification of the knowledge-statement and not its content *per se*, that is, the state of affairs entering the knowledge claim, since, as we have seen, the illocutionary force of the verb “to know” forces to consider the state of affairs at hand immune to any doubt.

This difference in use renders the epistemological difference between the verbs “to know” and “to believe” very clear in a way that can be easily understood by students since it stems from consideration concerning the language that they themselves repeatedly use. As in ordinary use, so in science, sentences that initially were in doubt and whose content was one among many other alternative possibilities may eventually become accepted as true and, in this sense, are not questioned any further, while, at the same time, all other alternatives are rejected. There are also other sentences whose truth status remains open and various alternatives are available.

As in ordinary use so in science the two sorts of sentences have different epistemic status and are treated differently. If the truth of a sentence is taken for granted, then, as a matter of course one does not question its truth-value but one can question the ways this knowledge was acquired and, also, whether the community is epistemologically speaking justified in thinking that the sentence is true. In a classroom setting, the above mean that the class can discuss the scientific controversy that led to the scientific community to endorse some sentences as true, and whether the decision to hold these sentences as true was well justified. In other words, the class poses a “how do they know?” question and the discussion centers around it.

Sentences that are still debated, on the other hand, are treated differently in that the discussion about them concerns the evidence supporting the various alternative

possibilities. By going back in time and placing themselves at the time of the scientific debate, students can question the truth of sentences that modern science considers to be true and discuss the evidence that supported the sentence at that time in contrast to the evidence supporting other alternative sentences.

At this juncture one might object that even discussion concerning knowledge-claims, that is, discussions about the epistemological justification of the knowledge-claims will have to include inevitably the assessment of the relevant evidence for the sentence presumed because any epistemological justification will have to examine the evidence available to the scientists during the debate. This is, of course, true but note the difference in emphasis. In examining whether some sentence is true or not one examines exclusively the available evidence. In examining whether one is justified in thinking that the sentence is true, on the other hand, one has to examine, in addition to the relevant evidence, various other factors that influence scientific decision-making. Such factors include the philosophical, political, ideological, esthetic, etc., repercussions of each debatable hypothesis, which, as the study of the History Science shows, always play a significant role in theory choice, a role that cannot be reduced to the strength of available evidence. One of the consequences, therefore, of distinguishing between the proper ways of questioning knowledge and belief-statements, therefore, is that the different ways these two sorts of claims are evaluated brings to the for the difference between the strength of the evidence and theory choice, which are not always correlated.

As we have seen, under certain conditions, the verb 'to know' may lose its illocutionary force and, consequently, its content may be placed under doubt. This entails two things. First, any empirical sentence is in principle vulnerable to counterevidence, or to a re-evaluation of the existing evidence, and can be questioned. Second, the scientific debates and controversies that resulted in the scientific community choosing some theory over another are unearthed and emphasized. This means that each scientific theory, no matter how well entrenched currently is, did not always enjoy the same status. It follows that the scientific debates should be discussed in class, because only then would it be possible for the students to understand how scientific research really functions and get a grasp of the multitude of factors involved in theory choice. This understanding would immediately reveal to the students that scientific knowledge is neither a final product, nor something static that appeared in its final form to help us explain some phenomena or solve some practical problems. Instead, it is something dynamic that evolves and which, not only underwent a stiff competition before it was accepted, but, in addition, it may face doubt, directly or indirectly, at any time.

REFERENCES

- Austin, J. R. (1946/1974). On other minds. In J. Urmson & J. Warnock (Eds), *Philosophical Papers*, Oxford: Oxford University Press.
- Belnap, Jr. N. D., & Steel, Jr. J. B. (1976). *The logic of Questions and Answers*. New Haven: Yale University Press.
- Van-Fraassen, B. (1980). The Pragmatic Theory of Explanation. In J. C. Pitt (ed.), *Theories of Explanation* (pp. 136-155), New York: Oxford University Press.