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HOW TASK EXPERIENCE INFLUENCES STUDENTS' PERFORMANCE EXPECTANCIES: THE ROLE OF CERTAINTY[1, 2]

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Summary.—The importance of performance expectancies for predicting behavior has long been highlighted in research on expectancy-value models. These models do not take into account that expectancies may vary in terms of their certainty. The study tested the following predictions: task experience leads to a higher certainty of expectancies; certainty and mean expectancies are empirically distinguishable; and expectancies held with high certainty are more accurate for predicting performance. 273 Grade 8 students reported their performance expectancy and the certainty of expectation with regard to a mathematics examination immediately before and after the examination. Actual grades on the examination were also assessed. The results supported the predictions: there was an increase in certainty between the two times of measurement; expectancies and certainty were unrelated at both times of measurement; and for students initially reporting higher certainty, the accuracy of the performance expectancy (i.e., the relation between expectancy and performance) was higher than for students reporting lower certainty. Given lower certainty, the accuracy increased after the students had experience with the examination. The data indicate that it may be useful to include certainty as an additional variable in expectancy-value models.

Expectancies are an important determinant of human behavior. Many investigations have shown that expectancies are highly correlated with performance in different life domains (Eccles, 1983; Bandura, 1997; Wigfield & Eccles, 2000). The basic assumption in expectancy research is that people generate expectancies on the basis of past experiences in order to predict the likely outcome in similar future situations. Expectancy-value models (e.g., Atkinson, 1957; Eccles, 1983; Wigfield & Eccles, 2000) typically postulate that expectations of valued outcomes influence people's choice, persistence, and performance. In this paper, the focus is on performance expectancies, which describe expectations people hold about their anticipated performance in a given, upcoming task (Marshall & Brown, 2004).

Olson, Roese, and Zanna (1997) defined expectancies as individual beliefs about future situations. Beliefs are bits of knowledge that relate attributes to a specific object. Research from the field of social cognition has

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found that beliefs can vary in the certainty with which they are held (as well as other dimensions) and that differences in the certainty of beliefs are of great importance; for example, certain beliefs are more predictive of later behavior than uncertain beliefs (Petty, Haugtvedt, & Smith, 1995). In models of performance expectancies, until now the role of certainty has been neglected. In the theory of planned behavior, certainty is discussed as one component of perceived behavioral control (see for example Ajzen, 2001). However, it must be pointed out that certainty can vary at different levels of behavioral control.

People build their performance expectancies out of previous experience and they use new experiences to adapt their expectancies (Olson, *et al*., 1997). Therefore, it was predicted that performance expectancies should become more certain with experience; specifically, individuals should hold more certain (Hypothesis 1a) and more accurate (Hypothesis 1b) performance expectancies after having been confronted with a specific task. That does not imply that expectancy should automatically increase, meaning that people are not necessarily expecting a better performance after they have had experience with the task. Rather, only the confidence in predictions should be higher after they have been confronted with the real task.

Certainty of an expectancy and expectancy itself should be independent dimensions (Hypothesis 2), because task experience should clearly result in higher certainty ratings but, at the same time, will make people realize that the task is difficult or easy, thus resulting in low or high performance expectancies. Apparently, this postulated independence between expectancies and certainty has not been demonstrated in previous studies. It is predicted that expectancies and certainty should not be correlated.

However, people hold expectancies with varying certainty even before being confronted with a task. It has been assumed and demonstrated that such differences in certainty can result from differences in information processing while building the beliefs (see Petty, Briñol, & Tormala, 2002). In a series of studies, Dickhäuser and Reinhard found that, depending on cognitive motivation, people build their performance expectancies differently (Dickhäuser & Reinhard, 2006, 2008, 2009; Reinhard & Dickhäuser, 2009, 2011). Given high cognitive motivation, expectancies are built via a central route of information processing. This route is characterized by deep processing of all information relevant to the judgment. Given a central route, expectancies are more closely related to achievement. In contrast, given low cognitive motivation, expectancies are built via a peripheral route of information processing characterized by the use of simple judgmental rules; in that case, expectancies are less closely related to performance. Information processing via the central route results in more

confident and more accurate beliefs (Bohner, Rank, Reinhard, Einwiller, & Erb, 1998; Chen & Chaiken, 1999), so it was predicted that expectancies that are initially held with a high certainty should be more closely related to performance even before the individual has experience with the concrete task (Hypothesis 3). This hypothesis is also in line with research on attitude strength suggesting that attitudes which are held with high certainty more closely relate to behavior (see Ajzen, 2001).

Method

Participants

The analyses were based on a sample of 132 girls and 141 boys, all Grade 8 students with an average age of 14.1 yr. ($SD = 0.6$). The students were recruited from four different vocational track secondary schools (German Realschule) in two small-sized and two middle-sized towns in Baden-Württemberg, a federal state of Germany. Data concerning the socioeconomic and cultural backgrounds of the students were not collected. The data were collected at three points; namely, immediately before and following a mathematics examination, and after the teachers had marked the mathematics examination. Informed consent was obtained from students and their parents.

Material and Procedure

Students reported their demographic data during the first measurement immediately before the mathematics examination. They also reported their grades in mathematics, which they had received at their last mathematics examination and their last report card. Furthermore, in order to assess students' performance expectancies, the students were asked to estimate the grade they were going to achieve on the upcoming mathematics examination on the grading scale regularly used in German schools. The exact wording for the assessment of students´ performance expectancy was: "What grade do you think you are going to achieve in this mathematics examination?" Grades (and grade expectations) range from 1: Best grade to 6: Worst grade. Students were further asked to rate the certainty of their estimation on a five-point scale ranging from 1: Very uncertain to 5: Absolutely certain, by the following item: "How certain are you that you are going to achieve this grade?"

Immediately after completing the mathematics examination, the students received a second set of questionnaires, again containing the two items on their performance expectancy and the certainty rating of their performance expectancy concerning the examination they had just completed. For the assessment of performance expectancy, the following item was used: "What grade do you think you have just achieved in this mathematics examination?" For the assessment of students´ certainty, the fol-

lowing item was used: "How certain are you that you have just achieved this grade?" In addition, the students rated their use of several learning strategies during the completion of the mathematics examination by means of self-report measures. However, these data are beyond the scope of the present investigation.

After the teachers had marked the examination, on a separate sheet of paper they filled in the grades the students had achieved on this mathematics examination. All grades and all grade expectations were reverse-coded so that high values indicated high performance and high performance expectancies.

Results

Students′ mean achievement (reverse-coded numerical grades) in the present mathematics examination was 3.55 ($SD = 1.22$), the mean achievement in the previous mathematics examination was 3.53 ($SD = 1.28$), and the mean achievement (reverse-coded numerical grades) in last year's report card was 3.66 ($SD = 1.03$). Students' mean performance expectancy before the examination was 3.76 ($SD = 0.94$) and their mean performance expectancy following the completion of the examination was 3.59 ($SD = 1.16$). Students' mean rating of their certainty was 3.31 ($SD = 0.78$) before the examination was conducted and 3.51 ($SD = 0.85$) after finishing the examination (Table 1).

The changes in the mean ratings of performance expectancy and certainty were examined as a function of experience. Paired-samples t tests were conducted and indicated a statistically significant decrease in students′ performance expectancy ($t_{269} = 3.24$, $p < .001$, $d = 0.16$). In contrast and supporting Hypothesis 1a (that experience is associated with higher certainty), there was a statistically significant increase in certainty; students' mean certainty rating became higher after being confronted with

TABLE 1

Means and Standard Deviations of Performance Expectancies and Certainty Before and After the Examination; Correlations Between Variables ($N = 273$)

	M	*SD*	1	2	3	4	5
Time 1 (before examination)							
1. Performance expectancy	3.76	0.94					
2. Certainty	3.31	0.78	.01				
Time 2 (after examination)							
3. Performance expectancy	3.59	1.16	.65*	.10			
4. Certainty	3.51	0.85	.03	.27*	−.02		
5. Performance on mathematics examination (reverse-coded numerical grade)	3.55	1.22	.47*	.01	.58*	.02	

Note.—High scores indicate high performance expectancies and high certainty. *$p < .01$.

the task ($t_{266} = -3.51$, $p < .001$, $d = -0.25$). Performance expectancy before the examination ($r = .47$, $p < .001$) as well as after the examination ($r = .58$, $p < .001$) correlated statistically significantly with students´ performance (reverse-coded numerical grade in the mathematics examination; Table 1). The two correlations were compared using the procedure suggested by Williams (1959) and the latter correlation was statistically larger than the former ($t_{270} = 2.66$, $p < .01$, $d = 0.32$). This supports Hypothesis 1b, which assumed that performance expectancies become more accurate as a function of task experience.

As predicted in Hypothesis 2, which postulated an independence of the mean expectancies and the certainty, there was no significant correlation between performance expectancy and certainty before the mathematics examination ($r = .01$, ns) as well as no statistically significant correlation between the variables assessed after finishing the examination ($r = -.02$, ns).

To test Hypothesis 3, postulating that expectancies that were initially held with a high certainty should be more closely related to performance, a regression analysis was conducted with performance in the mathematics examination as a criterion. The interaction term was calculated by multiplying certainty at Time 1 (standardized) with expectancy at Time 1 (standardized). The regression model used the interaction term and (as a control variable) performance in the last report card as predictors and performance in the mathematics examination as the criterion. The R^2 from the regression was statistically significant ($F_{2,191} = 60.66$, $p < .001$; $R^2 = .39$, $R^2_{adj} = .38$; Table 2). The ß for the performance from the last report card was .60 ($p < .001$) and—as predicted—the ß for the interaction term of certainty and expectancies was .14 ($p < .01$; see Table 2 for the standardized regression table). To illustrate the nature of the interaction, and to find out how the accuracy of expectancies changed as a function of certainty and task experience, the sample was split up into a group with high certainty (ratings of 3 or above) and a group with low certainty (ratings of 1 or 2). For both groups, a regression was calculated with performance of the last report card and expectancy at Time 1 as predictors and performance in the mathematics examination as the criterion. In the low certainty group, the coefficient for the expectancy at Time 1 predicting performance was ß = .17 (ns). In the high certainty group, the coefficient was ß = .58 ($p < .001$).[3]

[3]If one is interested in the accuracy of expectancies, the correlation between expectancies and performance is only one criterion for the accuracy of expectancies. A second criterion would be the absolute difference between expectancies and performance. This allows detection of over- and underestimation. However, in the present study, we refrained from using the second criterion due to the fact that the absolute performance in an examination strongly depends on the difficulty of the examination chosen by the teacher. In these cases, over- or underestimation cannot be clearly interpreted as a function of the accuracy of students' expectancies but also partly is a function of the difficulty chosen by the teacher.

TABLE 2
Regression Model Predicting Performance on Mathematics Examination ($N = 194$)

Model	Unstandardized Coefficients B	Standardized Coefficients β	*t*	*p*	95%*CI* for B
Performance in last report card (reverse-coded grade)	0.67	.60	10.52	.001	0.54, 0.79
Certainty (Time 1) × Performance Expectancy (Time 1)	0.20	.14	2.51	.01	0.04, 0.36

Discussion

In the present study, the accuracy of performance expectancies of Grade 8 students concerning a mathematics examination was investigated, depending on certainty and task experience. First of all, the performance expectancies and the certainty of the performance expectancy were not statistically significantly correlated. This finding supports the idea that certainty and mean level of expectancy ratings are separate components of expectancy. The idea that level of expectancies and certainty are independent constructs was also supported by the finding that the variables were differently related to task experience. While mean expectancies decreased, the mean certainty ratings increased. Given these findings and previous research on the importance of certainty for explaining behaviour (see Petty, *et al*., 1995, 2002), it seems reasonable to analyze possible effects of both level of expectancies and of certainty.

There was a statistically significant correlation between students´ performance expectancies and the actual performance at two times of measurement; namely, before the examination as well as following the examination. It is interesting to note that there was a stronger correlation between performance expectancies and performance after the test. These data support previous assumptions of the existence of a close relationship between expectancies and performance (Eccles, 1983; Bandura, 1997; Wigfield & Eccles, 2000). Overall, students´ performance expectancies decreased because students expected worse grades after they had finished the examination. In line with other studies (Fischhoff, Slovic, & Lichtenstein, 1977; Stankov & Crawford, 1997), these results indicate that students tended to overestimate their own capabilities. Furthermore, they used feedback, in this case the real requirements of the examination, to adapt their expectations to reflect more realistic achievement.

Following Olson and others (1997), research should focus not only on the performance expectancy, but also on its certainty. More certain performance expectancies should be more accurate, probably because more accurate beliefs result from more central information processing (Bohner,

et al., 1998; Chen & Chaiken, 1999). Indeed, the present data supported the hypothesis that higher certainty yields higher accuracy. The relationship between performance expectancy and performance in the mathematics examination for students that reported higher certainty did not change significantly between the two times of measurement. This means that for students who were rather sure of their performance, there was no need to change their expectation even after having performed the task at hand. On the other hand, for students who were not sure about the grade they would receive, the relationship between their performance expectancy and their subsequent performance changed significantly after they had seen the requirements of the examination. It is proposed that students with high certainty do not have to change their expectancy intensively after being confronted with the task. High certainty may have resulted from an accurate analysis of the demands of the task before being confronted with the actual task (see Reinhard & Dickhäuser, 2009).

One might assume that the current results might be limited to situations where performance expectancies can be finely graded. In the present study, the expectancies ranged between 1 and 6. In such situations, it seems important to distinguish between expectancy and certainty. Only in situations where performance outcomes are dichotomous (i.e., succeed vs fail), it is conceivable that expectancy and certainty are more closely related—in such cases, both expectancy and certainty may be expressed in terms of probability of success. However, in many everyday situations, performance expectations do not only concern dichotomous outcomes (e.g., grade expectations, expectation of how well one will do in a sports competition, etc.). In such situations, it seems necessary to disentangle the level of expectancies and certainty of expectancies. In the past, most expectancy researchers have not used measures that distinguished between "expectancy" and "certainty of expectancy" (see Pajares, 1996, for an overview of different scales measuring efficacy expectations including sample items).

There is first empirical evidence that more certain, high performance expectancies of students lead to more persistence during work on an examination (Dickhäuser, Reinhard, & Englert, in press). That is to say, students who are sure that they will get a good grade may be more persistent in the face of difficulties on a mathematics examination and therefore get a better grade than students who are expecting a good grade but are not sure about the correctness of their estimation. The latter students might not be as persistent because they do not know for sure if it is reasonable to be persistent, or in other words, they do not know for sure if they are capable of being successful. On the other hand, students who are expecting a poor grade and are absolutely certain about their estimation would not be persistent in their efforts because they know they cannot be successful,

compared to students who are also expecting a poor grade but are not certain about it. In this latter case, students may still try to get a better grade and will possibly not give up right away. However, these ideas have not been investigated in the present study. Future research is therefore needed to test these assumptions.

One final thought concerns the potential use of these results in educational environments. It is reasonable to think that a student who is absolutely certain that he is going to get a bad grade will not be as motivated as a student who also thinks that he is not going to achieve a good grade but is not really sure about it. The latter will at least try to prove his expectations to be wrong while the former will probably give up right away. High certainty may be debilitating for students with low performance expectancies, since the experience does not lead to an adjustment of expectancy. Therefore, it should be helpful to modify students' certainty of a bad result to increase motivation. An uncertain performance expectancy can surely change if the student receives unexpected positive feedback on his performance. Future research in this area should focus on the development of a potential training to negate low performance expectancies held with high certainty and to find further ways to foster positive performance expectancies.

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