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The development of traits of self-regulation in vocational education and training – A Longitudinal Study

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**The development of traits of self-regulation in
vocational education and training –
A Longitudinal Study**

The development of traits of self-regulation in vocational education and training – A Longitudinal Study

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Abstract

In this paper we provide reliability and validity data on the German language version of the Trait-Self-Regulation Questionnaire and report on the use of self-regulation as an outcome variable in training.

The notion of self-regulation defines a comprehensive field of research and of theory development within educational psychology (Bandura; Deci & Ryan). A major area of interest is self-directed learning (Simons; Boekarts). The focus of this paper is on the development of traits of self-regulation within vocational education and training (VET). This perspective is in accordance with the general objective of VET within the German speaking world. In Germany, it is addressed by means of the phrase 'training for the ability of self-directed planning, regulation and evaluation of vocational performance'. In Switzerland the notion of the 'life-time entrepreneur' is discussed.

In order to foster related abilities useful on the job site, specific vocational training programs were implemented in a training center in Switzerland. One of such approaches is under evaluation in this longitudinal study. From 1999 to 2003, a cohort of more than 100 apprentices has been monitored in respect to the development of vocational skills and traits. One of the trait instruments used is a German language version (Breuer) of the Trait Self-Regulation-Questionnaire (TSRQ). The English version of this questionnaire is documented by O'Neil and Herl (1998) and Hong, O'Neil, and Feldon (in press). The instrument covers four aspects of self-regulation: planning, self-monitoring, effort and self-efficacy. Data have been collected over 5 points of measurement covering the full apprenticeship program of 4 years. The focus of the data analysis is on the development of the traits over time.

Results indicate support for the factor structure of the questionnaire, sufficient internal consistency, and differential effects of training for subgroups among the trainees. As to our knowledge there is no other data set that has been published for vocational education and training using such approaches to both measure self-regulation in the German dual vocational system of training and attempt to train it in realistic, applied settings.

Self-Regulation Abilities in Vocational Education

1.1 Constructs of self-regulation

The competence of self-regulation has become an objective for academic learning throughout western societies. Zimmermann (2000, 221) as well as Weinert (1996) have stressed the importance of self-regulatory processes for both learning and achievement. In reference to Zimmermann individuals are capable of self-regulation, when they are able to participate in their personal activities in respect to their meta-cognition, their motivation, and their behavior (1989, 329). Weinert (1996, 5 -6) has added the volitional dimension of self-regulation by the inclusion of attitudes that protect intentions for learning against competing motives.

Theories of self-regulation are rooted in different paradigmatic orientations. There is a strong background from social-cognitive learning theory, which has been grounded by Bandura (1979; 1986). There is an *operant* root (Mace et al. 1989; Belfiore & Hornyak 1998) and there is one from *phenomenology* (comp. McCombs 1989). There too is a *cognitive-constructivist* root referring to Piaget and Bartlett. Paris & Byrnes (1989) are considered to be representatives of this orientation (compare Zimmerman 1989b, 21).

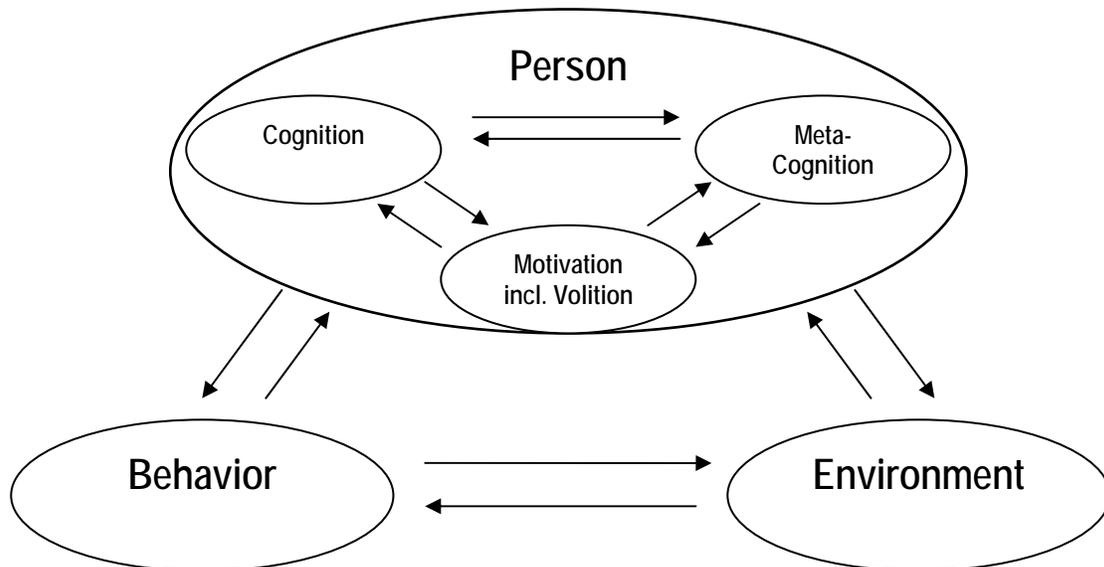


Figure 1: A model of self-regulation

Above differences in foundations the schools share the notion of the self-management of individuals in the processes of learning and achievement. In orientation towards the strong basis for self-regulation processes from social-cognitive learning theory we here adopt the basic interaction process between person, environment and behavior (Bandura 1997, 6). Maddux (1995, 5) has referred to this interactivity using the term of 'triadic reciprocity'. We extend this view (compare figure 1) in respect to a differentiation within the personal element in reference to the interacting processes of motivation and volition, meta-cognition and cognition (Breuer & Brahm, in press; Tennyson & Breuer 1997). This view highlights the active contribution of the individual to the processes of

self-regulation. It also gives focus to the three central processes of cognition, metacognition and motivation with the inclusion of volition. The structure can be referred to for the design and the development of an instrument which provides measures for the individual ability of self-regulation.

1.2 Fostering of Developments

From the perspective of vocational education and training (VET) there are three perspectives on the development of abilities of self-regulation. First there is the objective of stimulating self-regulation for individuals in general as in all compulsory education (compare Baumert et al. 1999, 19; Mittag, Kleine & Jerusalem 2002). Second there is the line of fostering self-regulation in respect to qualified vocational achievement. Within the German VET-system this is reflected in the term 'education and training for qualified vocational performance which includes self-directed planning, execution and control of activities' (compare KMK, 2002, 5). This indicates the change from highly specialized vocational practices within externally controlled conditions to a flexible craftsmanship based on the ability of self-regulation. Third there is the dimension of life-long learning in respect to vocational qualifications. Individuals become challenged more and more by vocational careers in which flexibility and mobility have become standard demands rather than exceptions (Dubs 1995, 171; Beck 2000). In this respect, the ability for self-directed vocation-centered learning activities is becoming essential. While the objective of fostering abilities of self-regulation in all three dimensions is out of question, it is not well defined in respect to the level of self-regulation which is to be achieved. Levels of control of action vary between the personal belief of being able to cope and the feeling of helplessness (Seligman 1975). The later is clearly undesirable. The level of control however, which an individual should be able to practice at the state level, may vary according to environmental conditions or to the level of experience a certain performance is based within. For cognitive respectively subject-matter oriented learning processes the expectation of 'more' or 'higher' knowledge acquisition is generally shared. For the development of abilities of self-direction this may not be an appropriate perspective. The notion of the limit capacity of the human information processing system may be a good reference for the expectation of an 'optimal' level of abilities of self-direction, which can be referred to according to situational needs.

2 The 'Lernzentren Baden' and its Approach to VET

2.1 The idea of the *Lifetime-Entrepreneur*

The ambiguous meaning of the expression is appropriate: Self-regulation is under construction. On the one hand self-regulation is a theoretical construct giving a description of personal traits or cognitive processes. On the other hand self-regulation is a learning objective which can never be achieved once and for all; in contrary it is a lifelong challenge. Educational attempts to foster self-regulation are confronted with both of these meanings. How can a concrete teaching and learning arrangement supply the students or trainees with measurable and sustainable self-regulation abilities? How can we organize learning environments where self-regulation is more than a pretending slogan? Especially in the field of vocational education there is – due to the permanent social change – a great demand of skills concerning self-regulation. But at the same

time the context of changing production and service conditions indicates also the problems of self-regulation as an objective or tool in vocational education: As Luhmann and Schorr have stressed, there is a principle lack of technology in teaching. The idea of imparting knowledge to a person presupposes a certain kind of causality, but for social interactions there is no causality which is valid objectively (Luhmann & Schorr, 1982). Foucault marked within the scope of his theory of social power the meaning of self-regulation as a self-technology. A technique of developing the own self can turn out to be a subtle mechanism of governing other people (Foucault, 1993). These short remarks suggest that the implementation of self-regulation in vocational education is really a complex challenge. Since 1999 one of the largest providers for technical vocational education in Switzerland practices a training concept which tries to arrange a learning environment especially suitable for the development of self-regulation abilities. The "Lernzentren - Lehrlinge für die Wirtschaft" (the former "ABB Lernzentren") were a specialized enterprise (according to the Swiss law as an association) which was instituted by Asea Brown Boveri (ABB), ALSTOM, Bombardier and 50 more companies. For these companies the "Lernzentren" provide the basic vocational training. This means that each company is no longer responsible for vocational training on its own. There now is an independent and specialized company, which offers - as a service centre - training and further development programs for its clients. In total 880 trainees have been employed by the "Lernzentren" in 2001. Most of these trainees aim at a diploma as a Polymechanic-, as Automation- or as an Electronic-technician. There also is a program for trainees in business administration and for IT specialists. After a multi-stage entrance test the vocational training at the "Lernzentren" takes four years and is divided in two main segments. During the first two years (for all technical programs the first one is similar) the trainees learn and work in working units, called "Kleinunternehmen", which means "Small companies" (SC) at the "Lernzentren" itself. At the end of this basic training they have to pass an intermediate test before they can work through the third and fourth year at a workplace in one of the different member companies. To get the final diploma they have to pass an official final examination according to federal standards. Throughout the training program the trainees have to attend public Vocational School for two days per week. Some of the trainees visit higher vocational Matura-school. The apprenticeship program is organized according to federal regulations and is executed under supervision of the governmental authorities. Each SC in average is set up from 12 first year, 12 second year trainees, and 3 master trainers. The label "Small Company" expresses the training philosophy pretty well. The trainees have to manage their learning and working unit supervised and fostered by their trainers only. That way the trainees are involved in and are responsible for acquisition and direct customer contact. Each SC is independent in an economic sense, they all have to accomplish given turnover objectives and have to meet given standards of quality management. Integrated in the operational processes the trainees take part in all activities of a real company: offer, acquisition, production, delivery, quality control etc. As a consequence of this organizational structure one can distinguish between 3 different types of orders, which the trainees have to perform on: These are orders by external customers, orders by internal customers (e.g. other small companies) or so called Learning tasks. The later ones become introduced to reach learning objectives, which can not be covered by means of external or internal orders. The management of the "Lernzentren" makes use the catch word "life-time entrepreneur" in order to summarize the overall educational objective of the SC-concept. A life-time is supposed to be acting

and not reacting in his professional environment. In this manner he or she is a proactive creator who knows that his or her own life not simply happens but has to be shaped actively. The entrepreneur is able to solve problems by self-reflection as well as in working-teams. He/she is not hoarding up knowledge but textures his knowledge in complex cognitive networks. So the "lifetime-entrepreneur" is more an ideal than a pedagogical target. In a more educational language we can address the main educational objectives - among others - as the promotion of traits of self-regulation, of self-directed learning and working, of subject-matter, social and methodical competences, the promotion of vocational creativity and of structural knowledge (Eugster, Wosnitza, Nenniger & Rüegg, 2003). An apprentice is expected to develop into a lifetime-entrepreneur if he/she can learn and work within a specifically organized and at the same time realistic vocational environment. The trainee has to be able to act on grounds of a differentiated structure of knowledge and competences that constitute a general vocational and life-aptitude based on the interactions of the components. Such accompanied and conducted processes of self-promoting enable him or her to use his or her independence creatively and responsibly. Within such an empirical framework the training concept "lifetime-entrepreneur" is embedded in the present discussion about lifelong learning. It connects the fundamental (anthropological) and never-ending need for learning with the social and economical conditions of globalization. More consequent, than the proclamation of basic key competencies ("Schlüsselqualifikationen") in the early 1970s (Mertens, 1974), the "lifetime-entrepreneur" focuses the fields of action also as markets (Voss, 1998; Voss & Pongratz, 1998). This includes not only the fact that he or she learns and works in a self-regulated manner but also that he or she uses self-regulation skills very consciously and strategically.

2.2 The approach to evaluation

It is to be supposed that the "lifetime-entrepreneur" provides the notional and perhaps theoretical link between the complexity of today's vocational education (e.g. lifelong learning) and what is expressed by the hardly translatable term "Beruf" (Rahn, 2002; Schulte, 2002). Whatever is implied in this term full of history, it describes the cornerstones of the apprenticeship in the typical dual vocational education as we find it in Switzerland and other German speaking countries. Although industrial production is involved in fundamental changes learning at the working place is still an important part of the socialization of a large number of young adults. Industry is actively involved and has benefits from these investments (Wolter & Schweri 2002; Wolter, Mühlemann & Schweri 2003). To become an entrepreneur includes first and foremost the task to master the transition from school into the labor market. These short references to the different connotations of a "lifetime-entrepreneur" indicate the difficulties an evaluation of such a training program is confronted with: For the "Lernzentren" the most relevant question is whether the graduates of the training have become 'real' lifetime-entrepreneurs. Obviously this question can not be answered in a direct way it was rather the starting point of a complex cascade of different methodological decisions. In a co-operation project of the University Koblenz-Landau, Campus Landau (M. Wosnitza, P. Nenniger), the Johannes Gutenberg-University Mainz (K. Breuer), the Swiss Federal Institute of Technology Zurich (K. Frey, B. Eugster), and the Lernzentren (A. Rüegg) we have tried first to specify the central dimensions of a lifetime-entrepreneur described

above. In order to record the different dimensions in a valid and reliable way we have selected several approved instruments which we have, if indicated, adapted to the special conditions of the "Small Company" in the Lernzentren (Wosnitza, Eugster, Nenniger & Breuer, 2000). The instruments administered are:

a) *Subject-matter, social and methodical competences* - an adapted version of the Competence-Questionnaire by Frey (1999),

b) *Learning and controlling strategies* - an adapted version of the Questionnaire "Motiviertes selbstgesteuertes Lernen " by Nenniger, Straka, Spevacek & Wosnitza (1995),

c) *Structural Knowledge* - "Mannheimer Netzwerk- Elaborierungstechnik" by Eckert (1998),

d) *Self-Regulation Abilities* – German version of the "Trait Self- Regulation Questionnaire (TSRQ)" by O'Neil & Herl (1998) (German Version by Breuer, 1999),

e) *Vocational Creativity Questionnaire* - "Berufsorientierte Kreativität" by Arbinger & Lissmann (2000),

f) *Vocational Training Conditions* - an adapted version of the "Mannheimer Inventar zur Erfassung betrieblicher Ausbildungssituationen (MIZEBA)" by Zimmermann, Müller & Wild (1994).

For the evaluation we have chosen a design that admits as well to compare different groups of the sample as to analyze different longitudinal sections: The first measurement with the instruments a) to d) took place during the first week of the training. Following up all instruments have been applied at the end of each year of training. So there are 5 points of measurement in total. Beyond this we also collect personal data (especially from the entrance-test) and marks from assessments in school and at the workplace. The interrelations between of the different pieces of information should reveal a deeper understanding of the developments the apprentices run through during their whole training program. We assume that the profiles which appear in outlines will support an answer to the question whether the SC-training concept of the "Lernzentren" is successful in fostering learning and working competences. Following the cohort of the technical apprentices who have entered a "Small Company" at the Lernzentren in August 1999 we can cover a sample of 133 trainees. 60 of them are polymechanic-, 48 automation-, and 25 electronic-technicians. All of them are male.

2.3 The 'Trait Self-Regulation Questionnaire' - TSRQ

According to the argumentation within the introduction an instrument for the measurement of abilities of self-regulation should cover four dimensions. These are the constructs of cognition, of meta-cognition, of motivation and of volition. In addition there is the need to differ between the approaches of depicting self-regulation as a state respectively as a trait. The distinction has been introduced by Spielberger (1975) within his research on anxiety. He differs between anxiety in form of a temporary state and of a relatively stable trait over time. The objective of our study is to trace the development of abilities of self-regulation in a longitudinal approach. This only can be achieved by the use of an instrument which depicts the individuals' traits. Temporary states may vary according to situational demands of the environment and do not support a developmental perspective. The theoretical foundation for the trait approach has been given by Bandura (compare Maddux, 1995, 7–8), though there is still a debate on the issue of generality versus specificity of abilities for self-regulation (Maddux, 1995, 8). There is an implicit tension between the notion of stability of traits over time and the educational objective of fostering such traits in processes of VET. Self-regulation abilities factually can be applied to more or less general environmental conditions. There however is no general abstract ability without reference to the environment. The trait approach has been adopted by O'Neil and co-authors (O'Neil & Herl 1998) for the design of the Trait Self-Regulation Questionnaire. This has been used as the basis for the development of a parallel version in German language (Breuer 1999). The structure of the questionnaire is based on four scales which cover two dimensions (compare Figure 2). It does not meet the requirement of covering the four dimensions stated above. The dimensions Cognition and Volition are missing at first glance. Volition however can be considered to be at least partly covered within the scale *effort*, as effort contributes to holding up motivation for the time necessary to solve a given problem. In this respect the scale *effort* is close to the construct of volition. An attempt to cover the dimension cognition is in contradiction to the trait approach. Cognition always refers to content and different contexts result in the use of different cognitive strategies. There hardly are general cognitive processes which could be depicted by means of a trait-based self-evaluation instrument.

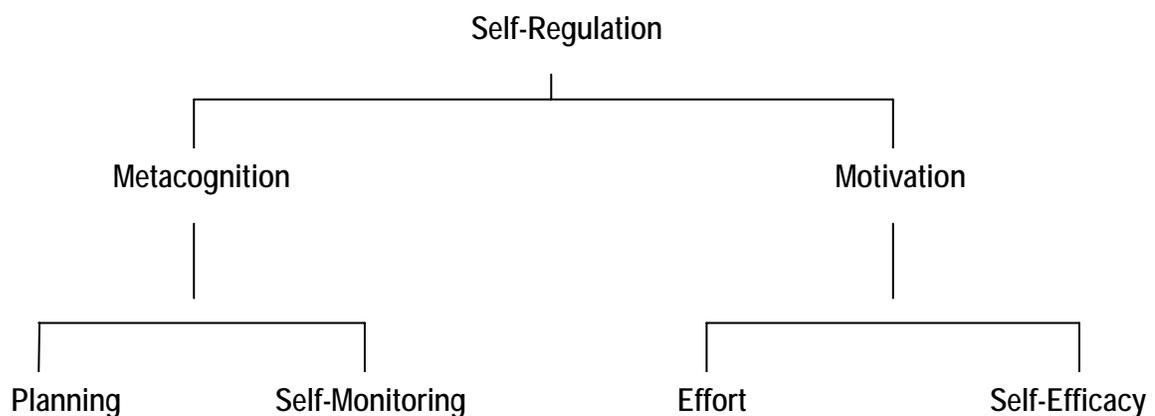


Figure 2: Structure of the TSRQ (adopted from Herl et al., 1999, 1)

In a positive perspective it is possible to state that the TSRQ covers the dimensions meta-cognition and motivation. Each comprises two sub-scales. For meta-cognition the subscales are planning and self-monitoring. For motivation they are effort and self-efficacy. Planning means targeting for an objective based in a plan. Self-monitoring supervises the process of achieving an objective. Effort depicts the degree of endeavor invested in the achievement of an objective. Self-efficacy ‘... refers to the resoluteness of a person’s convictions that he or she can perform a behavior in question.’ (Maddux 1995, 9) The four scales are based in 8 Likert-type items each.

	Fast nie	manchmal	Oft	Fast immer
3. Auch wenn mir eine Aufgabe nicht liegt, strenge ich mich an, um gut abzuschneiden.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I work hard to do well even if I don't like a task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Fig. 3: Sample item from the TSRQ in German and English language

They present statements in respect to learning-activities in VET. Participants have to rate their general behavior in vocational learning activities in respect to the statements. An example in German and its English language equivalent is given in figure 3.

The instrument has been validated based on a larger sample of participants in the field of VET (Breuer & Brahm, in press). All items attract responses which vary across the full scale. The mean for the scale *self-monitoring* is reported at the value of 2.7. For the three additional scales the mean is at about the value of 3.0. The internal consistency of the scales is represented by Cronbach’s alpha at ~ 0.7 (compare Table 2).

Table 2: Descriptive parameters for the scales

Scale	Minimum	Maximum	Median	Mean	Standard-deviation	Cronbachs Alpha
Planning	1,50	4,00	2,88	2,94	0,44	0,74
Self-Monitoring	1,63	3,75	2,71	2,68	0,40	0,66
Effort	2,00	3,88	3,13	3,14	0,43	0,71
Self-Efficacy	1,50	4,00	3,00	3,01	0,41	0,83

A confirmatory factor analysis based on a model of the four scales comes up with the fit indices according to Table 3.

Table 3: Fit indices for the confirmatory factor analysis

Index	Threshold	Empirics
χ^2/df	≤ 2	1,81
GFI	$\geq 0,90$	0,87
AGFI	$\geq 0,90$	0,86
RMSEA	$\leq 0,05$	0,047

The results indicate that the model depicting the four scales is reasonably supported by the fit indices (Brahm 2003). The German version of the TSRQ can be considered to be a valid instrument for the purpose of self-evaluation of traits of self-regulation. Results from the use of the scales should be well grounded.

3 Findings from the evaluation

3.1 The development of Traits of Self-Regulation

The trainees rate the level of their individual traits of self-regulation on the 32 items (4*8) of the TSRQ by means of a four-stage scale. The value expressing the individual levels on a scale is composed as the mean over the eight ratings within each scale. The arithmetic median value on a scale is 2.5. That way values above the median of 2.5 indicate positive and values smaller than 2.5 negative estimates on the personal traits of self-regulation.

Development of the mean values:

At the beginning of the training program (t_0) the trainees show high values on all four scales (planning, self-monitoring, effort and self-efficacy) that lie on the scale-mean (self-monitoring) or are distinctly positive (Figure 5) (Wosnitza, Eugster, Nenniger & Breuer, 2001). At the end of the basic training, that is two years later (t_2), the values on the four scales are almost similar: The value of one scale decreased slightly below the scale-mean (self-monitoring) whereas the values of the three other scales have stabilised on a high level (Figure 4). It is interesting to observe that the value of the scale "self-monitoring" returns approximately to the starting point after reaching a marked higher value at the end of the first year (t_1). During the third and fourth year (t_3 , t_4) of the training the mean values for the three scales "effort", "planning" and "self-efficacy" remain on the same level. The mean value of the scale "self-monitoring" increases again to the level reached at the end of the first year.

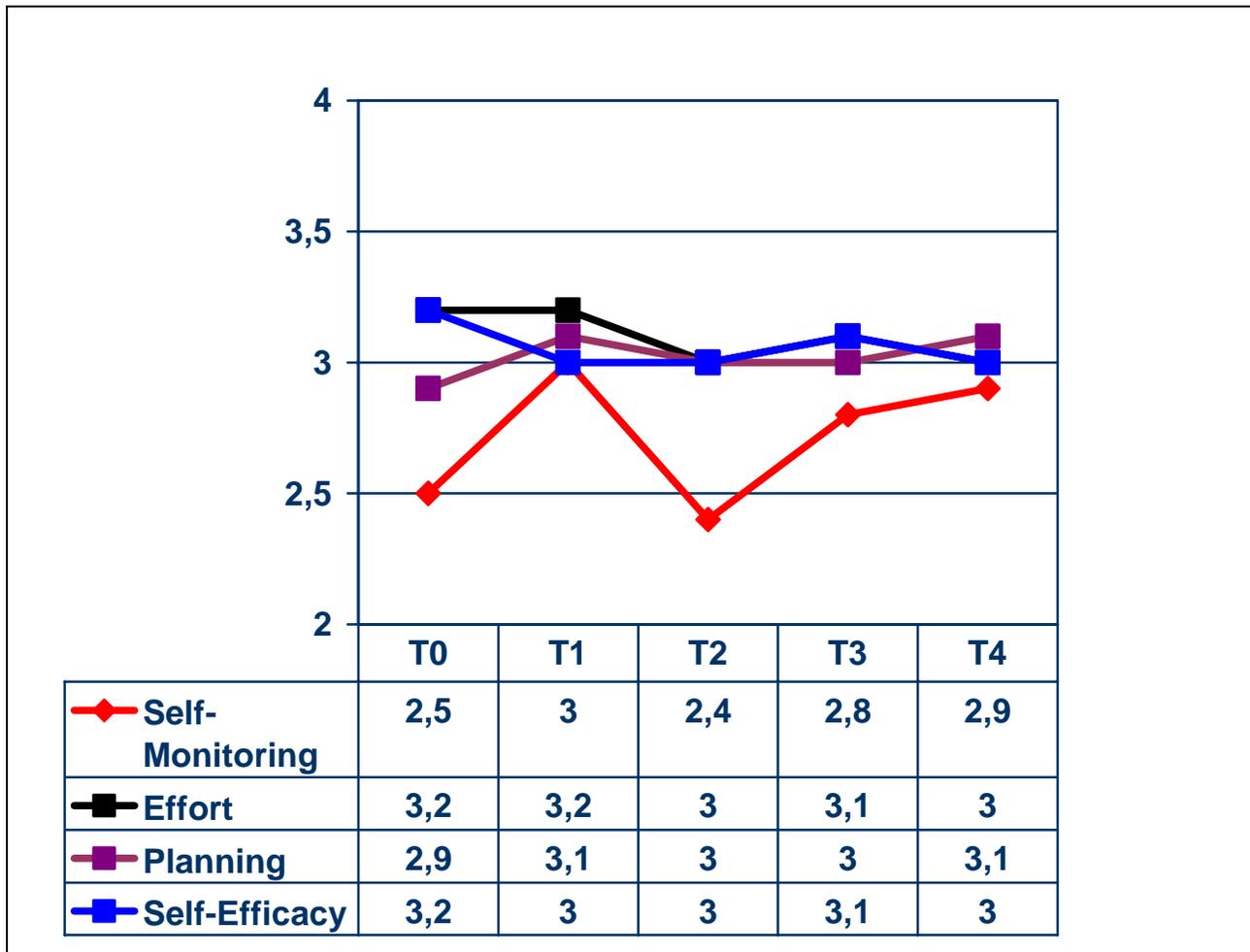


Figure 4: Mean scale values over time (N =133)

When analysing the development of the values over the four years of the training one can state significant increases and decreases in some extent. The scale "self-monitoring" shows the most remarkable development. In all the mean values starts in the positive range and fluctuate there more or less distinctly

Levels of self-regulation:

For a more detailed analysis we first have split the trainees into two subgroups that differ in regard to the values the trainees achieved at the end of the second year. For that grouping we have applied a cluster analysis technique. While the first group holds values around the scale-mean (type 1) the second group (type 2) shows values that lie above the scale mean. A comparison of the two groups in regard of additional measures applied in this evaluation comes up with a theory conform relation: Apprentices with higher values in the self-regulation scales (type 2) have achieved significantly higher marks during the second year of training in the assessments at their workplace than type

1 trainees. Development of the initial level: The mean values of all trainees rested rather stable during the basic training. In such an aggregated analysis the development of the individual trainees is not expressed. Especially what concerns the self-regulation scales, it is interesting to see which profiles of development can be differentiated.

In order to investigate such relations we have split the sample according to the quartiles on each scale. Thus the lower quartile represents the trainees who achieved the lowest values at the beginning of the training. Corresponding to that the upper quartile includes the trainees with the highest initial levels. This perspective allows an answer to the question whether the training concept of the "Small Company" can foster trainees who start their training on different levels. Programs based in self-regulation of learning activities are considered by instructors and as well from a scientific perspective (Dubs, 1993) as selective in favor of high achievers. On account of their special development we will report the findings for the scales "self-monitoring" and "self-efficacy" in this paper.

Self-monitoring

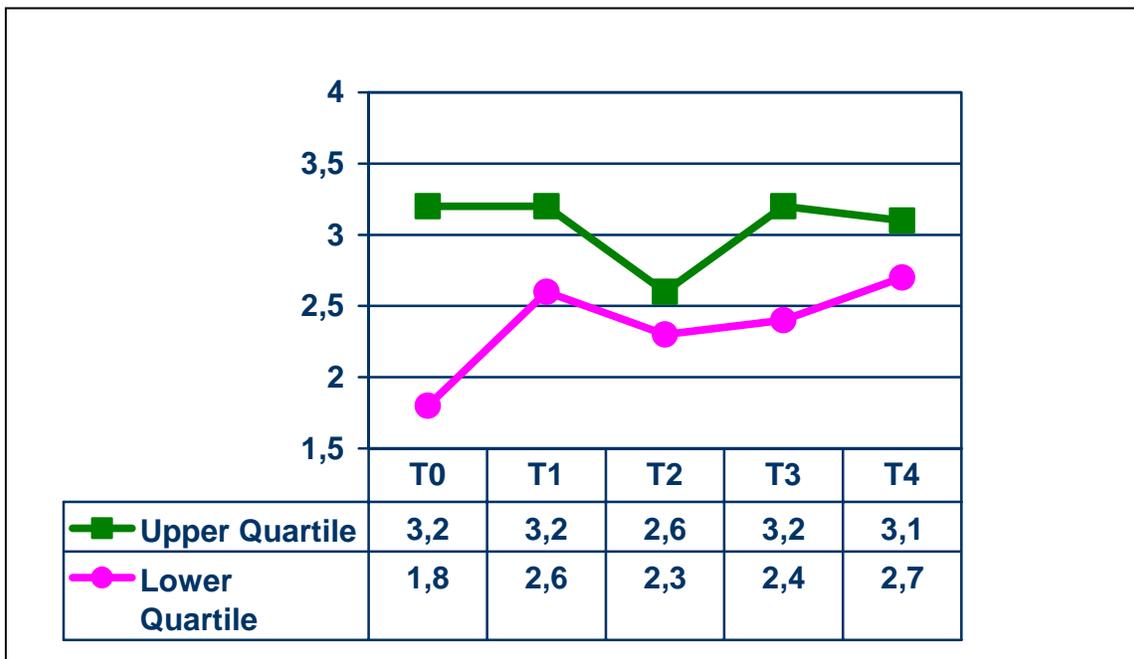


Figure 5: Development of the means for the extreme quartiles (N = 33) on 'self-monitoring'

The upper quartile starts with a rather high mean value (3.2) which remains stable during the first year (Fig. 5). In the second year there is a significant decrease (to 2.6) and during the third year an increase of the same amount. During the last year of the training program the mean value of the upper quartile remains on the same level.

The trainees in the lower quartile start with a mean value smaller than the arithmetic median value on a scale (1.8). During the first year we can observe a significant increase to a value a slightly above the arithmetic median value (2.6). In the course of the second year the mean value decreases to 2.3 and reaches 2.7 at the end of the training program.

We can conclude that for the trainees with a higher starting-level the learning environment is effective as self-confirmation. In contrast to this we can describe a development to the positive direction for the trainees with a lower starting-level.

Self-efficacy

For the scale "self-efficacy" we can state an approximation of the mean values of the lower and the upper quartile during the first year too. Different to the self-monitoring scale the trainees with the low initial level have achieved an even higher mean than the trainees who start on a high initial level (Fig. 6). The upper quartile starts at the maximum level of 4.0, drops significantly to 3.2 during the first year and decreases again significantly during the second year (2.8). The mean value of the lower quartile increases significantly from 2.3 to 2.9 during the first year. During the second year the mean increases again to a scale value of 3.1. In the course of the third year there is again a crossing of the two lines of development, because the value of the upper quartile increases again whereas the lower quartile remains stable.

During the fourth year both groups do not show any changes.

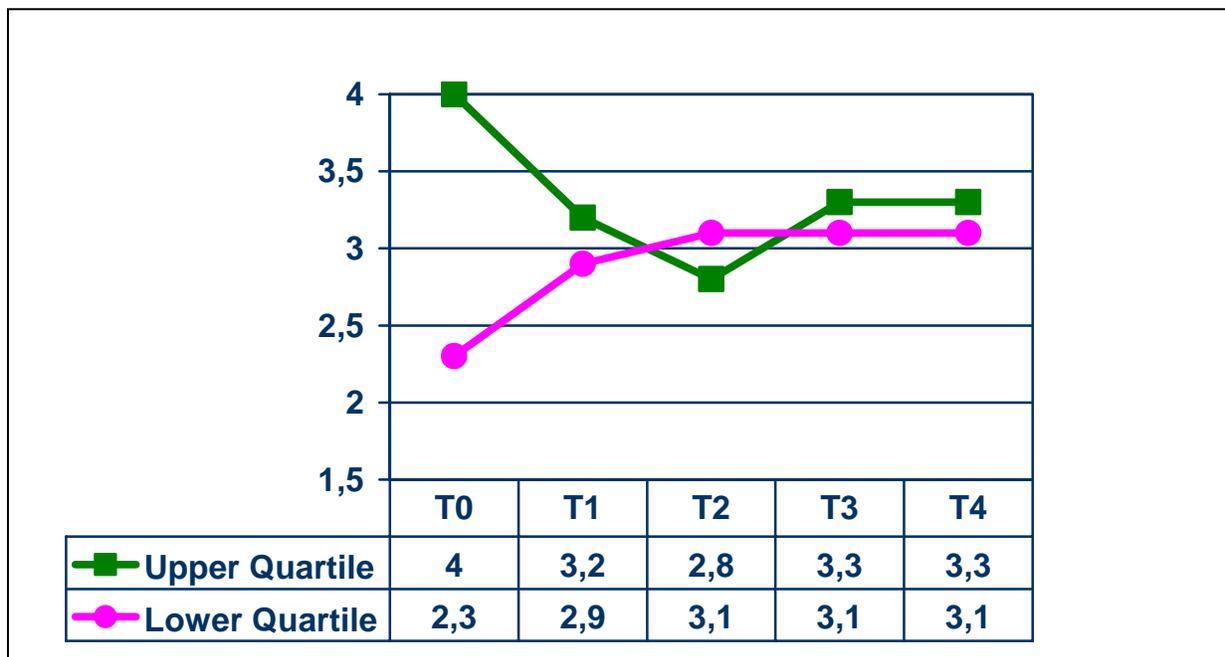


Fig. 6: Scale "self-efficacy", means for the extreme quartiles (N = 33).

The result may indicate a differential effect of the 'Small Company' training approach on the development of the 'self-efficacy' of the trainees. But as well as this effect was not evident within the overall analysis (compare Table 2) the means for the subgroups may

be affected by some extreme values or simply by some a statistical tendency of regression to the mean. To check for such impacts we have extended our analysis to the level of the individual differences. We have applied the logic of the ‘residual gains’ (Klauer 1973) in a variation on the pre- /post-measures ($t_0 - t_1$ and t_1 to t_2) for the individual trainees (Brahm 2003). The finding from this approach is that for each single trainee within the upper quartile the predicted post-test value is lower than the pre-test one. In reverse, for each single trainee within the lower quartile the predicted post-test value is higher than the given pre-test one. The developments in respect to a decline of high entry measures and an increase of low entry-measures can be confirmed at the individual level. Self-efficacy develops in a differential mode. The assumption, that traits of self-efficacy can be ‘fostered’ has to be phrased in more detail. Development in the light of our findings does not mean ‘higher’ measures on the scale of self-efficacy but rather measures which develop toward an ‘appropriate’ level of self-efficacy. Within the language of system dynamics development is not mere ‘growth’ but rather a ‘target-searching process’ over time. This matches the notion of a ‘triadic reciprocity’ between person, environment and behavior (compare figure 1).

3.2 Reflection on methodology

We have used the conventional approach for a ‘valid’ depiction of individual attributes. We have defined a design for an evaluation study. We have selected and administered instruments for which information on reliability and validity is available and we have compiled results using the information from the instruments. We report results on the developments of traits of self-regulation. The approach of a longitudinal study allows a reverse view also. We can use the information collected to look at the development of the measures of fit for our instruments. Table 3 holds that information in respect to the scale self-efficacy over the points of measurement t_0 to t_2 .

Table 3: Internal consistency of scale Self-Efficacy over time

<i>Scale / Alpha</i>	t₀	t₁	t₂
Self-efficacy	.8129	.7323	.8188

It is not surprising that the values on internal consistency can not be replicated exactly. They fluctuate over time. The consistency of the scale however remains at a level which is reported to be acceptable in other reports (Mittag, Klein & Jerusalem 2002, 151) and in standard textbooks on empirical methodology (Hair et al., 1995; Friedrichs 1990). Looking at the measures of fit for the confirmatory factor analysis (compare Table 4) however shows something like a decline in quality.

While the measure can be considered to be acceptable for the data from the first use of the instrument in the evaluation, this is not given for t_1 and t_2 any more. The measures no longer support a real good fit of the empirical data to the four-dimensional structure of the model. Did we loose validity?

The answer to the question is rather yes, if we explain the loss of fit to be based on an erosion of the participant’s motivation and accuracy to report on their perceptions of their

processes of self-regulation. From that view the findings, which we report are weekly grounded or may even be invalid.

The answer however may be no, if we assume that trainees are living in the reciprocal relation with environment and behavior as assumed within social-cognitive learning theory (compare Figure 1). The environment provides social support by means of models, verbal confirmation and assistance. There are processes of learning from personal experience; the consequences of the personal behavior become encountered. And there are structural features of the learning environment (in this case the structure of the Small Companies) which result in feedback processes.

Table 4: Measures of fit for the confirmatory factor analyses over time

Index	Threshold	t ₀	t ₁	t ₂
χ^2/df	≤ 2	1,81	2.50	1.74
GFI	$\geq 0,90$	0,87	0.83	0.79
AGFI	$\geq 0,90$	0,86	0.81	0.76
RMSEA	$\leq 0,05$	0.047	0.067	0.062

The personal behavior is a source of information too. There are processes of selfmonitoring, of self-evaluation and of self-reaction (Boekaerts, Pintrich & Zeidner, 2000). There is our questionnaire as part of the environment, which supports one approach to self-evaluation. All these processes have impacts on the perception of the individual traits. We have a classical case of a measurement which impacts the object. If there would not be any signals for some 'fluid validity', we rather would have to consider having not any impact by means of a sophisticated program of VET such as the SCs. In essence we will have a co-occurrence of both processes and can not attribute the decrease of fit in our explorations to one of the two sources.

4 Conclusions

The results of this evaluation study first indicate that effects over time in respect to the development of the traits of 'self-monitoring' and of 'self-efficacy' are observable. We can not directly attribute these effects to the training concept, as there is no experimental control over this interrelation. For the necessary internal validity the study lacks a control group with a 'standard' training concept. There was a plan for such an approach. This plan however failed, because of the attractiveness of the 'Small Company' concept. The training conditions for our control group were switched to the experimental ones soon after the concept had been introduced at Baden. That way we logically can not attribute any of our results to the training environment. At a level of plausibility the result nevertheless indicates a differential effect from the training concept of the 'Small Company' on trainees with low and high starting values in respect to 'self-monitoring' and 'self-efficacy'.

We too can learn that instruments which have been validated in the conventional

approach may be of limited value for longitudinal studies with repeated measurement designs. The limit may be given by processes of self-reflection which result in the elaboration of individual notions and perceptions of personal traits. There is a logical gap between the methodological expectation of stability of traits and the educational expectation of fostering traits, which can not be bridged by means of the conventional 'linear model' of statistical analyses. This approach does not cover interactions between variables, developments over time, delays of effects, and feedback processes in the development of a system. This however is exactly what is supposed to happen when we look at the basic model given from social cognitive learning theory (compare Fig. 1). Is there a solution to this problem? There is one approach which may help. There are attempts to model the structure of learning processes applying the methodology of System Dynamics (Gonzalez & Sawicka 2003). Besides the given approach of statistical modeling this may provide of view at learning processes which comprises the notion of non-linear developments over time. To make use of this approach we need well defined theories, as for example given with the cognitive social approach to learning, we need data from longitudinal studies for the purpose of validation of SD-based models, and we have to invest the effort of modeling learning processes and to come up with a deepened understanding of the dynamics within learning processes.

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