



The Use of Strategies in Motor Learning: Validation of a new Questionnaire

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Introduction

- ⇒ Analyzing cognitive learning, strategies are an important topic of psychological research since many years. On the majority, studies are focussed on the relationship between the use of learning strategies and academic achievement (e.g., Artelt, 2006; Streblov & Schiefele, 2006) and the development or evaluation of strategy trainings (e.g., Schmitz & Wiese, 2006). Numerous assessment methods are available, mainly in the form of self-report questionnaires (for a current review: Spörer & Brunstein, 2006).
- ⇒ By contrast, researchers in the field of motor learning has ignored so far this crucial aspect of motor learning. Thus, a questionnaire was developed to measure motor learning strategies. Based on psychological measures, five groups of learning strategies are differentiated:

1. Cognitive strategies [COG]
2. Metacognitive strategies [MET]
3. Management of internal resources [IRE]
4. Management of external resources [ERE]
5. Motor strategies [MOT]

- ⇒ Each group of strategies is measured by one subscale. Altogether, the instrument, named "StraBL" (abbreviation of "Strategies of motor learning" in German), contains of 35 items.

- ⇒ Using hypothetical learning situations, the German version of the StraBL-questionnaire was evaluated in two studies.

Results

STUDY 1

- ⇒ The exploratory factor analysis confirms the hypothesized 5-factor structure (see figure 2). The factor loadings are meaningful and relatively high ($\geq .50$ for 31 of 35 items). This factor solution explains 54% of total item variance.
- ⇒ The part-whole correlations range from $r = .37$ to $.69$ and correspond to the factor analysis results. The reliability coefficients of the subscales range from $\alpha = .78$ to $.84$ (see table 1).

Table 1: Means, standard deviations, part-whole correlations, and internal consistency of the StraBL-subscale

Subscale	M	SD	Part-whole correlations	Alpha
			MIN - MAX	
COG	3.57	.72	.42 - .67	.832
MET	3.21	.73	.42 - .69	.845
IRE	3.25	.65	.36 - .63	.782
ERE	3.30	.69	.37 - .64	.799
MOT	3.34	.69	.43 - .63	.825

STUDY 2

- ⇒ The results of this study reveal that most of the strategies (23 of 35, 65.7%) measured by the StraBL-questionnaire were used differently, depending on the sport skill which was (hypothetically) learned. For example, the strategy "I practice the parts of the motor skill separately" (Item 30) was frequently used to learn high jump, but very rarely to learn golf or swimming, $F_{(5,228)} = 4.92$; $p < .001$.

Strategies in Motor Learning: The StraBL-Questionnaire

		F1	F2	F3	F4	F5
COGNITIVE STRATEGIES	01 I try to identify the key points of the motor skill	.75				
	04 I mentally execute the motor skill in a specific situation	.58				
	07 I think about variations of the motor skill to learn it better	.79				
	08 I think about the key points of the motor skill	.77				
	09 I try to find out if the motor skill is similar to other motor skills which I already know	.71				
METACOGNITIVE STRATEGIES	22 I mentally divide the motor skill into phases	.77				
	28 I compare the advantages and disadvantages of different variations of the motor skill	.58				
	02 Prior to a practice session, I set goals for myself	.68				
	10 I think about which parts of the motor skill I need to practice further and which not	.72				
	18 Difficult parts of the motor skill I practice particularly attentive and intensive	.77				
INTERNAL RESOURCES	21 I make comparisons between my trials and the trials of others in order to know if I do it right or not	.76				
	23 I try to find out which parts of the motor skill still cause problems to me	.73				
	26 Before the practice session, I think about the most effective procedure	.72				
	29 If I can't master the motor skill, I practice more intensely	.57				
	06 I continue practicing even when I don't like the motor skill	.76				
EXTERNAL RESOURCES	13 I practice the motor skill until I'm sure to master it	.68				
	19 If I notice that I'm not focussed, I try to reconcentrate myself	.72				
	24 I use a schedule for practicing	.67				
	31 When I am practicing, I am completely focussed	.69				
	32 I time my practice sessions	.50				
MOTOR STRATEGIES	05 I arrange my environment to be able practice efficiently	.48				
	11 I ask someone to help me actively	.70				
	17 I ask someone to demonstrate or explain the motor skill to me	.67				
	20 I practice in a group	.79				
	25 I search for helpful information about the motor skill in journals and books (e.g., exercises, pictures)	.64				
MOTOR STRATEGIES	27 I ask someone to give me feedback	.65				
	33 I use electronic media to get informations about the motor skill	.50				
	35 I make sure that there is no distraction in my environment	.47				
	03 I practice the motor skill in different variations	.64				
	12 I practice the motor skill repeatedly	.70				
	14 At first, I practice the motor skill in a simplified way	.50				
	15 I practice alternately several variations of the motor skill	.46				
	16 I practice first the easy parts of the motor skill and then the difficult parts	.54				
	30 I practice the parts of the motor skill separately	.45				
	34 When I am practicing, I use visual or acoustic markers	.46				

Figure 2: Results of an exploratory factor analysis
Method: Principal components
(Total Variance Explained: 54%)

Method

STUDY 1

- ⇒ Purpose: (1) Testing the factorial validity of the StraBL-questionnaire; (2) Measuring the inter-item reliability of the StraBL-questionnaire.
- ⇒ Participants: 170 students (92 men, 78 women; $M = 24.2$ years).
- ⇒ Procedure: Learning strategies should be measured within a specific learning situation (e.g., Leopold & Leutner, 2002). Thus, participants were instructed to visualize how to learn skiing and then complete the StraBL-questionnaire.
- ⇒ Data analysis: Exploratory factor analysis (principal components with varimax rotation); part-whole correlations; internal consistency (Cronbach's alpha).

STUDY 2

- ⇒ Purpose: Testing the hypothesis that the use of learning strategies is task-related and, thus, specific to the task or situation.
- ⇒ Participants: 240 students (120 men, 120 women; $M = 24.4$ years).
- ⇒ Procedure: Participants were instructed to visualise how to learn motor skills of six different sports (e.g., athletics, golf; see figure 1) and then respond to the StraBL-questionnaire.
- ⇒ Data analysis: 6 (task) x 2 (gender) analysis of variance (ANOVAs)



Figure 1: Motor skills used in Study 2

Discussion

- ⇒ Overall, the data suggest that the StraBL-questionnaire is a valid and reliable measure of learning strategies in sport and is worthy of further development and use: (1) The factor analysis provides support for the differentiation of five groups of strategies, (2) the alpha coefficients are at good level, (3) in line with results in the field of cognitive learning, strategies in motor learning are task-specific.

- ⇒ However, it is important to note some restrictions of the present studies: (1) The German version of the StraBL-questionnaire was evaluated, *not the English version presented in figure 2!* The validity and reliability of this version is to examine in a further study. (2) *Only hypothetical learning situations were used!* In future studies, the StraBL-questionnaire should be applied on real learning processes in order to validate our findings.

- ⇒ In study 2 evidence was found that the use of learning strategies depends on gender, that is, *men and women used different strategies* in motor skill learning (see Bund, in press). Future research on learning strategies should address this and other learner-related aspects (e.g., age, skill level, goal orientation, self-efficacy). Furthermore, different learning tasks should be used (e.g., simple vs. complex tasks).
- ⇒ Another promising option is the interdisciplinary cooperation with cognitive psychologists in order to examine the behavioral differences between cognitive, or academic, learning and motor learning.

References

- Artelt, C. (2006). Lernstrategien in der Schule [Learning strategies in school]. In H. Mandl & H.-F. Friedrich (Eds.), *Handbuch Lernstrategien* (pp. 337-351). Göttingen: Hogrefe.
- Bund, A. (in press). Zur Geschlechterspezifität von Lernstrategien im Sport [Gender-specificity of learning strategies in sport]. *Leipziger Sportwissenschaftliche Beiträge*.
- Bund, A. & Wiemeyer, J. (2005). Strategien beim selbstgesteuerten Bewegungslernen: Ergebnisse zur Validität und Reliabilität eines neuen Fragebogens [Strategies in self-regulated motor learning: Validity and reliability of a new questionnaire]. *Zeitschrift für Sportpsychologie*, 12, 22-34.
- Leopold, C. & Leutner, D. (2002). Der Einsatz von Lernstrategien in einer konkreten Lernsituation bei Schülern unterschiedlicher Jahrgangsstufen. *Zeitschrift für Pädagogik*, 45, 240-258 (Beiheft).
- Schmitz, B. & Wiese, B. (2006). New perspectives for the evaluation of training sessions in self-regulated learning: Time-series analyses of diary data. *Contemporary Educational Psychology*, 17, 64-96.
- Spörer, N. & Brunstein, J.-C. (2006). Erfassung selbstregulierten Lernens mit Selbstberichtsverfahren. Ein Überblick zum Stand der Forschung [Assessing self-regulated learning with self-report measures: A state-of-the-art review]. *Zeitschrift für Pädagogische Psychologie*, 20, 147-160.
- Streblov, M. & Schiefele, U. (2006). Lernstrategien im Studium [Learning strategies in university]. In H. Mandl & H.-F. Friedrich (Eds.), *Handbuch Lernstrategien* (pp. 352-365). Göttingen: Hogrefe.

