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Talent for the future

Social and personality development of gifted children
Proceedings of the Ninth World Conference on Gifted and Talented
Children



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Aims and methodological problems of an intervention study in gifted and talented girls

Kurt A. Heller, Germany

Changes in unfavorable personality features or socialization conditions are often the object of practical measures of support for the gifted. However, intervention of this kind is rarely studied scientifically. Even rarer are giftedness research studies which aim to test hypotheses in a scientific way, in spite of the benefits to be expected for theory and the insights for the practical support of gifted children and young people. Opportunities of this kind will be illustrated here with a quasi-experimental modification study on sex-specific problem solving behavior.

It has been adequately confirmed empirically that, in the fields of Mathematics, Natural sciences and Technology (MNT), girls (in relation to boys) show less interest and enthusiasm, have less relevant experience and (perhaps for these reasons) perform worse. Since the beginning of the 1980's these sex-specific differences have been the subject of intense scientific interest. The most important approaches to this topic in giftedness research have come from biology and neuroscience, socialization theory and cognitive psychology (cf. Beerman, Heller & Menacher, 1992).

Theoretical basis

One cause of the low interest and enthusiasm which girls show towards MNT often seems to be their low self-confidence. In the planned study a number of elements from the psychology of motivation, testing feeling of self-worth and control of action, are to be investigated in 200 boys and girls in the seventh year of grammar school classes (Gymnasium) with the main emphasis on mathematics and natural sciences.

The key elements of the study are as follows:

- General and specific causal attributions following success and failure.
- Regulation of action after success and failure ("control of action" in Kuhl's terminology).
- Self-evaluation of heuristic competence (according to the intention regulation model by Dörner et al.).

I would like to mention very briefly the following *theoretical concepts* which serve as a basis for this discussion.

(1) The *Causal Attribution Theory* attempts to describe how people explain, or attribute causes to the results of behavior. There are several possible ways to attribute causes of success and failure. With his concept of "locus of control," Rotter (1966) suggested a one dimensional classification system, according to

which the result of behavior can be explained as caused internally (i.e., under the control of the individual) or externally (i.e., outside the control of the individual). Heider's "stability dimension" (1958) highlights an additional type of causality according to which internal causes are assigned either to the ability of the individual (stable) or to his or her effort (unstable) and the external causes are assigned either to the difficulty of the task (stable) or to chance (unstable), i.e., good or bad luck. According to Weiner (1979) there are then *four conditions for the subjective attribution of causes of success and failure*:

- internal; stable (ability) vs. unstable (effort);
- external; stable (task difficulty) vs. unstable (chance).

Other dimensions discussed in the literature will not be discussed here.

(2) In the *control of action theories*, just as in attribution theory, the subjective experience of success and failure is stressed. However, the accent is on the consequences of the concrete execution of the action, thus extending the attribution theory in an important new direction. Kuhl's control of action theory (cf. Kuhl, 1981, 1983, 1987), which is derived from action theory, distinguishes between "control of intention" and "control of execution." In the present context we are mostly interested in the *control of execution*, i.e., the extent to which the realization of an action is continued when difficulties intervene.

Kuhl makes a further distinction between state- and action-orientation: a person preferring *state-orientation* tends to focus on past, present and future (internal or external) situations, whereas a person tending to *action-orientation* is more concerned with the alternative courses of action which could contribute to overcoming the discrepancy between a present situation and an intended goal situation. *State-orientation* is, in the context of this discussion, (and perhaps generally) the less favorable strategy. Kuhl distinguishes four different aspects of state orientation:

- planning centeredness, i.e., an excessive fixation on the weighing of alternatives before forming an intention;
- goal centeredness, which, especially during the execution of the action, can lead to disturbances of the control of execution;
- failure centeredness, i.e., focussing on failure and its (perhaps emotional) consequences;
- success centeredness, i.e., an excessive preoccupation with success-related cognitions, which can disturb control of action (Kuhl, 1983, p. 254).

A disposition to state-orientation, which can arise from unfavorable socialization experiences, is connected to a feeling of lack of control over external matters. Girls seem to have had both generally and in MNT more "helplessness experiences" -- in the terminology of Seligman (1975) -- than boys. It seems reasonable to expect that girls act in a more state-oriented way than boys and tend to be distracted from problem solving (during a physics lesson, for instance) by "worry cognitions."

(3) Dörner's *intention regulation model* (Dörner et al., 1983; Dörner, 1986) is based on the principle that "behavior and consciousness in complex situations are dependent on the importance of the various intentions, their priority and the

subject's assessment of his or her ability to solve the problem" (Stäudel, 1988, p. 136). A distinction is made here between heuristic and epistemic competence. *Heuristic competence* is "general and comprehensive metaknowledge" (Stäudel, 1988, p. 137) which plays a role in the acquisition of knowledge in new situations for which insufficient knowledge exists. *Epistemic competence*, in contrast, is the knowledge which is relevant to a particular task.

The self-concept of each person contains subjective estimates of these competences. An individual's estimate of his or her own heuristic competence is the extent of his or her trust in the ability to cope with new and challenging situations.

Main hypotheses

The central thesis of this quasi-experimental study is that the sex of the subject affects the way failure in the MNT area is handled and in particular that girls characterise the cause as "internal stable" more frequently than boys (cf. Ryckman & Peckham, 1987; Weary, Stanley & Harvey, 1989). Since girls often have less prior knowledge than boys in, for example, physics lessons, the tasks facing them are experienced as belonging to an area outside their control, leading over a longer period of time to learned helplessness (Seligman, 1975), which can be interpreted functionally as a deficit in intention regulation (Kuhl).

A pronounced state-orientation (in Kuhl's terminology) among girls in physics towards previous failure, together with corresponding impairment of the individual's assessment of her own abilities, eventually lead to deficits in motivation (cf. Meyer, 1987) and can bring about progressively lower achievement in the important area of MNT. The interdependence between attributional style, state-orientation and low achievement has been demonstrated by Stiensmeier-Pelster (1988).

The planned study will test the following *hypotheses* (the detailed sub-hypotheses are not given here):

- Action- vs. state-orientation does not generalise in every case, as Kuhl supposes. Instead, domain-specific patterns of action control come into play. The patterns vary according to sex. This hypothesis is to be tested in the questionnaire section.
- Habitual state-orientation can be overcome with training. The assumption is that when active action-control strategies and efficient problem solving strategies are taught, the relevant tasks can be dealt with more effectively. It is to be hoped that a simultaneous longer-term improvement in attribution style will also be observed as a result, leading to more active control of intent and action orientation. This hypothesis is to be tested in the intervention study.

Method

A sub-sample will *undergo attribution* training with the main aim of learning to cope with failure appropriately. There are three relevant models here:

- "Misattribution" - here the subject is to be persuaded that the emotions connected with failure and/or a low feeling of self-worth come from a source other than what the subject supposes.
- The "veridical attribution" approach, which aims to contribute to the formation of new causal attribution patterns, for instance in showing the cause of failure to be low effort and in promoting corrective action has positive effects for self-concept and achievement.
- "Attributional style therapy," with the aim of illuminating the internal causes of success, which are normally ignored by those in the experimental group.

The following concrete steps should assist in the realization of these intervention measures. First, the experimenters tell the trainees about the importance of causal attributions. Then the various attributional styles are explained and those styles which are characteristic of the trainees themselves are demonstrated. This could take the form of role-play or could run according to the failure attribution technique: the trainees are given a task which is insolvable in the time allowed and are then asked to give an explanation for their failure. Those who attribute success as internal stable are told that nobody ever succeeds with the given problem and that the cause of the failure is to be found externally. In this connection a third step has proved to be useful: feedback on the individual results scored on the attributional style questionnaire. The fourth and final step consists of a request to keep a diary of positive and negative experiences (success and failure). The trainee then brings the diary to a psychological counseling session and its contents are discussed with a psychologist. Positive and negative experiences (in particular in physics lessons) should be noted daily by the trainees - in this case, by the school children in experimental group 1. Particularly in the case of negative experiences, any external causes should be noted.

According to Antaki & Brevin (1982) changes in attribution perspectives can be reached within 4 to 5 weeks using a similar method. However, clinical intervention with e.g., depressive patients took much longer to achieve corresponding changes in attributional style. In the study planned here, with grammar school girls in the seventh year of education who are interested in MNT and have good results in it, we expect to be able to influence unfavorable causal attributional styles positively and sustainably within about twelve weeks.

So the planned intervention aims directly at changes in state-orientation and attributional style and also in problem solving strategy for physics tasks (heuristic competence) and indirectly at changes in self-concept, interests and school achievement, especially in physics.

The *experimental design* involves four experimental groups of comparable ability, each including both girls and boys (possibly in separate training groups):

- *Experimental group 1* receives the described attribution training.
- *Experimental group 2* is involved in solving physics problems, revising and elaborating in small groups the material dealt with in the normal lessons. It is intended to use Neber's *objective knowledge model* (cf. Neber, 1992) for that. The inclusion of this second experimental group should contribute to the testing of the subsidiary question regarding which form of intervention is more economical for improving achievement in physics.

- *Group 3* receives *placebo* training. Since the two experimental groups are involved not just with psychologists but also with their physics teachers, this group is also sometimes led by the trainees' physics teachers. This should assist the development of particularly close emotional contact between teacher and students, which could have an (additional) influence at least on the development of the trainees' interests. The placebo training measures themselves not only include presentations on successful women in MNT (e.g., using films) but also visits to technical museums and other relevant institutions. In contrast to group 1, the central aim is the development of the trainees' interest in MNT.
- *Group 4*, a *control group* subject to no special measures at all, merely takes part in the pre- and post-experimental measurements.

The four experimental groups will be taken from grammar school classes (Gymnasium) specialising in mathematics and natural sciences; ability and interest will be taken into account during the construction of the sample. Factors such as class atmosphere and the specific lessons received by individual classes will be statistically controlled.

As *measuring instruments*, questionnaires and depth interviews, as well as classroom observations, are planned. In addition, standardized ability and knowledge tests, teacher ratings, etc., will be carried out before the samples are designed. In the *data analysis* more complex statistical procedures such as variance analysis and path analysis will be used to supplement the usual evaluation methods.

The data gathering begins half a year before the beginning of school physics lessons (in the second half of the seventh year at school). At the beginning of the eighth year at school, which is also the first year of school physics lessons in Germany, the intervention program is started with a provisional duration of twelve weekly sessions, that is, three months in total. This program is followed by a second measurement point at the end of the first year of physics lessons, aimed at registering the stability over time of the training effect. Finally the participants of the two experimental groups and the placebo group attend a two-week "summer academy" for individual feedback on the evaluation results. Apart from the motivating effect for the participants, this academy offers the opportunity to reinforce positive attribution patterns in a lasting way and to apply intensive training in the case of any participants who did not benefit positively from the program.

The results from the two experimental groups will be compared with those from the placebo and no-treatment control groups in order to test hypothesis 2 (H2). Here, not only theoretical insights but also results of practical significance are to be expected. These could be useful for intervention, individual counseling and for the support of the gifted -- especially female -- students in subjects such as physics.

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