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# Self-reports on Students' Learning Processes are Academic Metacognitive Knowledge

## *Autorrelatos de Estudantes sobre seus Processos de Aprendizagem são Conhecimento Metacognitivo Acadêmico*

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### **Abstract**

The current study postulates that students' self-reported perceptions on their academic processes are a type of metacognition: academic metacognitive knowledge (AMcK). We investigated, using Structural Equation Modeling (SEM), three hypotheses: (a) AMcK explains the variance of factor scores of students' learning approaches (SLA) and academic motivation (AM); (b) AMcK is distinct from working metacognition (WMC); and (c) AMcK has incremental validity, beyond WMC, on the explanation of general academic achievement (GAA) variance. Two tests (indicators of WMC) and two scales (indicators of AMcK) were administered to 684 ten-to-eighteen-year-old Brazilian children and adolescents. Annual grades in Math, Portuguese, Geography and History were used as indicators of GAA. The results show that none of the three hypotheses can be refuted.

**Keywords:** Metacognition, approaches to learning, motivation, intelligence.

### **Resumo**

Este trabalho postula que percepções autorrelatadas de estudantes sobre seus processos acadêmicos são um tipo de metacognição: conhecimento metacognitivo acadêmico (AMcK). Usando o Modelo de Equações Estruturais, investigamos três hipóteses: (a) AMcK explica a variância dos escores fatoriais das abordagens de aprendizagem (SAL) e da motivação à aprendizagem (MAL) dos estudantes; (b) AMcK é distinto da hipercognição de trabalho (WMC); e (c) AMcK possui validade incremental, além de WMC, na explicação do desempenho acadêmico geral (GAA). Dois testes (indicadores de WMC) e duas escalas (indicadoras de AMcK) foram aplicadas em 684 crianças e adolescentes de 10 à 18 anos. Notas anuais em Matemática, Português, Geografia e História foram usadas como indicadores de GAA. Os resultados apontam que nenhuma das três hipóteses pode ser refutada.

**Palavras-chave:** Metacognição, abordagens de aprendizagem, motivação, inteligência.

### **Theory Proposal**

Theoretically, we propose that two relevant concepts of psychology, student's approaches to learning (SAL) and motivation to academic learning (MAL), are components of a general construct that we have called academic meta-

cognitive knowledge (AMcK). In the theoretical level, we state some principles that are connected and allow us to conclude that SAL and MAL are AMcK (as can be seen below). After exposing the principles that guide our reasoning in the construction of the theory, we will propose an empirical modeling to investigate it in an exploratory level.

#### *First Principle: All Knowledge about the Inner Processes Belongs to the Metacognitive Domain*

Flavell (1987) states that the development of the metacognitive skills occurs through the interaction of four main components: metacognitive knowledge, metacognitive experiences, cognitive goals and cognitive actions. Despite the importance of all the four components, we are going to focus in only one of them, since the complete discussion about their characteristics is beyond the scope of this paper. The first component, metacognitive knowledge, is defined as the acquired knowledge about one's own cognitive processes. This knowledge focuses on three categories of variables (person, task and strategy)

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and how they interact and influence the results of the cognitive activities.

The personal variables involves knowledge of one's own learning processes (intra-individual), knowledge about the existence of different interpersonal learning processes (inter-individual) and general knowledge about how humans learn and process information (universal). An example of using personal variables knowledge is when a student knows that he is able to study more and better in a quiet library instead of at his noisy home, where there are many distracting factors.

The task variables involve the knowledge of the nature of the task, the knowledge about how to handle the available information as well as the knowledge about which kind of processing, demanded by the task, need to be used in order to accomplish such task. Knowing that it is easier to do something that has been done before, compared to do something completely new is one example of metacognitive task knowledge (Jou & Sperb, 2006).

The strategy variables comprise the knowledge of cognitive strategies, as well as when and where it is appropriate to use them. Knowing the moment to change the reading speed according to the difficulty or complexity of each topic in a text, aiming to produce a better understanding, is another example of metacognitive knowledge strategy.

All these components (i.e. personal, task-orientated and strategy-related metacognitive knowledge), are derived from perceptions and judgments of individuals regarding their interaction with the objects of knowledge. These perceptions are organized, recorded and stored in a structure called, by Demetriou and his colleagues, long-term hypercognitive system, indicating a specific type of memory: a metacognitive one (Demetriou, 1998; Demetriou, Spanoudis, & Mouyi, 2011).

*Second Principle: Metacognition is Composed by Two Broad Components: Self-Regulation and Memory of the Inner Process and the Self*

According to the experiential structuralism (Demetriou, Spanoudis, & Mouyi, 2010), there are two large components of the metacognition (the proponents of the theory prefer the term hypercognition but we are using both terms as synonyms): long-term hypercognition and working metacognition. The first one maps the other systems of the cognitive architecture, creating an internal representation of the various types of systems and cognitive processes, being the self-descriptive component of the mind architecture. Due to this ability, one can construct a theory of mind, a theory about its own inner functioning and a theory about the self (Demetriou & Kazi, 2001). The second one is responsible for monitoring and regulating the person's own cognitive activity, his strategies, the associated symbolic mechanisms, the relationship between structures and specific cognitive demands of reality, as well as evaluating the problem-solving solutions and identifying difficulties and limitations of the responses. The term

working metacognition refers to the concept of working memory, since the system postulated by Demetriou and colleagues involves structures that self-regulate, coordinate and manage the cognitive processes of working memory (Demetriou, Christou, Spanoudis, & Platsidou, 2002).

Demetriou, Raftopoulos and Butterworth (2005) argue that the working metacognition represents an instantiation responsible for self-regulation, management and on-line evaluation of how the subject interacts with any object of knowledge. In turn, the perception, the record and the knowledge about this online operation concerns another main metacognitive system, the long-term hypercognition. Thus, the real subject-object interactions are responsibility of the working hypercognitive system. On the other hand, people's perceptions and judgments on these interactions are object of the long-term hypercognition. Apparently the learning approaches tradition and the motivation research field has been collecting data focused almost only from the latter system. We will discuss this topic further

*Third Principle: The Learning Approaches and the Motivation for Academic Learning, at the Present Moment, is Related to the Perception and Judgment of People about their Inner Processes. In Consonance with the First and Second Principle, they must be Components of Long-Term Hypercognition*

In the 1970s, Marton and Saljö (1976a, 1976b) found different patterns of text reading and comprehension among students. They called these patterns surface approach (SAP) and deep approach to learning (DAP). The former characterizes a passive and limited interaction between the subject and the object of knowledge. The latter represents an active posture of the subject within the learning process, building connections, looking for better comprehension and construction of personal meaning when dealing with knowledge (Biggs, 1987a; Entwistle & Ramsden, 1983; Struyven, Dochy, Janssens, & Gielen, 2006).

From the initial research of Marton (1975) and Marton and Saljö (1976a, 1976b), other researchers begun to study the students' approaches to learning – SAL - (Entwistle, McCune, & Walker, 2001; Entwistle & Ramsden, 1983; Struyven et al., 2006), therefore in the 1990s both the DAP and the SAP were empirically identified in different countries and cultures (Wong, Lin, & Watkins, 1996). Furthermore, many researches showed evidences about the predictive validity of deep approach on academic achievement (Biggs, 1987a; Diseth & Martinsen, 2003; Entwistle & Ramsden, 1983; Kizilgunes, Tekkaya, & Sungur, 2009).

Several instruments were created to measure DAP and SAP: the Learning Process Questionnaire (Biggs, 1987a, 1987b), Study Process Questionnaire (Biggs, 1978, 1987b), the R-SPQ-2F (The Revised Two - Factor Study Process Questionnaire; Biggs, Kember, & Leung, 2001), Approaches to Study Inventory (Entwistle & Ramsden, 1983), the *Escala de Avaliação de Processos de Estudo* (Gomes, 2005), and the *Questionário de Processos de*

*Aprendizagem*, being the last one the Portuguese version of the Study Process Questionnaire (Rosário, Almeida, Núñez, & González-Pienda, 2004).

Instruments like the above mentioned have generated almost every data available in the SAL tradition, leading to a specific issue: they are all self-report questionnaires (Giordano, Litzemberger, Wagner-Menghin, & Binder, 2009). Therefore they collect data about the people's perception and judgment of their interactions with the objects of knowledge.

Another important psychological concept, motivation for academic learning, presents a large number of theories and models, from James' instinct theory to goal structures (see Tremblay, 1998 for an extensive revision). Thus, the psycho-educational instruments to assess motivation have different backgrounds, representing different research traditions: Children's Social Desirability Scale (Crandall, Crandall, & Katkovsky, 1965); Achievement Goal Questionnaire (Finney, Pieper, & Barron, 2004); Academic Motivation Scale (Vallerand, Pelletier, Blais, & Brière, 1992); School Achievement Motivation Rating Scale (Archer, 1994); and Children's Academic Intrinsic Motivation Inventory (Gottfried, 1985), are just few of the existing instruments (for a more complete revision see Fulmer & Frijters, 2009; Tremblay, 1998).

Despite the several traditions of research on motivation, and the variety of instruments used, self-report methodology dominates extensively the research on student's motivation (Fulmer & Frijters, 2009; Giordano et al., 2009). The data gathered by studies on motivation, as well as the learning approaches field, assess people's perceptions and judgments about their own inner processes.

Furthermore, some studies show that both constructs have a close relation (Dupeyrat & Marin, 2005; Phan, 2010; Senko & Miles, 2008). Cano and Berbén (2009), for example, investigated the relationship between SAL and motivation (i.e. achievement goals – AG) on 680, 1<sup>st</sup> year university students enrolled on mathematics courses. The authors have hypothesized that SAL and AG might be related due to the evidences of previously researches showing close relationships between mastery goals, intrinsic motivation and deep processing, and between surface processing, performance goals, fear of failure and extrinsic motivation. Their result showed that the two set of variables shared 71.70% of their variance, and they conclude that SAL and AG “appear to be intertwined aspects of students' experience of learning mathematics” (Cano & Berbén, 2009, p. 147). Moreover, the authors pointed that SAL and AG are related to both the way students perceived their academic environment and the way they conceived the nature of mathematics.

According to this result, it is possible to argue that the relation between SAL and motivation is quite obvious, since the own definition of the student's approaches to learn (Biggs, 1987a) emerged from the linkage of two distinct facets: learning strategies and learning motivations. Thus, finding positive correlations between the two set of

variables could be redundant. However we think that the evidences showing the close relationship between SAL and motivation (Cano & Berbén, 2009; Diseth & Martinsen, 2003; Kizilgunes et al., 2009), also between both variables and self-efficacy (Phan, 2011; Prat-Sala & Redford, 2010), and values (Matthews, Lietz, & Darmawan, 2007) have an underlying construct that has not been reported in the literature yet. As discussed before, since the preferred methodology for assessing those constructs is the self-report questionnaires, the data gathered by all the above mentioned studies encompass people's perceptions and judgments about their learning processes. Thus, we argue that these aspects are, actually, metacognitive knowledge. In the experiential structuralism language, they are components of the long-term hypercognitive system.

*Fourth Principle: Since SAL and MAL belong to the Academic Domain of Learning, we Propose that these Two Constructs are Integrated through a General Construct that we Have Called Academic Metacognitive Knowledge (AMcK). Concomitantly, we Propose that AMcK is a General Academic Component of Long-Term Hypercognitive System that Connects Different Perceptions and Judgments of People about their Academic Abilities.*

### Empirical Modeling

The current study suggests that student's self-report of their academic learning processes are a type of metacognitive knowledge, called academic metacognitive knowledge (AMcK). Aiming to verify the empirical plausibility of this assertion, the first hypothesis focuses on the argument that any self-report related to academic performance processes are explained by a latent variable: academic metacognitive knowledge (AMcK).

To examine this hypothesis, we have created a model, through structural equation modeling, in which three academic metacognitive knowledge indicators are present. These indicators are factor scores of DAP, SAP and MAL. The three indicators are explained by the latent variable AMcK. Failure to identify this latent variable, as well as the absence of at least a moderate factor loading ( $\geq .40$ ) between the observable variables (indicators) and the latent variable, are sufficient to reject the hypothesis of an academic metacognitive knowledge (see the Academic Metacognitive Knowledge Model Figure 1a).

Besides the fact that academic motivation and learning approaches are explained by a latent variable, AMcK, it must be distinguished from the working metacognition (WMC). Otherwise, if AMcK is reduced to WMC, the hypothesis of the existence of an academic metacognitive knowledge is rejected. Therefore, the second hypothesis, dependent on the non-rejection of the first hypothesis, postulates the distinction between AMcK and WMC.

In order to verify the second hypothesis, a model was created maintaining the variables and its relationships with the first model. However, three working metacog-

nitive indicators were added. One is a factor score of monitoring and the other two are factor scores of the students' appraisals of success in arithmetic expressions. WMC explains the variance of the working metacognition indicators, and the self-appraisal's indicators covariate their errors. The model stipulates the presence of two distinct, but related, latent variables (see Figure 1b for the Distinctive Model).

A concurrent model was developed to verify if a single latent variable of metacognition (GMA – general metacognition ability) can explain all six indicators. If the concurrent model shows more adequate data fit than the second model, we must reject the hypothesis of a distinction between academic metacognitive knowledge and working metacognition. Otherwise, if the concurrent model do not present an adequate data fit, the distinctive relation holds (see Figure 1c for the Concurrent Model).

If the first and second hypotheses can not be refuted, a third hypothesis can take place and states that the academic metacognitive knowledge should be able to explain part of the student's academic achievement variance, beyond working metacognition. For that reason, a model was elaborated to empirically verify the third hypothesis, incorporating, to the second model, four academic performance indicators (Math, Brazilian Portuguese, Geography and History annual grades) explained by a latent variable, called general academic achievement (GAA). In this model, both AMcK and WMC explain GAA. The third hypothesis will be rejected if the explanation of GAA by AMcK is not statistically significant (see the General academic achievement predictors' model at Figure 1d).

To sum up, the study hypotheses are:

1. The latent variable AMcK explains the variance of DAP, SAP and MAL factor scores. Factor loadings of the observable variables are equal or greater than .40;
2. The latent variable AMcK is distinct from the latent variable of working metacognition (WMC);
3. AMcK has incremental validity, beyond WMC, on the explanation of the general academic achievement (GAA) variance.

## Method

### Participants

The sample was composed by 684 students (6<sup>th</sup> to 12<sup>th</sup> graders) of a private school in Belo Horizonte, Minas Gerais, Brazil. Data was collected in 2008. The tests were administrated collectively in 19 classes by psychologists or trained psychology students. The sample was relatively balanced in graders (6<sup>th</sup> graders,  $n=91$ ; 7<sup>th</sup> graders,  $n=107$ ; 8<sup>th</sup> graders,  $n=98$ ; 9<sup>th</sup> graders,  $n=116$ ; 10<sup>th</sup> graders,  $n=90$ ; 11<sup>th</sup> graders,  $n=93$ ; 12<sup>th</sup> graders,  $n=89$ ), sex ( $n=328$  male and  $n=356$  female) and age (11 years old,  $n=83$ ; 12 years old,  $n=106$ ; 13 years old,  $n=92$ ; 14 years old,  $n=108$ ; 15 years old,  $n=98$ ; 16 years old,  $n=80$ ; 17 years old,  $n=73$ ) with exception of 10 years old ( $n=35$ ) and 18 years old ( $n=9$ ).

### Measures and Procedures

*Working Metacognition Tests.* We have selected two tests that were specifically designed to investigate WMC: (a) *Read Monitoring Test (RMT)* - this is a one page long text that contains in its statement nine contradictory informations. It is expected that respondents who adequately regulate (monitor) the reading action can observe and indicate the errors presented in the text. The test instructions contain two examples of contradictory statements and a fictitious respondent makes his analyses about the reading process. The errors were classified according to their difficulty level in three categories: easy, medium and difficult. The person received a score (1) if she found the error or (2) if she failed to identify the text errors. The test has a time limit of 40 minutes; (b) *Students' appraisals of success in arithmetic expressions (SASAE)* this test is comprised of 18 items, being each one composed of an arithmetic expression. The respondent must evaluate the probability of success in solving the item and answer a four-point scale, representing that he or she (1) *is sure that has failed the item*; (2) *is not sure, but thinks that has failed the item*; (3) *is not sure, but thinks that has succeeded in the item*; (4) *is sure that has passed the item*. Items were classified according to their difficulty level as easy, medium and difficult.

The score was established in the following way: Students who were certain that they had failed an item scored 0. Those who were sure that they had completed an item successfully, but, in fact, failed in the item, scored 1. Students who were not sure, but thought that they had failed an item and, in fact, passed it, were scored 2, as well as those who were not sure, but thought that they had successfully answered an item, when they actually had not. Those who were not sure, but thought that they had passed an item and in fact had not, and those who were not sure, but thought that they had failed an item and failed it, were scored 3. Students that were sure that they had successfully completed an item and, in fact, they had, scored 4. This way, the scores are 0, 1, 2, 3 and 4, for each of the 18 items. This test had a limited time of 30 minutes.

Both tests present reliability and factorial structure validity as markers of working metacognition. These psychometrical proprieties are described in Golino and Gomes (2011). The monitoring factor score of RMT, the appraisals of easy items factor score and the appraisals of difficult items factor score of SASAE are used in the study.

*Brazilian Learning Approaches' Scale (BLAS).* The Brazilian Learning Approaches' Scale is a self-report questionnaire composed by 17 items, developed by Gomes and colleagues (Gomes, 2010; Gomes, Golino, Pinheiro, Miranda, & Soares, 2011). Nine items were elaborated to measure deep learning approaches, and eight items measure surface learning approaches. Each item has a statement that refers to a student's behavior while learning. The student considers how much of the behavior described is present in his life, using a Likert-like scale ranging from (1) *not at all*, to (5) *entirely present*. BLAS

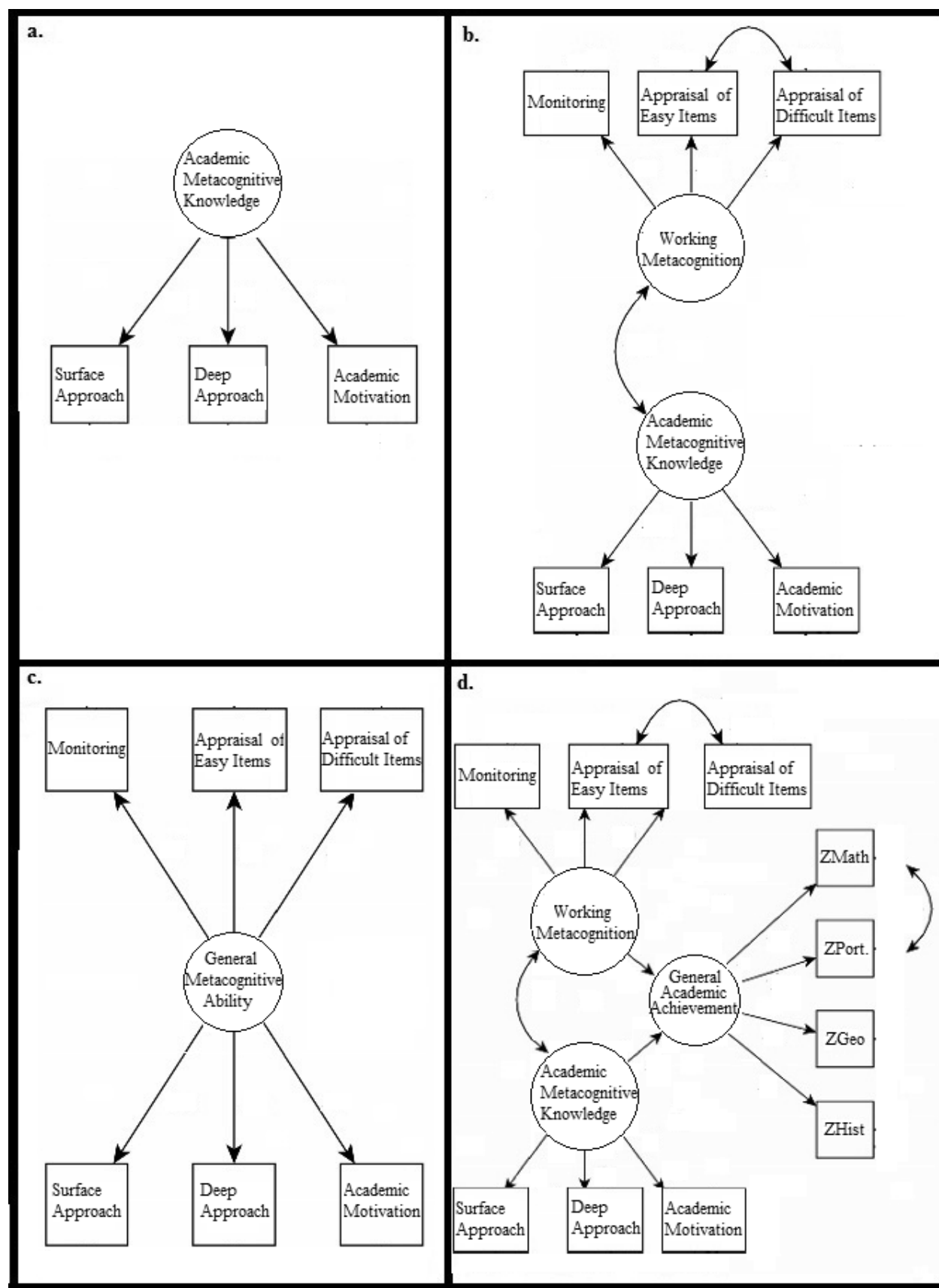


Figure 1. Models: (a) Academic metacognitive knowledge model; (b) Distinctive model; (c) Concurrent model; (d) General academic achievement predictors model.

presents reliability, factorial structure validity, predictive validity and incremental validity as good marker of learning approaches. These psychometrical proprieties are described respectively in Gomes (2010, 2011) and Gomes et al. (2011). The DAP and SAP's factor scores are used in the current study.

*Students' Perceptions on Academic Achievement Behaviors (SPAAB).* A self-report questionnaire was specifically created for the current study to measure students' perceptions about their academic achievement behaviors, indicating the motivation for academic learning. Each one of the nine items has a particular statement representing different behaviors related to academic achievement. The student considers how frequent the described behavior occurs in his life, using a Likert-like scale ranging from (1) *not at all*, to (5) *very frequent*. Examples of academic achievement behaviors are: "I get in contact with teachers in the areas that I have interest in developing" and "I try to be the best student in my class".

Cronbach's alpha was .78 for the SPAAB items. A confirmatory factor analysis (CFA) was performed through Mplus 5.2 statistical package. One perception latent variable (motivation to academic learning - MAL) explained the variance of the items. The model fit was adequate ( $\chi^2 = 60.32$ ;  $df = 23$ ; CFI = .98; RMSEA = .05). None of the items had a factor loading lower than .43. The MAL's factor score is used in the current study.

#### Data Analysis

Factor scores of the items of DAP (deep approach), SAP (surface approach), MAL (motivation to academic learning), (AE) appraisals of easy items, (AD) appraisals of difficulty items, and monitoring (Mon) were used instead of raw scores to compose the observed variables. All the factor scores cited above, plus the Math, Portuguese, History, and Geography annual grades were standardized with mean 100 and standard deviation 10, in each group of graders. This procedure allowed us to analyze all the students' grades and factor scores in the same data matrix. Structural Equation Modelling (SEM) was applied to investigate the model data fit related to the hypotheses of the study. The model data fit was verified by the comparative fit index (CFI) and the root mean square error of approximation (RMSEA). CFI  $\geq .95$  and RMSEA  $\leq .06$  indicate adequate model fit (Byrne, 2001). SEM was performed through software Amos 18.0.

### Results

#### Testing the First Hypothesis

The basic hypothesis argues that the latent variable AMcK explains the variance of DAP, SAP and MAL's factor scores. Concomitantly, it sustains that the factor loadings of the observable variables are equal to, or greater than, .40.

All SEM can be evaluated in terms of its data fit, if it has at least one degree of freedom. Thus, we constrained that the variance of the error of SAP was the same as the

variance error of MAL. Otherwise, the present model would have zero degrees of freedom and could not be analyzed. The model (see Figure 2a) shows an adequate data-fit ( $\chi^2 = 3.60$ ;  $df = 1$ ; CFI = 1.00; RMSEA = .06). However, the analysis of model-data fit is not enough to sustain the first hypothesis. The factor loadings of the latent variable AMcK on the observable variables need to be at least moderate (approximately .40 or higher) to support the evidence that both learning approaches and academic motivation self-reports are part of the same latent variable, the academic metacognitive knowledge. The hypothesis advocates that any self-report procedure related to academic performance must be explained by the latent variable AMcK. Weak factor loadings of the observed variables imply the rejection of the hypothesis.

The SEM results are: (a) SAP showed a factor loading of .69; (b) DAP presented a factor loading of .91; and (c) MAL had a .71 factor loading. Thus, all observed variables were heavily loaded by the latent variable, indicating that self-reports of different psychological constructs are good indicators of this latent trait. In light of this evidence, the first hypothesis can not be refuted.

#### Testing the Second Hypothesis

The latent variable AMcK is distinct from the latent variable working metacognition (WMC).

There was no more need to assume the error variance of SAP and MAL are the same, since new variables had been added to the second hypothesis model. Once the self-appraisal manifest variables are the factor scores of the SASAE, it was determined the correlation of its variance errors. The second hypothesis model was compared to the concurrent model, where AMcK and WMC are not present, but a general metacognitive latent variable instead, explaining the variance of all the observable (or manifest) metacognitive variables. The result points to a non-adequate data fit of the concurrent model – see Figure 2c – ( $\chi^2 = 79.94$ ;  $df = 8$ ; CFI = .93; RMSEA = .12). Moreover, the factorial loadings of the working metacognition observable variables are too low ( $\leq .18$ ), indicating a weak relationship with the general latent variable. The second hypothesis model, in its turn, presented a satisfactory degree of fit ( $\chi^2 = 16.52$ ;  $df = 7$ ; CFI = .99; RMSEA = .04), and a weak correlation (.19) between WMC and AMcK (see Figure 2b). Therefore, based on the evidences, the second hypothesis can not be rejected.

#### Testing the Third Hypothesis

AMcK has incremental validity, beyond WMC, on the explanation of general academic achievement's (GAA) variance.

The model representing the third hypothesis has an adequate data fit ( $\chi^2 = 69.13$ ;  $df = 30$ ; CFI = .99; RMSEA = .04). The correlation between WMC and AMcK is .21 (see Figure 2d). Both latent variables explain GAA. WMC has a factor loading of .48 in GAA, explaining 22.94% of its variance, while AMcK has a factor loading of .25 in GAA, explaining 6.30% of its variance. Since the incre-

mental validity of AMcK is crucial to reject or not the third hypothesis we performed a bootstrap of 1000 cases with 90% confidence interval. The WMC and AMcK factor loadings' range lies, respectively, between .37 and .58, and

between .18 and .32. So, WMC explains GAA between 13.76% and 33.41%, while AMcK explains between 3.24% and 10.24%. The evidence presented does not indicate a rejection of the third hypothesis.

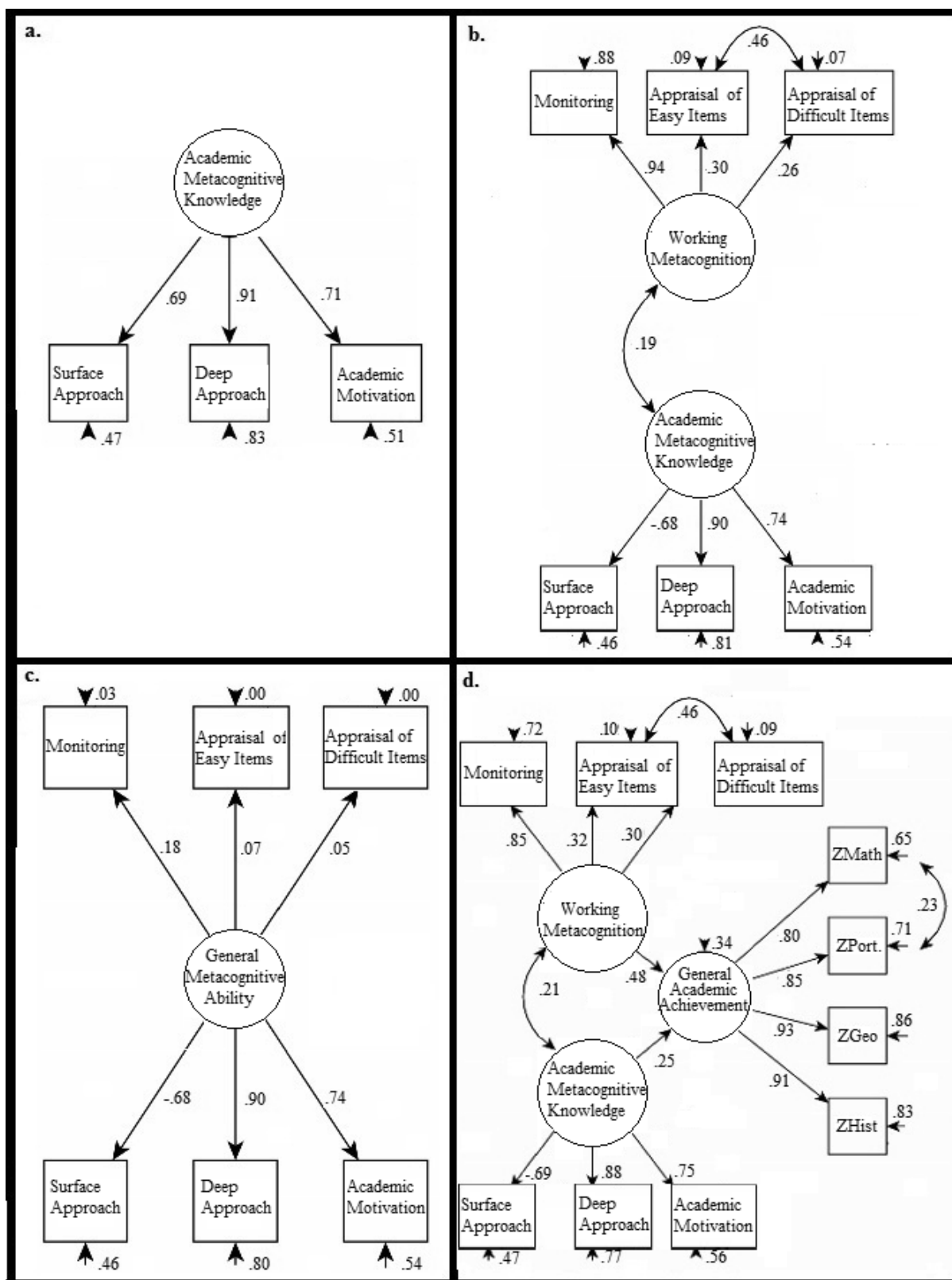


Figure 2. Tested models.



## Discussion

The current study addresses the following research question: Are students' self-reports of their academic learning processes a specific type of metacognitive knowledge, named earlier as academic metacognitive knowledge (AMcK)? Our result shows that the AMcK model is adequate to our data, with all the variables presenting consistent loads on the latent variable. Moreover, there are evidences showing that the six observable metacognitive variables cannot be explained by a general metacognitive ability, as shown by the poor adjustment of the concurrent model and the weak loadings of the observable variables on the latent variable GMA. Furthermore, the result shows the incremental validity, yet relatively small, of AMcK on academic achievement, explaining between 3.24% and 10.24% of its variance, together with WMC, that explains from 13.76% to 33.41%.

This result leads to at least one main consequence. The existence of AMcK can be a key to interpret several data showing the existence of a close relationship between student's self-reports of their learning approaches and several other constructs such as motivation, epistemological beliefs (Kizilgunes et al., 2009; Phan, 2007), reflective thinking (Phan, 2007), and others. It seems that the majority of the constructs investigated through self-report methodologies are somewhat related to each other. Our study goes in the direction of a structural cognitive explanation. These constructs are related to each other because the self-report instruments generally used, assess people's perceptions and judgments about their own functioning regarding their relation with the objects of knowledge (i.e. they assess academic metacognitive knowledge). As discussed before, the perception, the record and the knowledge about the cognitive operations are tasks accomplished by the long-term hypercognition, which maps the other systems of the cognitive architecture, creating an internal representation of the various types of systems and cognitive processes (Demetriou et al., 2002; Demetriou & Kazi, 2001; Demetriou et al., 2005).

It is relevant to say that the own learning approaches tradition emerges from the postulate about an inexorable relation between motivation and learning strategies. This tradition starts its proper agenda through the articulation of two relevant domains: motivation and strategy. It is notorious to observe that the focus on the strategies is a kind of metacognitive process, and that studying the former you are studying the latter. In this way, the learning approaches tradition indirectly investigates metacognition, even though this relation has never been theoretically pointed out by the researchers of the field. Even arguing about the relationship between motivation and strategy, the learning approaches tradition does not explain that the motivation-strategy articulation in the students' perception and registry are a form of metacognitive knowledge. This theoretical proposition is an innovation not present in the original conceptualizations of the learning approaches

tradition. Concluding, if the learning approaches tradition proposes that motivation and strategy are intrinsically related, we propose that motivation, strategy and any others psychological constructs evaluated by self-reports are hierarchically articulated by their pertaining to the metacognitive knowledge system or, using the experiential structuralism vocabulary, by their pertaining to the long-term hypercognitive system.

We are aware of this study limitations. To be consistent, our proposal must be vigorously studied, incorporating a vast number of other psychological constructs related to learning and that are studied fundamentally through self-perceptions of the students. This paper is the first and it is a small tentative to present the theoretical propositions, it is also the first study to verify the plausibility of the proposal. Beyond the need to enhance the number of psychological constructs analyzed and the need to employ larger samples, our study has the merit to show that it is possible to invest in the proposed integrative vision, in order to build future integrative theories.

## References

- Archer, J. (1994). Achievement goals as a measure for motivation in university students. *Contemporary Educational Psychology*, 19, 430-446.
- Biggs, J. B. (1978). Individual and group differences in study processes. *British Journal of Educational Psychology*, 48, 266-279.
- Biggs, J. B. (1987a). *The Learning Process Questionnaire (LPQ): Users' manual*. Hawthorn, Australia: Australian Council for Educational Research.
- Biggs, J. B. (1987b). *The Study Process Questionnaire (SPQ): Manual*. Hawthorn, Australia: Australian Council for Educational Research.
- Biggs, J. B., Kember, D., & Leung, D. Y. P. (2001). The revised Two-factor Study Process Questionnaire: R-SPQ-2F. *British Journal of Educational Psychology*, 71, 133-149.
- Byrne, B. (2001). *Structural equation modeling with AMOS: Basic concepts, applications and programming* [Manual software]. Mahwah, NJ: Lawrence Erlbaum.
- Cano, F., & Berbén, A. G. (2009). University students' achievement goals and approaches to learning in mathematics. *British Journal of Educational Psychology*, 79(1), 131-153.
- Crandall, V. C., Crandall, V. J., & Katkovsky, W. A. (1965). A children's social desirability questionnaire. *Journal of Consulting Psychology*, 29, 27-36.
- Demetriou, A. (1998). Nooplasis: 10 + 1 postulates about the formation of mind. *Learning and Instruction*, 8(4), 271-287.
- Demetriou, A., Christou, C., Spanoudis, G., & Platsidou, M. (2002). The development of mental processing: Efficiency, working memory, and thinking. *Monographs of the Society for Research in Child Development*, 67(1), 1-155.
- Demetriou, A., & Kazi, S. (2001). *Unity and modularity in the mind and the self: Studies on the relationships between self-awareness, personality, and intellectual development from childhood to adolescence*. London: Routledge.
- Demetriou, A., Raftopoulos, A., & Butterworth, G. (2005). *Cognitive developmental change: Theories, models and measurement*. Cambridge, UK: Cambridge University Press.

- Demetriou, A., Spanoudis, G., & Mouyi, A. (2010). A three-level model of the developing mind: Functional and neuronal substantiation. In M. Ferrari & L. Vuletic (Eds.), *The developmental relations between mind, brain, and education: Essays in honor of Robbie Case* (pp. 9-48). New York: Springer.
- Demetriou, A., Spanoudis, G., & Mouyi, A. (2011). Educating the developing mind: Towards an overarching paradigm. *Educational Psychology Review*, 23(4), 601-663.
- Diseth, Å., & Martinsen, Ø. (2003). Approaches to learning, cognitive style, and motives as predictors of academic achievement. *Educational Psychology*, 23(2), 195-207.
- Dupeyrat, C., & Marin, C. (2005). Implicit theories of intelligence, goal orientation, cognitive engagement, and achievement: A test of Dweck's model with returning to school adults. *Contemporary Educational Psychology*, 30, 43-59.
- Entwistle, N. J., McCune, V., & Walker, P. (2001). Conceptions, styles and approaches within higher education: Analytic abstractions and everyday experience. In R. Stenberg & L.-F. Zang (Eds.), *Perspectives on cognitive, learning and thinking styles* (pp. 211-245). Mahwah, NJ: Lawrence Erlbaum.
- Entwistle, N. J., & Ramsden, P. (1983). *Understanding student learning*. London: Croom Helm.
- Finney, S. J., Pieper, S. L., & Barron, K. E. (2004). Examining the psychometric properties of the Achievement Goal Questionnaire in a General Academic Context. *Educational and Psychological Measurement*, 64(2), 365-382.
- Flavell, J. (1987). Speculations about the nature and development of metacognition. In F. Weinert & R. Kluwe (Eds.), *Metacognition, motivation, and understanding* (pp. 21-29). Hillsdale, NJ: Lawrence Erlbaum.
- Fulmer, S. M., & Frijters, J. C. (2009). A review of self-report and alternative approaches in the measurement of student motivation. *Educational Psychology Review*, 21(3), 219-246.
- Giordano, R., Litzenberger, M., Wagner-Menghin, M., & Binder, J. (2009). Assessing learning achievement, time effort, learning approaches and tempo during learning within the experiment-based behavioral task LAsO - Reliability and incremental validity. *Psychology Science*, 51(3), 247-265.
- Golino, H. F., & Gomes, C. M. A. (2011). Preliminary internal validity evidences of two Brazilian Metacognitive Tests. *Testing International*, 26, 11-12.
- Gomes, C. F. (2005). Escala de avaliação de processos de estudo (EAPE). In *Psicologia.com.pt - O Portal dos Psicólogos*. Recuperado em 22 de setembro 22, 2008, de <http://www.psicologia.com.pt>
- Gomes, C. M. A. (2010). Perfis de estudantes e a relação entre abordagens. *Psico*, 41(4), 503-509.
- Gomes, C. M. A. (2011). Abordagem profunda e abordagem superficial à aprendizagem: Diferentes perspectivas do rendimento escolar. *Psicologia: Reflexão e Crítica*, 24(3), 438-447.
- Gomes, C. M. A., Golino, H. F., Pinheiro, C. A. R., Miranda, G. R., & Soares, J. (2011). Validação da Escala de Abordagens de Aprendizagem (EABAP) em uma amostra brasileira. *Psicologia: Reflexão e Crítica*, 24(1), 19-27.
- Gottfried, A. E. (1985). Academic intrinsic motivation in elementary and junior high school students. *Journal of Educational Psychology*, 77(6), 631-645.
- Jou, G. I., & Sperb, T. M. (2006). A metacognição como estratégia reguladora da aprendizagem. *Psicologia: Reflexão e Crítica*, 19(2), 177-185.
- Kizilgunes, B., Tekkaya, C., & Sungur, S. (2009). Modeling the relations among students' epistemological beliefs, motivation, learning approach and achievement. *The Journal of Educational Research*, 102, 243-256.
- Marton, F. (1975). What does it take to learn? Some implications of an alternative view of learning. In N. Entwistle & D. Hounsell (Eds.), *How students learn* (pp. 125-138). Lancaster, UK: University of Lancaster.
- Marton, F., & Säljö, R. (1976a). On qualitative differences in learning: I – Outcome and Process. *British Journal of Educational Psychology*, 46, 4-11.
- Marton, F., & Säljö, R. (1976b). On qualitative differences in learning: II. Outcome as a function of the learner's conception of the task. *British Journal of Educational Psychology*, 46, 115-127.
- Matthews, B., Lietz, P., & Darmawan, I. (2007). Values and learning approaches of students at an international university. *Social Psychology of Education*, 10(2), 247-275.
- Phan, H. P. (2007). An examination of reflective thinking, learning approaches, and self-efficacy beliefs at the University of the South Pacific: A path analysis approach. *Educational Psychology*, 27(6), 789-806.
- Phan, H. P. (2010). Students' academic performance and various cognitive processes of learning: An integrative framework and empirical analysis. *Educational Psychology*, 30(3), 297-322.
- Phan, H. (2011). Interrelations between self-efficacy and learning approaches: A developmental approach. *Educational Psychology*, 31(2), 225-246.
- Prat-Sala, M., & Redford, P. (2010). The interplay between motivation, self-efficacy, and approaches to studying. *British Journal of Educational Psychology*, 80(2), 283-305.
- Rosário, P., Almeida, L., Núñez, J. C., & González-Pienda, J. A. (2004). Abordagem dos alunos à aprendizagem: Análise do construto. *Psico-USF*, 9(2), 117-127.
- Senko, C., & Miles, K. M. (2008). Pursuing their own learning agenda: How mastery-oriented students jeopardize their class performance. *Contemporary Educational Psychology*, 33, 561-583.
- Struyven, K., Dochy, F., Janssens, S., & Gielen, S. (2006). On the dynamics of students' approaches to learning: The effects of the learning/teaching environment. *Learning and Instruction*, 16(4), 279-294.
- Tremblay, P. F. (1998). *Development and construct validation of the academic motivation inventory*. (Unpublished doctoral dissertation). The University of Western Ontario, Ontario, Canada).
- Vallerand, R. J., Pelletier, L. G., Blais, M. R., & Brière, N. M. (1992). The Academic Motivation Scale: A measure of intrinsic, extrinsic, and amotivation in education. *Educational and Psychological Measurement*, 52(4), 1003-1017.
- Wong, N. Y., Lin, W. Y., & Watkins, D. (1996). Cross-cultural validation of models of approaches to learning: An application of confirmatory factor analysis. *Educational Psychology*, 16(3), 317-327.

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