

A Study of the Internal Structure of Critical Thinking Dispositions

Ana M^a Nieto

School of Psychology, University of Salamanca (Spain)

Jorge Valenzuela

Sede Regional Villarrica. Pontificia Universidad Católica de Chile (Chile)

Abstract

The execution of critical thinking depends on a set of skills and dispositions. It is unanimously accepted that skills represent the cognitive component, but consensus varies with regard to dispositions. Although most theoreticians admit that this is a complex construct integrated by motivations and mental habits, they don't explain further. We have performed a study attempting to explore the internal structure of dispositions. We suggest a possible hypothesis of "Motivational Genesis of Dispositions," according to which disposition would be formed by motivation and by mental habits, although the contribution of each of these factors would change depending on the practice gained in critical thinking. Thus, when a person is not practised in critical thinking, motivation makes a greater contribution than mental habits. Nevertheless, with practice and motivated exercise of the skills of critical thinking, the influence of these mental habits increases. The regression analyses carried out support such a hypothesis.

Key words: Critical thinking, dispositions, motivation, mental habits.

Critical thinking is "reasoned and reflexive thinking focused on what to believe or what to do" (Ennis, 1987, p. 10). People think critically when they are trying to solve a problem, assess arguments, make a decision about a belief, or make a decision in general. One is therefore dealing with concrete issues: reasoning, deciding, solving, etc. In these tasks, critical thinking evaluates not only the products of thinking — that is, how good a decision, a belief, an argument or a solution is — but also analyzes and assesses the actual process of thinking: how valid was the reasoning that led to such conclusion, or how strong was the inference, or what factors led to such a decision. Thus, critical thinking implies the evaluation of both the product of thinking and the process involved, with a view to gaining useful and accurate feedback that will serve to improve it (Halpern, 1998). The execution of critical thinking demands the implementation both of a series of cognitive skills and of a set of dispositions (e.g. APA, 1990; Ennis, 1996; Halpern, 2003; Paul & Elder, 2001). Both components seem to be necessary, since if someone knows how to apply a given skill — for example, elaborating an explanation concerning the issue in hand — but is not disposed to do so, that person will not engage in critical thinking.

It is accepted that skills represent the cognitive component: knowing what and how to do something. Nevertheless, the particular list of skills that comprise critical thinking varies from one author to another. For example, Ennis (1996) suggests skills such as focusing on the issue, analyzing arguments, posing and responding to questions dealing with clarifications and/or challenges, judging the credibility of sources, observing and judging observations, deduction, induction, value judgements,

defining terms, identifying assumptions, and deciding and interacting with others. Halpern (1998, 2003) adds the following skills: checking hypotheses, verbal reasoning, argument analysis, uncertainty and decisions and problem-solving. Swartz and Perkins (1990) propose much more generic categories: creative thinking, critical thinking, decision-making, the solving of daily problems and the solving of mathematical problems. This lack of consensus attracted the attention of an international panel of experts (APA, 1990) who wished to reach consensus about the concept and meaning of critical thinking. The group identified the following skills as being crucial to this kind of thinking: interpretation, analysis, evaluation, inference, explanation and self-regulation.

Regarding dispositions there is greater variability both in regard to the particular set of dispositions established by different authors and in regard to the concept disposition itself. Regarding the concept, Ryle (1949) considered a disposition to be a propensity or susceptibility to a given state or to undergo a change when the circumstances so permit it. For Ennis (1962), dispositions are a tendency to do something, and recently (Ennis, 2003) that author has underlined its non-automatic but reflexive nature. Norris (2003) also considers dispositions as tendencies to think in a particular way under certain circumstances. Along a different line, Salomon (1994) suggests that a disposition is a composite of preferences, attitudes and intentions. Likewise, Facione and Facione (1992; Facione, Facione & Giancarlo, 2000) consider dispositions to be a constellation of attitudes, intellectual virtues and mental habits. Dewey (1922) referred to them as mental habits, although he also stated that they could also be referred to as

attitudes or dispositions. In an analysis of these definitions, it may be seen that some of them, such as those of Ryle, Ennis or Norris, underscore concepts such as *propensity*, *susceptibility* or *tendency*. In contrast, others allude to concepts such as *attitude* or *mental habits* (e.g. Facione & Facione, 1992; Paul & Elder, 2001; Salomon, 1994).

This differentiation can also be seen through an analysis of the classifications mentioned above. Thus, Ennis (1996) established three large dispositions, each of them formed by other more specific ones. The first, the disposition to ensure that beliefs are true and decisions are justified, includes looking for alternatives, adopting a position as long as it is justified, being well informed, etc. The second — representing a standpoint or stance honestly — involves interrelated dispositions: being clear in what is said, determining the focus or conclusion, searching for and offering reasons, taking the overall situation into account, etc. Ennis's third disposition — respecting everybody's dignity and value — involves listening to the points of view of others, taking their feelings into account, etc. As dispositions of critical thinkers, Perkins, Jay and Tishman (1993) suggested the disposition to question matters and to look for and investigate problems, the disposition to construct explanations and understand them, the disposition to make plans and act strategically, the disposition to seek and evaluate reasons, and the disposition to be metacognitive. In these classifications of dispositions it may be seen that reference is made to motivations or tendencies to engage in specific cognitive behaviours, such as looking for information, focusing on conclusions, looking for and offering reasons, and building explanations. Accordingly, dispositions are understood as involving motivation to engage in thinking skills.

In contrast, there are classifications of dispositions that allude to them as *mental habits*, *intellectual virtues* or *attitudes* as regards addressing situations and not so much to the motivating nature of certain cognitive behaviours. For example, Paul (1990) differentiates the following dispositions: humility, courage, perseverance, integrity, faith in reason. As important dispositions, Siegel (1988) considers objectivity, honesty, impartiality, the wish to make judgements and actions congruent, and the commitment to look for and assess reasons. Similarly, Facione and Facione (1992, 2007) invoke the dispositions of open-mindedness, inquisitiveness, systematicity, analyticity, truth seeking, self-confidence in critical thinking and maturity. As may be seen, whereas the earlier categorizations emphasize motivational meaning to dispositions in the sense that dispositions are factors contributing to initiating and persisting in cognitive behaviour, the classifications offered by Paul, Siegel, and Facione and Facione point to a notion closer to attitudes, mental habits, and a general willingness to address situations demanded by critical thinking. Since dispositions have been conceptualized either in motivational terms (inclinations, tendencies, predispositions) or in attitudinal terms (attitudes, mental

habits, intellectual virtues), this means either (a) that we are using the same term to refer ambiguously to different psychological constructs or (b) that this term really does refer to a complex construct composed of several factors.

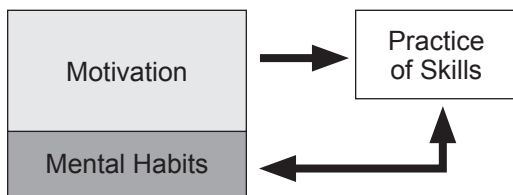
The complex and multidimensional natures of dispositions was recognised by Dewey (1922) when he stated that habits, a term which he preferred to use, are rooted in knowledge, motivation and attitudes. More recently, Ennis (1996) has asserted that dispositions are a constructs that combine attitudes and inclination. Although most theoreticians of critical thinking have admitted the complexity of this component, in their programs or models they have typically chosen to emphasize one of the two possible conceptualizations: the attitudinal or the motivational one.

Attempting to understand the internal structure of the dispositional component is crucial, since knowledge of this may afford very relevant information for intervening with a view to enhancing and improving critical thinking. What does seem to be clear is that we are not dealing with a unitary construct but a “multidimensional” one, formed at least by motivations and attitudes or mental habits. If we admit the multicomponent nature of dispositions, it would then be of interest to know how, and at what moment, the factors comprising them contribute to engaging in critical thinking so that we can improve our understanding of the internal structure of dispositions and the factors contributions to that structure.

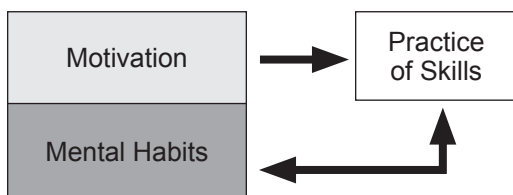
Following some theoreticians (e.g. Dewey, 1922; 1933; Ennis 1996), in this study we have assumed that dispositions are complex and are formed by at least one *motivational factor* and one *attitudinal or mental habits factor*. With this background, we conducted a study with university students who completed a course in critical thinking, the aim of which was to determine how the factors of the dispositional component would evolve. We have proposed what we have called the *hypothesis of a motivational genesis of the dispositions of critical thinking*. According to this hypothesis, the dispositions involve both a motivational factor and a habits of mind factor, but the relative weight of each of these factors in the performance of the skills of critical thinking will differ as a function of experience or practice in this type of thinking. More specifically, the *motivational factor*, that is the factor that initiates and maintains a type of behaviour, determines whether the skills of critical thinking are activated or put into practice. Over time, after practicing the skills of critical thinking, individuals become trained and consolidate *attitudes, mental habits or intellectual virtues* of critical thinking that form the so called “critical spirit” of critical thinkers (Facione & Facione, 1992) and what we are called attitudinal factor. Although these attitudes or mental habits to are a certain extent pre-existent, perhaps in a very rudimentary or immature way, motivation would contribute more to forming intellectual attitudes or mental habits and motivation would have greater weight in the

performance of critical thinking during the first phases of practice. However, after practice and motivated exercise of the skills of critical thinking, then the contribution of attitudes or mental habits will increase, since these would become consolidated. According to this hypothesis, the contribution or relative weight of these constructs, motivation and mental habits, would be different as a function of an individual's experience and practice in critical thinking. Thus, during the first stages of engaging in this type of thinking the weight of motivation will be greater than that of mental habits or attitudes (which have still not become consolidated). Nevertheless, once critical thinking has been deployed and has become the normal way of addressing problems and situations, the contribution of the attitude component of the dispositions to critical thinking performance will increase. Even though mental habits are strengthened, motivation continues to contribute to and determine critical thinking, but to a lesser extent since performance will depend more on those habits of mind or attitudes. A possible graphic representation of the way in which motivation and the attitudes of critical thinking participate as a function of the practice gained in this way of thinking would be as follows:

Figure 1
Motivation and Mental Habits in a Person Who Has Not Practiced Critical Thinking



Motivation and Mental Habits in a Person Who Has Practiced Critical Thinking



In order to test this hypothesis of a possible motivational genesis of dispositions and to determine how the factors of critical thinking dispositions evolve, we conducted a study with a sample of university students who completed a course in critical thinking. Specifically, we formulated the following hypotheses:

(I) If dispositions can be considered attitudes or mental habits that become consolidated with motivated practice in

critical thinking, then on the pre-test mental habits or attitudes (which have not yet been acquired) would account for a lower percentage in the performance of the skills of critical thinking than motivation.

(II) If dispositions can be considered as attitudes or mental habits that become consolidated with motivated practice in critical thinking, then on the post-test mental habits or attitudes would account for a higher percentage of performance in the exercise of the skills of critical thinking than on the pre-test. In other words, an increase in their explanatory capacity would occur, while the contribution of motivation would decrease.

Method

Sample

The sample included 158 university students from the 4th year of a psychology degree. Their mean age was 21.7 years (SD = 1.2). The individuals forming the sample were mainly women, as is traditional in this type of degree course (71% women, 29% men). The students were rewarded academically in the sense of offering them additional marks in a subject for participating in the survey.

Instruments

As assessment instruments, we used the following tests:

CCTDI – California Critical Thinking Disposition Inventory (Facione & Facione, 1992). The test consists of 75 questions in which the individuals must state how much in agreement or disagreement they are with each of the statements. The test assesses the following dispositions: truth-seeking, open-mindedness, analyticity, systematicity, confidence in critical thinking, inquisitiveness and maturity. The dispositions in this Inventory are conceptualized as a constellation of *attitudes, intellectual virtues and mental habits*. The time allotted for the test was 20 minutes, and according to the manual the test has reliability indices between 0.71 and 0.80.

CCTST – California Critical Thinking Skills Test (Facione et al., 1990). This test assesses the following skills of critical thinking: analysis, assessment, inference, deductive reasoning and inductive reasoning. To accomplish this, it employs 34 multiple-choice items in which the individual must choose the correct answer to different problems and situations, posed. The time allowed is 45 minutes, and according to the manual, the reliability of the test is between 0.87 and 0.91.

CTMS – Critical Thinking Motivation Scale (Valenzuela, 2007; Valenzuela, Nieto & Saiz, 2011).

This scale measures motivation to engage in critical thinking. It was developed from the Expectancy and Value model proposed by Wigfield and Eccles (1992; Wigfield, 1994). The test aims to assess the extent to

which a person evaluates critical thinking and feels able to engage in it. The scale is composed of 20 Likert-like items with scores from 1 to 6 which individuals use to express their agreement/disagreement with a series of statements referring to the Expectancy that they have about thinking critically and with a series of statements referring to the value that person assigns to this way of thinking. The Value component of the scale is formed by the subscales of Attainment, Utility, Cost and Interest. The test takes about 10 minutes to complete and the reliability of the different factors is 0.73 for Expectancy and 0.85 for Value.

Instruction in critical thinking

The intervention program in critical thinking aims at developing the following skills: practical reasoning, deductive reasoning, inductive reasoning, decision-making and problem-solving. To teach these skills, the instructor explained the skill being learned through examples similar to those found in real-life situations. Emphasis was placed on the structural characteristics of the arguments and of the situations used so that the learning of critical thinking would not depend on the content. Next, the students carried out a large number of practical exercises, which again were designed to be as close as possible to real-life circumstances. The work was then corrected in class or was handed in to the instructor, who corrected it and gave the students feedback about their performance. This procedure is based on the one suggested by Halpern (1998), which has been shown to be effective (Nieto and Saiz, 2008).

Procedure

One week before the instruction in critical thinking was given the students completed the tests described above. They did the tests in the following order: the CTMS, the CCTDI, and finally the CCTST. The following week instruction started, and it lasted 18 weeks at 1.5 hours per week. During that time, the students practised the skills of critical thinking, and in the week after instruction was completed, the same three tests were taken and taken in the same order.

Results

To study the internal structure of dispositions and to analyze the contribution of two of its components, motivation and mental habits, at different times of practice or experience in critical thinking, linear regression analysis was implemented. Table 1 shows the means and standard deviations of the variables studied at two times of the evaluation: pre-test and post-test.

In order to determine the degree of contribution of motivation and mental habits before having experience in critical thinking, a Linear Regression Analysis was carried out using the Enter Method. To accomplish this, the dependent variable was the performance on the skills of critical thinking evaluated by the students' scores on the

CCTST pre-test, and as independent variables we entered first the students' motivation measured by their score on the CTMS, and then the mental habits component of the disposition toward critical thinking measured by their scores on the CCTDI, so all of these measure were taken prior to instruction. The analyses (see table 2) revealed that motivation only explained 10.2% of the total variance accounted for ($F = 2.83$; $p < 0.05$). When the variable of attitudes or mental habits toward critical thinking was added to motivation, both variables accounted for 12.9%, an increase that was not significant ($F = 1.441$; $p = 0.159$). Thus, when attitudes were incorporated into the first model formed by the motivation factor, they only added 2.7% more to the total variance explained in comparison with the variance explained by motivation alone.

Table 1
Descriptive Statistics

	PRETEST		POSTTEST	
	Means	Stand. Dev	Means	Stand. Dev
Attainment	5.10	0.889	5.08	0.791
Cost	4.40	0.836	4.39	0.949
Interest	4.81	0.848	4.96	0.794
Utility	5.00	0.942	5.08	0.807
Expectancy	3.77	0.695	3.90	0.798
<i>Total Motivation</i>	4.30	0.660	4.40	0.695
Truth-Seeking	36.18	5.92	37.72	5.604
Open-minded	46.31	4.76	47.05	4.445
Analyticity	43.18	4.60	44.88	5.140
Systemacity	40.17	6.43	40.62	5.707
Confidence	42.21	5.74	43.08	6.129
Inquisitiveness	46.94	4.96	47.29	5.400
Maturity	45.55	5.10	48.18	5.106
<i>Total Dispositions</i>	300.54	24.58	308.82	26.25

Table 2
Motivation-Mental Habits Regression at Pre-test

Model	R	Adjusted R Square	Std. Error of the R Square	Estimate	F	Sig.
1	0.320	0.102	0.066	3.562	2.830	0.019
2	0.359	0.129	0.039	3.613	1.441	0.157

a – Predictors: (Constant), Expectancy_pre, Cost_pre, Utility_pre, Attainment_pre, Interest_pre.

b – Predictors: (Constant), Expectancy_pre, Cost_pre, Utility_pre, Attainment_pre, Interest_pre, Maturity_pre, Inquisitiveness_pre, Open-mindedness_pre, Truth-Seeking_pre, Systematicity_pre, Analyticity_pre, Confidence_pre

Following this, we changed the order of introduction of the independent variables, by first adding the mental habits variable and then motivation, with a view to determining what motivation would add to what was

explained by the attitude or habits of mind variable alone. Thus, as may be seen in table 3, we observed that attitudes prior to instruction only explained 6.6% of the total variance, with no statistical significance ($F = 1.226$; $p = 0.293$). When the components of motivation were added to the mental habits, the variance explained rose to 12.9%, although this was not significant either ($F = 1.441$; $p = 0.195$). Thus, motivation added 6.3% more to the initial explanatory capacity.

Table 3
Mental Habits-Motivation Linear Regression at Pre-test

Model	R	Adjusted R Square	Std. Error of the R Square	Estimate	F	Sig.
1	0.256	0.066	0.012	3.664	1.226	0.293
2	0.359	0.129	0.039	3.613	1.441	0.157

Model 1 – Predictors: (Constant), Maturity_pre, Inquisitiveness_pre, Open-mindedness_pre, Truth Seeking_pre, Systematicity_pre, Analyticity_pre, Confidence_pre

Model 2 – Predictors: (Constant), Maturity_pre, Inquisitiveness_pre, Open-mindedness_pre, Truth-Seeking_pre, Systematicity_pre, Analyticity_pre, Confidence_pre Expectancy_pre, Cost_pre, Utility_pre, Attainment_pre, Interest_pre,

In sum, regarding the pre-test it can be said that of all the variance in the skills of critical thinking explained by the two variables of motivation and mental habits which was 12.9%, mental habits variable explained only 2.7%, whereas, as we saw in the previous paragraph, motivation provided a higher explanatory capacity of 6.3%. It can therefore be seen that before the intervention and practice in critical thinking the explanatory power of habits of mind was much lower than that of motivation, since the motivation variable explained more than double the amount of variance.

After the instructional period concluded, we performed the same analyses — the two Linear Regressions — applying the Enter Method, in which we changed the order of introducing the independent variables in order to determine their specific weights. We used as the same dependent variable the students’ performance on the CCTST post-test,, and as independent variables we again used the motivation score from CTMS and the mental habits score from CCTDI, both measured at post-test. First, we introduced motivation variable and then the mental habits variable. As may be seen in Table 4, motivation explained a significant part (10.5%) of the total variance ($F = 2.407$; $p < 0.05$); and when the attitude or mental habits variable was included, the variance explained rose to 17.8%, although this increase was not significant ($F = 1.736$; $p = 0.071$). Thus, disposition increased the explanatory power of motivation alone by 7.3%, although this was not significant.

Table 4
Mental Habits-Motivation Linear Regression at Post-test

Model	R	Adjusted R Square	Std. Error of the R Square	Estimate	F	Sig.
1	0.323	0.105	0.061	3.717	2.407	0.042
2	0.422	0.178	0.076	3.688	1.736	0.071

Model 1 – Predictors: (Constant), Expectancy_post, Cost_post, Utility_post, Attainment_post, Interest_post.

Model 2 – Predictors: (Constant), Expectancy_post, Cost_post, Utility_post, Attainment_post, Interest_post, Maturity_post, Inquisitiveness_post, Open-mindedness_post, Truth-Seeking_post, Systematicity_post, Analyticity_post, Confidence_post

Upon changing the order of introduction of the variables (Table 5) — mental habits first and then motivation — we observed that the attitude or mental habits variable alone accounted for 9% of the total variance of the post-test while the second model, mental habits plus motivation, explained 17.8%. As may be seen in Table 5, in this case while neither of the models explained the variance in a significant way, motivation added 8.80% to the total variance explained.

Table 5
Mental Habits-Motivation Linear Regression at Post-test

Model	R	Adjusted R Square	Std. Error of the R Square	Estimate	F	Sig.
1	0.30	0.090	0.027	3.784	1.425	0.204
2	0.422	0.178	0.076	3.688	1.736	0.071

Model 1 – Predictors: (Constant), Maturity_post, Inquisitiveness_post, Open-mindedness_post, Truth-Seeking_post, Systematicity_post, Analyticity_post, Confidence_post

Model 2 – Predictors: (Constant), Maturity_post, Inquisitiveness_post, Open-mindedness_post, Truth-Seeking_post, Systematicity_post, Analyticity_post, Confidence_post, Expectancy_post, Cost_post, Utility_post, Attainment_post, Interest_post,

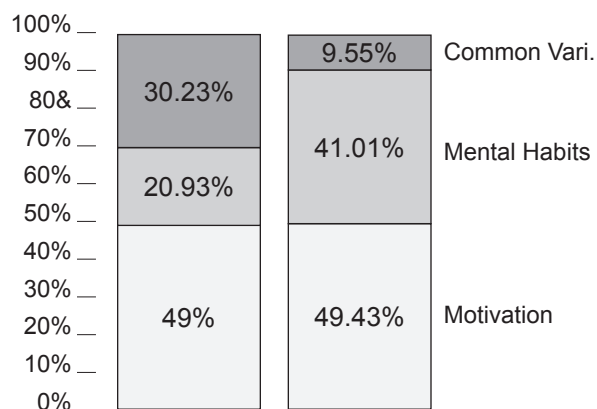
In sum, after practice with critical thinking, the total variance explained by these variables had increased to 17.8%, of which attitude accounted for 7.3% and motivation 8.8%. It may be appreciated that the percentage of variance explained by habits of mind or attitudes had increased considerably from the pre-test, and the percentage explained by motivation also increased but to a lesser extent.

In synthesis, the percentage of total variance explained by the mental habits variable on critical thinking performance changed from 2.7% prior to practising critical thinking to 7.3% after instruction, an increase of nearly 5% in the explanatory power of this variable. Regarding

motivation, the total variance explained by this variable was 6.3% before practice in critical thinking and 8.8% at post-test, so it increased as well.

In Figure 2, considering like a total the percentage explained by both variables together at the two times of evaluation, it may be seen that in the pre-test motivation accounted for 48.8% of the variance, while mental habits only explained 20.83%, the common variance being 30.23%. Regarding the post-test, the total percentage of variance explained by motivation (49.43%) was similar to that observed in the pre-test while the percentage of variation explained by mental habits increased almost two-fold: from 20.93% in the pre-test to 40.01% in the post-test. In this case, the common variance between both variables was reduced to a considerable extent: 9.5%.

Figure 2
Percentages of Total Variance Explained by Motivation, and Mental Habits and Common Variance at Pre- and Post-test



Discussion

The aim of the present work focuses on understanding the factors comprising the internal structure of dispositions. Although most theoreticians (e.g., Dewey, 1922; Ennis, 1996; Facione & Facione, 1992; Perkins & Tishman, 2001) have recognised that the disposition for critical thinking is a complex construct that integrates motivations and mental habits, in their theories and models they have ordinarily prioritized only one of the two possible components: motivational or attitudinal. Here we assumed that both factors form part of the dispositions and we attempted to determine their relative contribution at different phases of practice with critical thinking.

Thus, our goal was to test the hypothesis of a possible motivational genesis of the dispositions of critical thinking. According to this hypothesis, the dispositional component would combine motivations and mental habits, although the contributions of each of those two factors vary as a function of the practice gained in such thinking. Specifically, motivation would have a greater initial weight; that is, it would make a greater contribution than attitudes in the

initial stages of practice in critical thinking. With practice and the exercise of the skills of critical thinking, activated and maintained by motivation, attitude or mental habits linked to critical thinking should become consolidated, so that their explanatory power would increase while that of motivation would decrease.

The results obtained here to some extent support such a hypothesis. In this sense, before practice in critical thinking the percentage of variance explained by attitudes, which form the dispositional component and which were assessed by the CCTDI was considerably lower than what was accounted for by motivation. However, after practice in critical thinking the percentage explained by the mental habits or attitude variable increased substantially, becoming almost twice the percentage explained in the pre-test. Nevertheless, the variance explained by motivation remained almost the same, no decreases being observed, and this is in contrast to our prediction. This suggests that motivation to think critically continues to be an important factor in the deployment of critical thinking skills, even though certain mental habits or attitudes associated with performing them have become consolidated. In fact, motivation significantly explains almost half of the total variance explained by both variables, both before and after practice in critical thinking. In contrast, mental habits doubled its explanatory power after practice in critical thinking, providing support for our hypothesis by suggesting a consolidation of these mental habits or attitudes after the skills of critical thinking have been practised.

However, this increase was not enough to appear as a statistically significant variable in the explanation of the variance of the skills. We believe there are two possible reasons that could account for this. On one hand, the short time available for practice in critical thinking could have given rise to the occurrence of an increase, but not one sufficiently large to be statistically significant. Or, on the other hand, it could be that an excessive number of variables were incorporated into the equation, and hence there was a decrease in the degrees of freedom.

Another important aspect that could be interpreted favourably in terms of our hypothesis of a motivational genesis of dispositions is the fact that the common variance of both variables decreased considerably in the post-test: from 30% in the pre-test to 9% in the post-test. This observation suggests that both constructs overlap in an important way in the beginning but that after practice and engagement in critical thinking they begin to become differentiated, giving rise to a series of mental habits, attitudes or dispositions linked to engaging in critical thinking. Accordingly, practice would generate a differentiation between the two constructs: motivation and mental habits.

It is important to note that the hypothesis of a motivational genesis of the dispositions of critical thinking does not propose that there would be a causal relationship between motivation and dispositions or that motivation

alone generates dispositions. What it does suggest is that, when practice in critical thinking is increased, then, possibly because its results and benefits are appreciated, the contribution of the attitude component of dispositions also increases. This would imply that mental habits or attitudes come from the exercise of motivated skills. These attitudes or dispositions probably start out as highly germinal and materialize with practice.

If motivation and mental habits comprise the critical thinking dispositional component, we must bear in mind that when we are assessing critical thinking the assessment cannot be limited to the attitudinal dimension of critical thinking. If we evaluate only that dimension, we receive only partial information, and, if we really wish to know and make use of the dispositional factor of critical thinking, then motivation must be explored because it plays a very important role. This is especially clear when this variable is seen to be statistically significant when predicting engagement in the critical thinking. If we wish to offer a course designed to improve critical thinking, the evaluation of mental habits alone would not be very functional because that do not afford concrete and specific information with which to perform an intervention. In contrast, evaluating motivation provides us with much more useful information. For example, it may much easier and more effective to try to increase the self-efficacy expectancy of students, for example, by giving them positive feedback after their performance (e.g. Bandura, 1997; Fencl & Scheel, 2005), than to attempt to make someone who is careless into a systematic thinker, or to make someone who is immature mature. This is precisely one of the advantages of incorporating into our assessment a motivational focus such as the Expectancy-Value model. Employing that model we can determine the level of subjects on the different components of motivation: (1) on one hand *expectancy* and, on the other hand, (2) the value component assigned to a task, in particular its *attainment*, its *utility*, its *cost* and the *interest* of the person in thinking critically. On the basis of the evaluation of the different factors, we can plan our actions aimed at strengthening or increasing the critical thinking skills of people who score low on some of them. For example, we can incorporate techniques to improve the expectancy of students in which it is not very high, or we can try to show them the importance and utility of this way of thinking, and thereby contribute to increasing the value they assign to critical thinking.

Our aim has not been to study whether dispositions change after instruction, but to study the internal structure of the dispositional component and analyze the contribution of the factors integrating it along practice in critical thinking. It would have been interesting to have measured simultaneously the values of variables in a control group without any intervention, and perhaps the lack of a control group detracts from the relevance of our results. One could surmise that the greater explanatory

power of mental habits in the post-test is due to practice or social desirability, but the fact that motivation gave relatively constant results leads us to question such an interpretation. Another possible limitation of the study has to do with the short time between the pre- and post-test, only four months. It would have been interesting to observe how the variables behave over a longer period of time, or even to have performed a third assessment. However, the limited control we were able to exercise on the availability of the sample did not allow us to accomplish this. In any case, our results encourage us to explore a factor, motivation, that theoretically seems important in disposing a person to think critically but that in practice is often neglected.

References

- APA [American Philosophical Association] (1990). *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction*. Executive Summary "The Delphi Report." www.insightassessment.com/dex.html.
- Bandura, A. (1997). *Self efficacy: The exercise of control*. New York: Freeman.
- Dewey, J. (1922). *Human nature and conduct*. New York: Henry Holt and Company.
- Ennis, R. H. (1962). A concept of critical thinking. *Harvard Educational Review*, 32(1), 81-111.
- Ennis, R. H. (1987). A taxonomy of critical thinking dispositions and abilities. In J. B. Baron & R. J. Sternberg (Eds.), *Teaching thinking skills* (pp. 9-26). New York: Freeman and Company.
- Ennis, R. H. (1996). *Critical thinking*. Upper Saddle River, NJ: Prentice-Hall.
- Facione, N. C., & Facione, P. A. (1997). *Critical thinking assessment in nursing education programs: An aggregate data analysis*. Millbrae, CA: The California Academic Press.
- Facione, P. A. et al. (1990). *The California Critical Thinking Skill Test (CCTST); and the CCTST Test Manual*. Millbrae, CA: The California Academic Press.
- Facione, P. A., & Facione, N. C. (1992). *The California Critical Thinking Dispositions Inventory (CCTDI); and the CCTDI Test Manual*. Millbrae, CA: The California Academic Press.
- Facione, P. A., Facione, N. C., & Giancarlo, C. A. (2000). The disposition toward critical thinking: Its character, measurement, and relationship to critical thinking. *Informal Logic*, 20(1), 61-84.
- Fencl, H., & Scheel, K. (2005). An examination of the effects of teaching strategies on self-efficacy and course in a nonmajors Physics course. *Journal of College Science Teaching*, 35(1), 20-24.
- Halpern, D. (1998). Teaching critical thinking for transfer across domains. *American Psychologist*, 53(4), 449-

- 455.
- Halpern, D. (2003). *Thought and knowledge. An introduction to critical thinking*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Nieto, A. M^a, & Saiz, C. (2008). Evaluation of Halpern's "Structure Component" for improving critical thinking. *The Spanish Journal of Psychology*, 11(1), 266-274.
- Norris, S. P. (2003). The meaning of critical thinking test performance: The effects of abilities and dispositions on scores. In D. J. Fasko (Ed.), *Critical thinking and reasoning: Current research, theory and practice*. (pp. 315-329). Cresskill, NJ: Hampton Press, Inc.
- Paul, R. W. (1990). *Critical thinking: What every person needs to survive in a rapidly changing world*. Rohnert Park, CA: Center for Critical Thinking and Moral Critique, Sonoma State University.
- Paul, R. W., & Elder, L. (2001). *Critical thinking: Tools for taking charge of your learning and your life*. Upper Saddle River, NJ: Prentice Hall.
- Perkins, D. N., Jay, E., & Tishman, S. (1993). Beyond abilities: A dispositional theory of thinking. *Merrill-Palmer Quarterly*, 39(1), 1-21.
- Perkins, D. N., & Tishman, S. (2001). Dispositional aspects of Intelligence. In S. Messick & J. M. Collins (eds.), *Intelligence and personality: Bridging the gap in theory and measurement* (pp. 233-257). Mahwah, NJ: Erlbaum.
- Ryle, G. (1949). *The concept of mind*. London: Hutchinson
- Salomon, G. (1994). *To be or not to be (mindful)*. Paper presented at the Annual Meeting of the American Educational Research Association. New Orleans: LA
- Siegel, H. (1988). *Educating reason: Rationality, critical thinking and education*. New York: Routledge.
- Swartz, R. J., & Perkins, D. N. (1990). *Teaching thinking: Issues and approaches*. Pacific Grove, CA: Critical Thinking Press & Software.
- Valenzuela, J. (2007). *EMPC, Escala de Motivación por el Pensamiento Crítico*. Salamanca, Spain: Facultad de Psicología, USAL.
- Valenzuela, J. & Nieto, A. M^a. (2008). Motivación y pensamiento crítico: aportes para el estudio de esta relación. *Revista Electrónica de Motivación y Emoción*, 11, 28.
- Valenzuela, J., Nieto, A. M^a, & Saiz, C. (2011). CTMS: A contribution to the study of relationship between critical thinking and motivation. *Electronic Journal of Research in Educational Psychology* 9(2), 823-848.
- for learning and executing it. Specifically, she studies the dispositional component of critical thinking, both motivation and epistemological competence. She is especially interested in what are the relevant dispositions, how to assess them, and how they work when we think critically. Correspondence should be addressed to: Ana M^a Nieto, Facultad de Psicología, Avda. De la Merced, 109, 37005 Salamanca, Spain. Email: acarracedo@usal.es
- Jorge Valenzuela Carreño, Ph.D. (PUCCH,2006) is an Associate Professor at The Pontificia Universidad Católica de Chile, Sede Regional Villarrica. He teaches courses of research methodology. His research is focused on motivation and learning, and critical thinking. Correspondence should be addressed to: Jorge Valenzuela, Sede Regional Villarrica, Pontificia Universidad Católica de Chile, O'Higgins 501. Villarrica, Chile. Email: valenzu@uc.cl.

Author Information

Ana M^a Nieto, Ph.D. (Univ. Salamanca, 2002) is a professor at the University of Salamanca, Spain. She teaches Psychology of Thinking. Her main research interest is about how to improve thinking and learning and about critical thinking and the factors necessary

