# Supplementary material for the paper Classifying Students' Meta-Cognitive Comments

## A Classification Scheme

Table A.1 summarizes the 9 consolidated categories at the output of the classification scheme generation process, their definitions and typical keywords. The first three categories concern monitoring activities: factual and interpretative

| **Category** | **Definition** | **Typical Keywords** |
|---|---|---|
| MonCal.Facts.RF | Factual evaluation of the test results, in terms of number/quantity of correct/incorrect answers | Correct, Incorrect, Right, False |
| MonCal.Facts.DC | Factual evaluation of the test results, in terms of number/quantity of uncertain knowledge, well-founded knowledge, unexpected errors, presumed errors | Uncertain knowledge, Well-founded knowledge, Unexpected errors, Presumed errors* |
| MonCal.Interpret | Interpretations of the test results beyond quantitative evaluation, reflecting students' subjective interpretations of their performance | Prudence, Imprudence, Doubt* |
| BDS.Emotions | Comments expressing emotions felt by the student during and after the test and their implications | Stress, Anxiety, Fear, Disappointment, Satisfaction |
| MotOrient.Value | Comments about interest in test type (true false questions with degres of certainty) and their perceived value to learners | Evaluation, Utility, Allow |
| MotOrient.SelfEff | Comments on students' self-efficacy and confidence related to the tested domain | Confidence, Abilities, Overestimation, Underestimation, Realism, Competency |
| DomainKldg | Comments identifying missing or achieved disciplinary concepts/domains and their degree of acquisition | Gaps, Concepts, Lesson, Subject, Chapter, Physics |
| StratKldg | Comments about learning strategies during the test and student behavior analysis | Forgetting, Misreading, Difficulties, Attention, Inattention, Lack of time |
| CTRL | Comments about future learner behavior and attitudes | Next time, Next Test, Future, have to, should |

**Table A.1.** Classification Categories and Keywords.
*These keywords reflect the specific vocabulary used in our context to provide post-test feedback: Uncertain knowledge (correct answer and low certainty), Well-founded knowledge (correct answer and high certainty), Unexpected errors (incorrect answer and high certainty), Presumed errors (incorrect answer and low certainty)

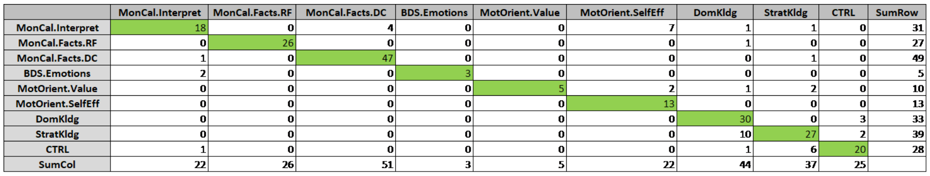
evaluation of the test results. The following five categories deal with students' comments showing that the test had an impact on their cognitive conditions: emotional dispositions, motivational factors, self-efficacy, awareness of gaps or changes in subject knowledge, enhanced knowledge of their learning strategies (cf. COPES model, Winnie and Hadwin, 1998). The final category concerns meta-cognitive control, i.e. students' reflections on the attitudes and behaviors they can adopt to improve their learning.

## B Classification Results for Corpus 2

### B.1 Agreement between two human coders

Fig. A1 illustrates the number of agreements and disagreements between the two human coders involved in the classification of Corpus 2. The numbers in the diagonal (green cells) are the number of agreements, off-diagonal numbers indicate disagreements. The Inter-Coder-Reliability measured by Cohen's Kappa is 0.67. The high number of disagreements (10) between StratKldg and DomKldg can be explained by the fact that one coder assigned comments like "*I realized that I still hadn't revised many of the topics covered by the test*" to the DomKldg category, while the other classified it in the StratKldg category. This type of comment, while not explicitly identifying a specific notion to be learned, implicitly suggests it, but it can also be interpreted as an unsuitable pre-test learning strategy. This is a typical example of how the ambiguity of some comments makes it difficult to establish a ground truth. Other examples concern the MonCal.Interpret and MotOrient.SelfEff categories, as in the comment: "*I have too much confidence in incorrect answers*", which can be classified both as the student's interpretation of the feedback received on his level of confidence and as a first step towards an adjustment of perceived competence (self-efficacy). Another significant number of disagreements appear between the CTRL and StratKldg categories (8 in total), see the discussion concerning the example comment *C2: "I could be more realistic if I read the questions better"*, given in the paper.

The human coders agreed to choose a category for contentious cases in order to establish a ground truth. In many cases, the other choice was also acceptable. This suggests an avenue to explore for another approach to classification, which could be to allow the same comment to be classified in two different categories. The disadvantage of this approach is that it would create repetition in the comment classification table.

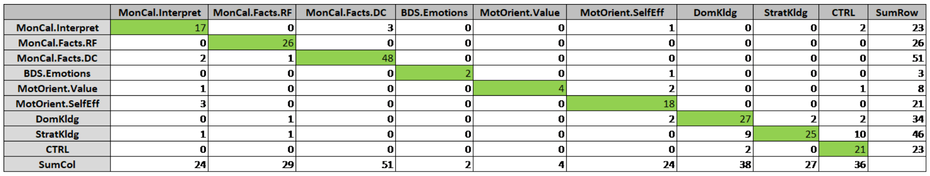


| | MonCal.Interpret | MonCal.Facts.RF | MonCal.Facts.DC | BDS.Emotions | MotOrient.Value | MotOrient.SelfEff | DomKldg | StratKldg | CTRL | SumRow |
|---|---|---|---|---|---|---|---|---|---|---|
| MonCal.Interpret | 18 | 0 | 4 | 0 | 0 | 7 | 1 | 1 | 0 | 31 |
| MonCal.Facts.RF | 0 | 26 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 27 |
| MonCal.Facts.DC | 1 | 0 | 47 | 0 | 0 | 0 | 0 | 1 | 0 | 49 |
| BDS.Emotions | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 5 |
| MotOrient.Value | 0 | 0 | 0 | 0 | 5 | 2 | 1 | 2 | 0 | 10 |
| MotOrient.SelfEff | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 13 |
| DomKldg | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 3 | 33 |
| StratKldg | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 27 | 2 | 39 |
| CTRL | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 20 | 28 |
| SumCol | 22 | 26 | 51 | 3 | 5 | 22 | 44 | 37 | 25 | |

**Fig. A1.** Inter-Coder-Agreement Matrix between the two human coders.

### B.2 Agreement between LM Phi-4 and the Human reference classification

Fig.A2 illustrates the alignment between the final human classification (after coder consensus) and the classification achieved with the LM Phi-4. The rows correspond to the human reference and the columns to the LM classification. The Inter-Coder-Reliability measured by Cohen's Kappa is 0.77 and the accuracy 0.8. Regarding disagreements between LM Phi-4 and human classification, we find discrepancies similar to those between human coders. Comparable difficulties in deciding which category is most appropriate appear between StratKldg and CTRL, and between DomKldg and StratKldg. A total of 47 comments were classified differently by the LM than in the reference. We evaluated each of them to judge whether the alternative classification was acceptable (as in the examples given above for human disagreements). This was the case for 29 comments, so only 18 were actually misclassified. If we recalculate the accuracy on this basis, it rises to 0.92.



| | MonCal.Interpret | MonCal.Facts.RF | MonCal.Facts.DC | BDS.Emotions | MotOrient.Value | MotOrient.SelfEff | DomKldg | StratKldg | CTRL | SumRow |
|---|---|---|---|---|---|---|---|---|---|---|
| MonCal.Interpret | 17 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 2 | 23 |
| MonCal.Facts.RF | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| MonCal.Facts.DC | 2 | 1 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 51 |
| BDS.Emotions | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 3 |
| MotOrient.Value | 1 | 0 | 0 | 0 | 4 | 2 | 0 | 0 | 1 | 8 |
| MotOrient.SelfEff | 3 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 21 |
| DomKldg | 0 | 1 | 0 | 0 | 0 | 2 | 27 | 2 | 2 | 34 |
| StratKldg | 1 | 1 | 0 | 0 | 0 | 0 | 9 | 25 | 10 | 46 |
| CTRL | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 21 | 23 |
| SumCol | 24 | 29 | 51 | 2 | 4 | 24 | 38 | 27 | 36 | |

**Fig. A2.** Inter-Coder-Agreement Matrix between human (rows) and Phi-4 (columns).