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ABSTRACT

Drawing on an unusually large set of employer-employee data, we examine how workers' pay is related to the educational composition within their occupational group. We find that educational composition as measured by the educational diversity and the educational level of an occupational group is positively related to its workers' pay within that group. In addition, our findings suggest that the educational level moderates the positive effect of educational diversity, i.e. that pay increases related to diversity are higher in occupational groups with higher levels of education. We also discuss implications for management practice and possible further theoretical developments.

Keywords: Knowledge spillovers; educational diversity; pay; work groups.

JEL-Classification: I21, J24, J31, L20, M52

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One potential benefit of diverse groups is their increased variety of task-relevant knowledge and skills as compared to homogeneous groups (van Knippenberg, De Dreu, & Homan, 2004). The pool of knowledge within a group is strongly dependent on the educational composition of that group. If a group of workers is highly diverse in terms of its educational composition, workers will likely possess different sets of knowledge that they can share. Higher educational diversity within a group therefore increases the potential for high group performance. Given that organizations have the opportunity to benefit from educational diversity in terms of higher group performance and, as a result, higher organizational performance, we expect the educational composition within a group to be related to individual workers' pay for at least two reasons: first, if workers' pay reflects productivity and if educational diversity of groups is associated with higher productivity and second, if—because pay influences workers' behavior and consequent performance (Rynes & Gerhart, 2000)—firms set pay to give workers incentives for gainfully using the diversity within their group.

Diversity research provides strong evidence for the impact of group composition on aggregate outcomes such as group or organizational performance (van Knippenberg & Schippers, 2007; Williams & O'Reilly, 1998). However, studies analyzing how diversity affects *individual* outcomes such as pay are so far scarce (Jackson, Joshi, & Erhardt, 2003). For example, studies on educational diversity—almost all of which focus primarily on top management teams—indicate that an increase in diversity may have a positive impact on company adoption of innovations (Bantel & Jackson, 1989), the probability of strategic change of organizations (Wiersema & Bantel, 1992), the return on company investment and sales growth (Smith, Smith, Olian, Sims, O'Bannon, & Scully, 1994), the change in firm profitability or sales (Simons, 1995; Simons, Pelled, & Smith, 1999), the change in a company's market share and profits (Hambrick, Cho, & Chen, 1996) or a company's return on assets (Carpenter, 2002). These studies suggest

that extensive organizational benefits accrue from educational diversity in top management teams. However, both from a theoretical and from an empirical point of view it is less clear whether these *organizational* benefits also suggest benefits for *individual* team members, and whether such diversity effects also occur within other occupational groups. We therefore analyze whether individual employees (outside of top management teams) benefit from diversity effects in terms of higher pay—and if so, to what extent.

We suggest using diversity and spillover theory to derive hypotheses on the relationship between the educational composition of a group and workers' pay within that group. We focus on occupational groups within organizations and define an occupational group as a group of workers engaged in the same activity—for example, the manufacturing and processing of products, accounting and personnel or research and development. In organizational settings, diversity of skills or knowledge, reflected in educational background (among other attributes), is particularly important for various group outcomes (e.g., Milliken & Martins, 1996). Diversity research—or, more precisely, diversity research based on information and decision-making theories—emphasizes the different knowledge, skills, information, expertise and perspectives reflected in the educational diversity of groups. Given appropriate incentives, we expect workers to transfer their knowledge or to share their information with co-workers. According to theoretical considerations of diversity, we thus hypothesize a positive impact of group educational *diversity* on individual workers' pay.

Based on spillover theory (Acemoglu & Angrist, 2000; Rauch, 1993) we argue that the mean level of education should also be considered in an analysis of educational composition and worker's pay. Spillover theory essentially holds that workers' investments in education not only influence their own productivity and pay but also that of their co-workers. These effects result from the sharing of knowledge and skills between workers (Rauch, 1993) and thus should also

directly affect the pay of all workers in a group. Furthermore, we argue that a group's educational mean level moderates the effect of educational diversity on workers' pay because the effect of additional information or new perspectives on a group's potential to perform well should also depend on the preexisting average level of education within a group of workers. Overall, for a group's educational *mean level* we hypothesize a *direct* effect on individual workers' pay and an *indirect moderating* effect of group educational diversity on individual workers' pay.

By examining the impact of group educational composition on workers' pay, we make several contributions to the existing literature. Firstly, we analyze the mostly unexplored issue of diversity effects on pay. We focus on an individual as opposed to a group outcome to investigate whether workers themselves—and not only organizations—benefit from diversity. Secondly, we provide a theoretical framework for the impact of group composition on individual workers' pay, a framework that simultaneously integrates both educational diversity and the mean level of education. In doing so, we link theoretical elements from two different—and, to date, mostly unconnected—lines of research: diversity and spillover research. While diversity research has traditionally focused on the relationship between group diversity and group outcomes, spillover research primarily investigates the impact of a group's mean level of education on individual workers' pay. We combine both strands of research in proposing that the mean level of education moderates the effect of educational diversity on workers' pay. Thirdly, we are fortunate enough to have data on a large number of organizations and their entire workforce that includes a large number of demographic characteristics of occupational groups within organizations (e.g., education, tenure, gender).

Our results show that educational group composition, measured as educational diversity and the mean level of education, has a positive effect on individual workers' pay. In other words,

workers in occupational groups that are more diverse in terms of education and that have a higher mean level of education on average receive higher pay. In addition, our results suggest that the mean level of education also moderates the relationship between educational diversity and workers' pay. The findings thus demonstrate that workers benefit from educational diversity. Such benefits help in understanding workers' incentives to share knowledge and point to the importance of knowledge sharing within an organization. The following section covers theories relating to both diversity and spillover effects that we will use to develop a theoretical framework describing the relationship between group composition and individual workers' pay.

THEORY AND HYPOTHESES

First, we discuss in detail the relationship between educational diversity and workers' pay by applying previous findings from diversity research to an individual outcome and derive our hypotheses on group diversity and individual workers' pay. Next, we present the parts of spillover theory needed to develop additional hypotheses on the effects of the mean level of education on individual workers' pay.

Diversity and Workers' Pay

Diversity is any attribute that may lead people to think that another person is different from them (Triandis, Kurowski, & Gelfand, 1994). Under some circumstances, we expect diverse groups to outperform more homogeneous groups. According to information and decision-making theory (Gruenfeld, Mannix, Williams, & Neale, 1996), the positive effects of diversity arise from the increased pool of task-relevant knowledge and skills that groups of workers with different characteristics possess.

In our study, we consider two dimensions of education to measure diversity: First, the educational level, which is a proxy for a lower or higher level of not directly observable attributes such as knowledge, skills, or abilities (Bantel & Jackson, 1989; Wiersema & Bantel, 1992) and can vary within groups; and second, the type of education (vocational or academic), which we assume to reflect differences in cognitive style or in a person's values or perspectives (Hambrick & Mason, 1984; Wiersema & Bantel, 1992) and which can also vary within groups. For both dimensions, we expect an increase in diversity to reflect a larger pool of task-relevant knowledge and information (Jehn, Northcraft, & Neale, 1999).

Based on existing information and decision-making theories (Gruenfeld et al., 1996), we expect educational diversity within a group to be positively associated with group performance, because group members that are part of the same social network tend to share redundant knowledge and perspectives, while group members that belong to different social networks have greater access to various informational networks. Workers' different backgrounds give diverse groups access to a larger pool of task-relevant knowledge and skills, and the availability of a broad range of knowledge and experience may enhance group performance. The diversity of expertise within a group may force workers to discuss their different and possibly conflicting perspectives, potentially leading to more creative ideas and a higher quality of group decisions. The empirical evidence supports these predictions (Jehn et al., 1999). Therefore, we expect groups of workers with a diverse set of task-relevant knowledge and skills to have an information advantage over more homogeneous groups.

However, social categorization theory (Turner, 1987) argues that diverse groups of workers may not fully realize the potential gains resulting from the increased variety of knowledge and skills, as workers may prefer to interact only with similar others. Similarity/attraction theory (Berscheid & Walster, 1969) also argues that people not only like those who are similar to

themselves but also perceive people whom they like as being more similar to themselves than they actually are. Following van Knippenberg et al. (2004) categorization-elaboration model (CEM) integrating the ideas of the social categorization and information and decision-making theories, we argue that all dimensions of diversity may have both positive and negative impacts on group outcomes. In addition, however, we argue that for education, the positive effects of diversity are, in general, likely to be stronger then the potentially harmful effects of social categorization processes.[1]

Support for this argument—that diversity in education is more beneficial than detrimental to groups—comes in the form of studies generally classifying demographic diversity variables along two dimensions: Pelled (1996) suggests using the level of visibility (i.e., how detectable an attribute is) and the level of job-relatedness, making education a more job-related and less easily observable attribute (van Knippenberg & Schippers, 2007).[2] Educational diversity is an even purer indicator of informational advantages as compared to functional diversity, an indicator which researchers often use to analyze the information and knowledge advantages of diverse groups (Dahlin, Weingart, & Hinds, 2005; Williams & O'Reilly, 1998). The empirical evidence on top management teams indeed shows that an increase in educational diversity (as measured by the type and level of education) leads to a better organizational performance (Bantel & Jackson, 1989; Simons et al., 1999; Wiersema & Bantel, 1992).

While some initial diversity adds more value in terms of group members' significant knowledge, different perspectives, or new information, a further increase in an already diverse group may be less valuable (van Knippenberg & Schippers, 2007; Williams & O'Reilly, 1998).

[1] For empirical evidence on the precise condition under which the positive effects of diverse groups outweigh the potentially negative effects associated with higher diversity see Joshi and Roh (2009) or Kearney, Gebert, and Voelpel (2009).

[2] Jackson, May, and Whitney (1995) do not restrict their classification to demographic attributes but propose categorizing the attributes as either readily detectable or underlying, and as either task-related or relations-oriented. In their classification, education is a task-related and readily detectable attribute.

As diversity increases, the probability that a new member will bring new knowledge, expertise, or information decreases, and the exchange of knowledge and sharing of information becomes more difficult. Dahlin et al. (2005) investigate how education—measured as group members' undergraduate studies—is related to information use, and find that for highly diverse teams an additional increase in educational diversity no longer adds benefit. Accordingly, we expect a decreasing return to diversity in educational type. However, for diversity in educational level we assume the relationship with group performance to be possibly weaker positive and linear, because educational level might also reflect more or less education and different educational backgrounds (Williams & O'Reilly, 1998). Overall, we expect a clear positive but decreasing return to diversity in educational type in terms of group performance, and a much weaker, strictly linear relationship between diversity in educational level and group performance.

But why should we expect that group performance be related to individual workers' pay and thus, educational diversity be related to worker's pay? There are at least two channels through which individual workers' pay may benefit from diversity: first, if pay reflects productivity and educational diversity leads to higher group performance because of the higher variety of knowledge and skills within diverse groups, the members of diverse groups should on average have higher pay; and, second, if firms use compensation systems that reward workers' interaction and sharing of knowledge to foster the use of the variety of skills and knowledge, individual pay should also be higher in diverse groups.

The first channel primarily relies on the assumption that due to labor market competition, pay will reflect productivity at least to some extent. While pay may rarely be perfectly correlated with productivity, it is nonetheless reasonable to assume that the two are correlated to some degree; otherwise, workers would look for jobs on the external labor market where they would receive payments more closely reflecting their productivity. Accordingly, the factors identified

as having an influence on group performance are also potentially related with workers' pay. The second channel focuses on the incentive mechanism of pay. Because pay influences workers' motivations (Rynes & Gerhart, 2000), firms may use performance pay schemes to provide workers with an incentive to gainfully use the diversity within their group. In this case, workers have an incentive to make better use of diversity, which on average will result in higher performance. As workers directly receive part of the performance gain, pay would tend to be higher in more diverse groups.[3]

Overall, we are able to derive two empirically testable hypotheses in respect to the relation between educational diversity within groups of workers and individual workers' pay:

*Hypothesis 1a: An increase in diversity in educational **level** within an occupational group is positively related to workers' pay.*

*Hypothesis 1b: An increase in diversity in educational **type** within an occupational group is positively related to workers' pay but with a decreasing return.*

The Mean Level of Education and Workers' Pay: Both a Direct and a Moderating Effect

To understand the relationship between diversity and pay, we also have to consider the mean level of education. Therefore, we add and link spillover theory to diversity research. Diversity research focuses on the distribution of educational background within groups, while the mean level of education is mentioned only marginally, if at all. Harrison and Klein (2007) are a notable exception, as they discuss from a statistical point of view the importance of simultaneously considering the mean level and the diversity of educational background. If diversity reflects separation or disparity, researchers should also control for the mean of the attribute because an

[3] Depending on the bargaining power of the worker and the firm, respectively, performance and pay effects may differ.

attribute's standard deviation and mean may be confounded. In addition, we argue that spillover theory also provides important theoretical arguments as to when the average level of education should have a larger or smaller impact on the performance of groups, and why.

Spillover effects result from the transfer of knowledge and skills that occurs when workers interact, because workers may exchange ideas or benefit from learning by doing (Acemoglu & Angrist, 2000; Rauch, 1993). Marshall (1966: 179) was the first to mention the idea of spillover effects. He argues that "the economic value of one great industrial genius [who became a genius because he received a good education, amongst others] is sufficient to cover the expenses of the education of a whole town; for one new idea, such as Bessemer's chief invention[4], adds as much to England's productive power as the labor of a hundred thousand men." Lucas (1988) again raises the idea of workers having an impact on the productivity of others, referring to this effect as an "external effect" of human capital. Acemoglu and Angrist (2000) argue that imitation, the exchange of ideas, and learning by doing are the channels through which external effects work. Based on these considerations from spillover theory, we expect a higher mean level of education within an occupational group to have a directly positive effect on group performance (and individual pay) as a result of workers' constant interactions.

Existing literature provides evidence for spillover effects on different levels of aggregation. Several studies have examined the spillover effects of human capital within regions (Moretti, 2004) or industries (Kirby & Riley, 2008; Sakellariou & Maysami, 2004). Some studies also focus on external effects at the firm level (Battu, Belfield, & Sloane, 2003; Martins & Jin, 2010). However, almost no studies cover a more disaggregated level within firms, such as work groups. A noteworthy exception is a study by Wirz (2008), which investigates external effects of the average educational level within occupational groups on workers' wages. The study finds

[4] The Bessemer process (named after its inventor) is a process for changing molten pig iron to steel on an industrial scale.

spillover effects on individual wages within occupational groups—beyond external effects on firm-level. However, these studies analyzing and testing spillover effects exclusively examine the mean level of human capital and disregard educational diversity.

Some evidence suggests that not only the mean level of education but also the mix of workers within a group may be relevant. For example, Hamilton, Nickerson, and Owan (2003) examined the mix of high-ability and low-ability workers within teams and show that the effect on productivity indeed depends on the mix of workers, with average ability held constant. Similarly Mas and Moretti (2009) have shown that the presence of high-skill workers enhances the productivity of other workers. However, we still do not know whether workers benefit in terms of higher pay.

We hypothesize a positive relation between the mean level of education and workers' pay (on top of a diversity effect of education):

Hypothesis 2: An increase in the mean level of education within an occupational group is positively related to workers' pay.

We also expect the mean level of education to moderate the effect of educational diversity on workers' pay because in groups of workers with a higher mean level of education the group members are, on average, better able to utilize the variety of skills and task-relevant knowledge than in groups with a lower mean level, an effect that is well-known in other contexts as the complementarity effect.[5] Therefore, we propose a third hypothesis:

Hypothesis 3: The mean level of education moderates the impact of diversity on workers' pay.

[5] Ennen and Richter's (2010) overview over the concept of complementarities indeed suggests that such complementary relationships between different factors in organizations are an important determinant of organizational performance.

Figure 1 summarizes how we expect workers' pay to be affected by educational group composition and average educational level.

Insert Figure 1 about here

METHODS

Data and Sample

An analysis of the effects of educational group composition on workers' pay requires information about all members of the relevant group—in our case, all workers employed in the same occupational group within a particular organization. Fortunately, such a dataset is available for Switzerland, a country that according to Flückiger (1998), Nickell (1997) or the OECD (2004) also has a labor market that is in many respects very similar to that of the U.S. or the UK; this makes the data valuable from a broader perspective.

The Swiss Earnings Structure Survey (ESS) is a large employer-employee survey that represents all economic sectors except agriculture and allows us to perform analyses for representative samples of all occupational groups within organizations. The survey is based on two-level sampling (i.e., the survey covers organizations and workers), and the organizations are selected from the Swiss "business and enterprise" register. The Swiss Federal Statistical Office has been collecting the data biannually since 1994 using a questionnaire sent to organizations. Participation is compulsory for organizations that receive a questionnaire. The data used in our analyses span the period from 1994 to 2006. The ESS is particularly suitable for use in our study because the dataset provides information on workers' and co-workers' educational types and levels, their occupational activity, their earnings, and other personal and job-related factors.

We restrict our sample to occupational groups within organizations in the private sector. Additionally, we drop organizations from the agricultural sector because, as previously

mentioned, the observations in our data are not representative for this economic sector. We restrict our sample to organizations that provide information about all workers.

For our pay variable, we restrict the sample to include only "prime-age" employees, a range we define as spanning ages 30-60—otherwise, pay data may be inaccurate. Below 30 a considerable percentage of workers are still enrolled in (higher) education, and over 60 there is non-negligible early retirement. With the exclusion of young and older workers, we therefore aim to rule out biases due to schooling and retirement decisions. Focusing solely on employees with complete information on the included variables, we are left with 900,686 observations.

Measures

Occupational group. Whereas existing diversity research has mostly focused on one specific type of organization (e.g., high technology firms) or on narrow teams of workers (e.g., board members of top management teams), we investigate all groups of workers that are a part of the same occupational field and are thus likely to profit from diverse knowledge and information among their co-workers. Regarding our explanatory variables, therefore, our unit of interest is workers belonging to the same occupational group within an organization. We differentiate among 24 different occupational groups. Examples of such groups are the manufacturing and processing of products, accounting and personnel, or research and development. We assume that workers within these groups are most likely to work together and be able to use diverse knowledge. Table 1 lists all occupational groups.

Insert Table 1 about here

Educational group composition. To determine the educational diversity and mean level of education within an occupational group, we aggregate variables of educational background for individual workers to the occupational level. As Harrison and Klein (2007) emphasize, the choice of a diversity index for the empirical analysis should be driven by an explicit specification of the diversity type (e.g., separation, dispartity or variation). If the specification of the diversity type and the choice of the diversity index do not match, conclusions may be misleading.

For our measure of diversity in educational type, we calculated the proportion of workers with different types of education. Different educational types that we distinguish are: lower vocational, lower academic, higher vocational and higher academic. As, according to our hypotheses, different educational types reflect different knowledge or information, diversity in educational type indicates variety (Harrison & Klein, 2007: 1204-1205). To operationalize variety, we use Blau's (Blau, 1977) index ($1 - \sum p_e^2$) where p is the proportion of workers with a particular type of education e. This index ranges from zero—i.e., all workers of a group have the same education—to a maximum that occurs when each education category is equally represented (Harrison & Klein, 2007).

For our measure of diversity in educational level, we use workers' years of schooling. The EES provides information about workers' highest educational degree. Following the literature (Simons et al., 1999), we transform the highest educational degree into years of schooling.[6] We argue that diversity in educational level may reflect not only variation in knowledge but also—more importantly—in status. In this case, educational diversity indicates disparity (Harrison & Klein, 2007). Therefore, we use the coefficient of variation to measure diversity in educational level.

[6] For detailed information on how to transform educational degrees into years of schooling in Switzerland cf. Weber and Wolter (1999: 86-89) and Wirz (2008: 340).

To investigate the impact of the mean level of education within an occupational group, we calculate the average number of schooling years within that occupational group. To estimate the moderating effect, we use an interaction term between mean level of education and educational diversity. Due to statistical matters, however, we can only estimate the moderating effect for diversity in educational type, not for diversity in educational level. As both diversity in educational level and the mean level of education include years of schooling, an interaction term would be inappropriate.

Pay. Workers' pay is measured in terms of gross monthly wages. This wage measure includes workers' contribution to social insurance (which includes the elderly, disability, and unemployment); payment in kind; regularly paid-off participation in sales, bonuses, or provisions; and compensation for shift-work and night-work. In addition, thirteen months payments or yearly special payments are included pro rata.[7] All wages are adjustes for inflation based on the National Consumer Price Index[8].

Control variables. To reduce potential confounding effects when estimating individual pay, we control for the individual workers' educational background as measured by the number of schooling years, and other individual and employment variables known to be correlated with work-related attitudes and behavior, i.e. age, tenure, gender, part-time employment, nationality, and professional status. To capture differences in other employment characteristis that may affect pay, we use the type of activity a worker performs (i.e., production-related activities vs. services), the number of workers within their occupational group, the size and geographical location of their firm (i.e., the seven different Swiss regions), and 13 industry and year dummies.

Diversity research has identified group composition—measured in terms of other characteristics such as tenure, age, or gender—as having an impact on group outcomes (Jackson

[7] For more information see BfS (2008: 19).
[8] http://www.bfs.admin.ch/bfs/portal/de/index/themen/05/02/blank/key/basis_aktuell.html

et al., 2003; Williams & O'Reilly, 1998). To analyze whether our results are robust to other group controls, (i.e., to rule out the possibility that our findings are driven by a correlation between different group characteristics), we thus control for other group composition variables. We consider group composition not only in terms of education but also in terms of age, tenure, gender, part-time employment, nationality, and professional status. All variables indicate separation expect for tenure (which indicates variety) and professional status (which indicates disparity).

Because group-level effects may be systematically different from organizational effects (as argued by Ragins & Gonzalez, 2003 or van der Vegt, van de Vliert, & Huang, 2005: 1172), we also have to take potential interdependecies between the two levels into account when conducting our analysis. To this end, we also control for the composition of the demographic variables at the organizational level when estimating diversity effects on the occupational group level.

Analysis

In our analysis we also have to account for the fact that workers are nested within occupational groups, and that occupational groups are in turn nested within organizations. Thus, the observations within the same unit of analysis may not be interdependent and a simple ordinary least squares regression (OLS) may provide biased standard errors and consequently biased test statistics. To solve this problem, we cluster robust standard errors at the occupational level within organizations in our OLS regressions (Moulton, 1990). This estimation procedure takes the structure of our data into account.

RESULTS

Table 2 provides means, standard deviations, and correlations for each of our main variables. As expected, the correlations between individual workers' pay and the variables measuring educational diversity within occupational groups are positive and highly significant. The correlation between workers' pay and the mean level of education is also positive and highly significant. To test hypotheses 1-3, we include the variables measuring educational composition within occupational groups step by step. Table 3 presents the results. We also estimate additional models to test for moderating effects of task complexity, length of time, and type of activity (Table 4).

Insert Table 2 about here

Hypotheses 1a and 1b

Hypothesis 1a proposes that diversity in educational level within an occupational group is positively related to workers' pay. Model 1a depicts the results when using diversity in educational level as the only educational composition variable. We find a significant positive value for diversity in educational level within an occupational group ($\hat{\gamma}$ = 0.259, $p < .01$). Workers in occupational groups characterized by a high diversity in terms of workers' level of education thus have higher pay (all else being equal). By contrast, model 1c, which also includes the measure for diversity in educational type, reveals a statistically negative value for diversity in educational level. The two measures for educational diversity are highly positively correlated. Occupational groups that are more diverse in terms of educational level are also likely to be more diverse in terms of educational type. If we do not take into account both types of educational diversity, the variable for educational level therefore picks up part of the effect for educational type.

Model 1e also considers the variable for the mean level of education within an occupational group. In this model, the coefficient for diversity in educational level is again highly significant and positive. This result supports the importance of controlling for the mean when analyzing diversity effects, as Harrison and Klein (2007) suggest. Failure to do so would confound the two effects, because occupational groups with a lower mean of education are generally characterized by a higher diversity in educational level. The value for diversity in educational level continues to be both positive and significant when we include the interaction term between diversity in educational type and the mean level of education (model 1f).

Insert Table 3 about here

Hypothesis 1b proposes that diversity in educational type within an occupational group and workers' pay are positively related, but with a decreasing rate. Model 1b only includes the variables for diversity in educational type. We find a significant positive value for diversity in educational type within an occupational group (γ = 0.124, $p < .01$). The results indicate that workers benefit from higher variety in co-workers' educational background. However, the results do not support the non-linear relationship that hypothesis 1b suggests. For the range of diversity in educational type observed in our sample, an increase of diversity in educational type is equally beneficial for all occupational groups, regardless of their previous level of variety.

Adding the measure for diversity in educational level does not change the coefficient for educational type (model 1c); adding the mean level of education within an occupational group, however, does (model 1e). A high level of diversity in educational type often goes along with a high mean level of education within an occupational group. Although the coefficients of diversity in educational type still show the relationship with workers' pay to be positive with an increasing rate, they are not significant anymore. In model 1f, in which we also include the

interaction term between diversity in educational type and mean level of education, we again find a positive effect for educational type.

Overall, our results partly support hypotheses 1a and 1b. As we expected from the theory, diversity in educational level within an occupational group is positively related to workers' pay. In addition, workers in occupational groups characterized by high diversity in educational type generally have higher pay than workers in less diverse groups. However, we find rather mixed evidence for a non-linear relationship between diversity in educational type and workers' pay (i.e., the non-linear effect is not significant throughout all model specifications), suggesting that the effect of diversity in educational type strongly depends on the other variables we control for.

Hypothesis 2

Hypothesis 2 predicts a positive effect of the mean level of education within an occupational group on workers' pay. Model 1d shows the results when we include the mean level of education as the only educational composition variable. We find a significant positive value for mean level of education within an occupational group ($\lambda = 0.053$, $p < .01$). Workers' pay tends to be higher when the mean level of education within their occupational group is higher (all else being equal). This result holds true independently of whether we also include the measures for educational diversity (model 1e) or add the interaction term between the mean and the variety of education within an occupational group (model 1f).

In sum, we find that in addition to educational diversity, the mean level of education also influences workers' pay. This relationship is as spillover theory predicts, and supports hypothesis 2.

Hypothesis 3

Hypothesis 3 predicts that the mean level of education within an occupational group moderates the impact of diversity in educational type on workers' pay. Model 1e reveals a statistically significant, positive value for the product of mean level of education and diversity in educational type (γ = -0.063, $p < .01$) and a statistically significant, negative value for the product of the mean level of education and the squared term of diversity in educational type (γ = 0.134, $p < .01$). Therefore, the positive effects of diversity in educational type are higher in occupational groups with a high mean of education, than in groups with a low mean of education. Nonetheless, an increase in the variety of educational type is also beneficial for workers' pay in groups with a low mean of education. Figure 2 illustrates the relationship between diversity in educational type and workers' pay for occupational groups with a low, intermediate and high mean of education, respectively. To create the figure, we use the coefficients of model 1f.

Insert Figure 2 about here

To test whether our findings also hold when we control for other demographic variables at the occupational or the organizational level, we include additional control variables. Specifically, we add variables for group composition in terms of other demographic variables (model 2f), for organizational composition in terms of education and other demographic variables (model 3f), and for both (model 4f). The inclusion of the additional control variables does not change the results. We still find positive effects for both educational diversity and mean level of education within an occupational group, and a moderating effect of the mean level of education.

Supplementary Analysis of Several Moderators as Robustness Checks

We take our analysis one step further by taking into consideration other moderators that may have an impact on the relationship between diversity and group outcomes. Specifically, we use task complexity, length of time, and type of occupational activity, because these factors have been identified as moderators of the relationship between diversity and group outcomes (e.g., Jehn et al., 1999; Joshi & Roh, 2009). Table 2 provides means, standard deviations, and correlations for these variables. To test for moderating effects, we perform further estimations that inlcude an interaction term of educational diversity in addition to the three factors mentioned above. Table 4 summarizes the results.

Insert Table 4 about here

First, we test whether (and to what extent) task complexity moderates the relationship between educational diversity and workers' pay. If tasks are simple, a discussion of ideas and an exchange of knowledge are likely to be less valuable, if not entirely unnecessary. By contrast, if tasks are complex, discussion among workers on how to proceed and on what decisions to make may be very important and valuable. To measure task complexity, we categorize workplaces with simple and repetitive tasks as low in task complexity and all other workplaces as high in task complexity. We introduce this variable for job complexity in model 5e, alongside two product terms of the variable, one for diversity in educational level and one for diversity in educational type. Our basic results remain stable. Additionally, our findings indicate that, as expected, diversity in educational type is especially beneficial in groups with a high task complexity as compared to groups with a low task complexity. By contrast, the reverse is true for diversity in educational level, which we explain with diversity in educational level to also reflect more or less education and different educational backgrounds.

Second, we test for the impact of group longevity, a relationship that has not yet been analyzed in the context of educational diversity. Price, Harrison, Gavin, and Florey (2002) demonstrate that diversity effects in general change as time passes. To analyze whether the effects of educational diversity also vary over time, we construct a measure for the length of time that workers were employed in a particular organization. We separate workers with less than 3 years of tenure from workers with 3 or more years of tenure. In model 6f we entered this variable for the length of time a worker already stays with the organization and production terms with the educational diversity variables. Again, our basic results do not change. Furthermore, we find that diversity in educational type has a stronger positive impact on pay for workers with less than three years of tenure as compared to workers with longer organizational tenure. This finding suggests that organizations hire new workers to complement existing workers' knowledge, and that organizations indeed use new workers' knowledge fruitfully.

Third, we consider the type of activity. Joshi and Roh (2009) demonstrate the importance of considering different activity types (or, as they call it, occupation types) when analyzing the impact of diversity on performance. Different types of activites may take place within specific organizational environments that determine the benefits from sharing knowledge and, that affect how workers interact. Studies typically differentiate between production (i.e., blue-collar) and non-production (i.e., white-collar) types of activities (e.g., Berman, Bound, & Griliches, 1994 or Dunne, Haltiwanger, & Troske, 1997). Therefore, we classify the type of activity into two broad categories: production-related activities and services (Table 1). In model 7f we test for a moderating effect of the type of activity. Our basic results again remain stable. We find a significant and positive coefficient for the product term of diversity in educational level and production-related activities. We do not find a significant coefficient for diversity in educational

type for either one of the product terms. In production-related activities educational diversity is more positively related to workers' pay than in services.

To summarize our results, we found evidence that the mean level of education moderates the relationship between educational diversity and workers' pay beyond a direct effect of the mean level of education. In other words, the higher the mean level of education within an occupational group, the lower the positive impact of educational type diversity on workers' pay. These results are robust against the inclusion of other demographic variables at the occupational and organizational level or variables identified as potential moderators in previous research.

DISCUSSION

This study analyzes whether the educational composition within an occupational group is related to individual workers' pay. We provide four novel empirical results in line with our hypotheses. First, we find that diversity in educational *level* of occupational groups is positively related to individual workers' pay. Second, we show that diversity in educational *type* of occupational groups is positively related to individual workers' pay. Third, we confirm that an increase in the *mean level* of education is associated with an increase in workers' pay. Fourth, we show that the mean level of education is a moderator of the relationship between educational diversity and workers' pay. Our results point to the importance of educational group composition, in terms of both educational diversity and mean level of education, when studying individual workers' pay. We also confirm the results of previous studies that identify task complexity, group longevity, and type of activity as moderators of the relationship between diversity and group outcomes.

Theoretical Implications

Our study extends the theoretical literature on diversity in three important ways. First, heeding the call of Jackson et al. (2003) to investigate the influence of diversity on individual outcomes, we provide a theoretical framework for explaining how educational group composition is related to workers' pay. To develop the theoretical model, we use the elaboration categorization model (van Knippenberg et al., 2004) as a starting point. The model explains the relationship between group diversity and group outcomes; this also enables us to derive theoretical predictions on the effects of group diversity on individual workers' pay.

Second, we add spillover theory to derive theoretical predictions on how the mean level of education influences workers' pay. We argue that spillover theory helps to explain why the mean level of education is needed in an analysis of educational group composition and individual workers' pay, beyond mere statistical reasons. We hypothesize that educational diversity and the mean level of education within an occupational group are directly and positively related to workers' pay due to the constant interaction of workers within occupational groups.

Third, we argue that the mean level of education is a moderator for the impact of educational diversity on workers' pay because workers with a higher educational level are better equipped to use the pool of different knowledge and ideas of more diverse groups. Even in groups with a low average level of education, however, variety of knowledge and skills is beneficial for individual workers in terms of higher pay.

Managerial Implications

In light of our results, managers should recognize that successful management of diversity effects may yield a competitive edge (Ragins & Gonzalez, 2003). If some organizations succeed in fostering the benefits of diversity while preventing the detrimental effects, they may gain a

competitive advantage over organizations that do not. Our results show that organizations increase compensation for workers who use the large pool of knowledge within a diverse occupational group to enhance their performance. If workers themselves—and not only their organization—benefit from diversity, and are aware of this benefit, they may adapt their behavior in terms of reacting to, as well as interacting in, more diverse groups. Therefore, it is the manager's task to make each individual worker aware of these benefits, particularly in groups where diversity may otherwise be considered a threat rather than a blessing.

Recent studies demonstrate the importance of human resource management (HRM) in general and of diversity management strategies in particular for the management of workforce diversity. Kossek, Lobel, and Brown (2006) show that appropriate human resource practices not only (positively) affect diversity within the workforce but also help to successfully manage this diversity (e.g., by changing employees' attitudes towards diversity through training or mentoring). The need for managing educational diversity may depend on how important knowledge activities are within the organization. If an organization's competitive advantage depends on the effectiveness of creating, sharing, and combining of knowledge, then the implementation of appropriate human resource practices to organize and support these processes may be essential (as shown for age diversity by Backes-Gellner & Veen, 2008). Jackson, Chuang, Harden, and Jiang (2006) show the importance of knowledge-intensive teamwork for firms to leverage the knowledge within their workforce, and emphasize the role of human resource practices in supporting this type of teamwork. We argue that pay increases with diversity and that the awareness of this relationship may be an important part of a succesfull diversity management.

Another strand of literature in this context points to the importance of using particular types of pay schemes to successfully manage diversity. For example, the results of Jones, Kalmi, and

Kauhanen (2010) show that productivity increased when performance-related pay was added to production teams, which suggests that group incentive pay and team work are complements and that team learning contributed substantially to the increase in productivity. McNabb and Whitfield (2007) also find that workers' pay is highest when it includes a group-based component. Zenger and Marshall (2000) further identify important determinants, such as the capacity to control performance measures or the size of the group, for the strength of the effect of group-based pay. Thus, a genuine part of diversity management seems to be developing a pay scheme that sets the correct incentives for workers participating in diverse groups.

Limitations, Future Research, and Conclusion

For this study we acknowledge certain limitations that may provide opportunities for future research:

Our study did not account for diversity effects that may differ from one occupational group to another, implicitly assuming that diversity potentials are similar across occupational groups. Future studies could challenge that assumption by focussing on a specific set of occupational activities. They could then also study in more detail the underlying effects of group composition on workers' pay in that specific occupation. Since we were initially interested in finding out whether there are positive diversity and moderating effects on individual pay at all, we refrained from such a focussed approach. In this context, our test of diversity effects becomes even stronger because heterogeneous effects would make it more difficult to find a consistent and stable effect. Our results thus suggest that educational composition has a relatively strong impact on workers' pay.

In addition, further research should focus on how to design reward systems that would lead workers to gainfully use diversity within groups and across departments. Our study did not

directly measure the underlying process of group composition on workers' pay, and thus on workers' motivation to share ideas and transfer knowledge, but rather indirectly by showing that there are positive effects. As Jackson et al. (2006) point to the importance of workers trusting their organization not to use the benefits of increased knowledge and idea-sharing to their disadvantage (for instance by reducing the number of employees), future research may wish to analyze the conditions for trustful compensation systems. Employees' attitudes toward diversity and their resulting behavior may be different depending on whether the employees—not only the organization—benefit from diversity. Organizations may be well advised to carefully examine their approach to managing diversity.

In the last few years, organizations have focused on how to avoid the detrimental effects of diversity, but they may have neglected the potential benefit of diverse groups due to the higher variety of task-relevant knowledge and skills. Our findings suggest that the mean level of education within an occupational group is an important determinant of the degree to which occupational groups—and thereby organizations—benefit from the pool of knowledge and thus educational diversity within groups. For an organization to gainfully utilize the educational composition within an occupational group, workers must be aware of the importance of sharing knowledge and skills and realize that the resulting performance gain is also to their own benefit. Through diversity management and pay policy, managers can ensure that workers are indeed able to understand the potential benefit of educational diversity, and trust the organization to receive part of the gain.

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FIGURE 1

A Model on the Relation of Educational Group Composition and Workers' Pay

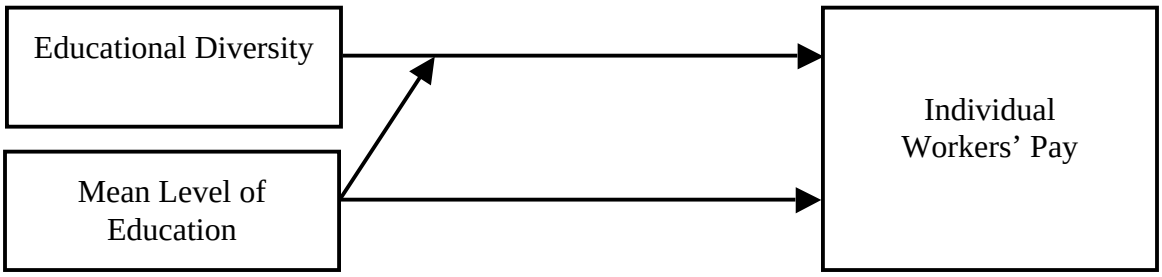

FIGURE 2

Effects of Educational Type Diversity on Predicted Pay by Different Group Means

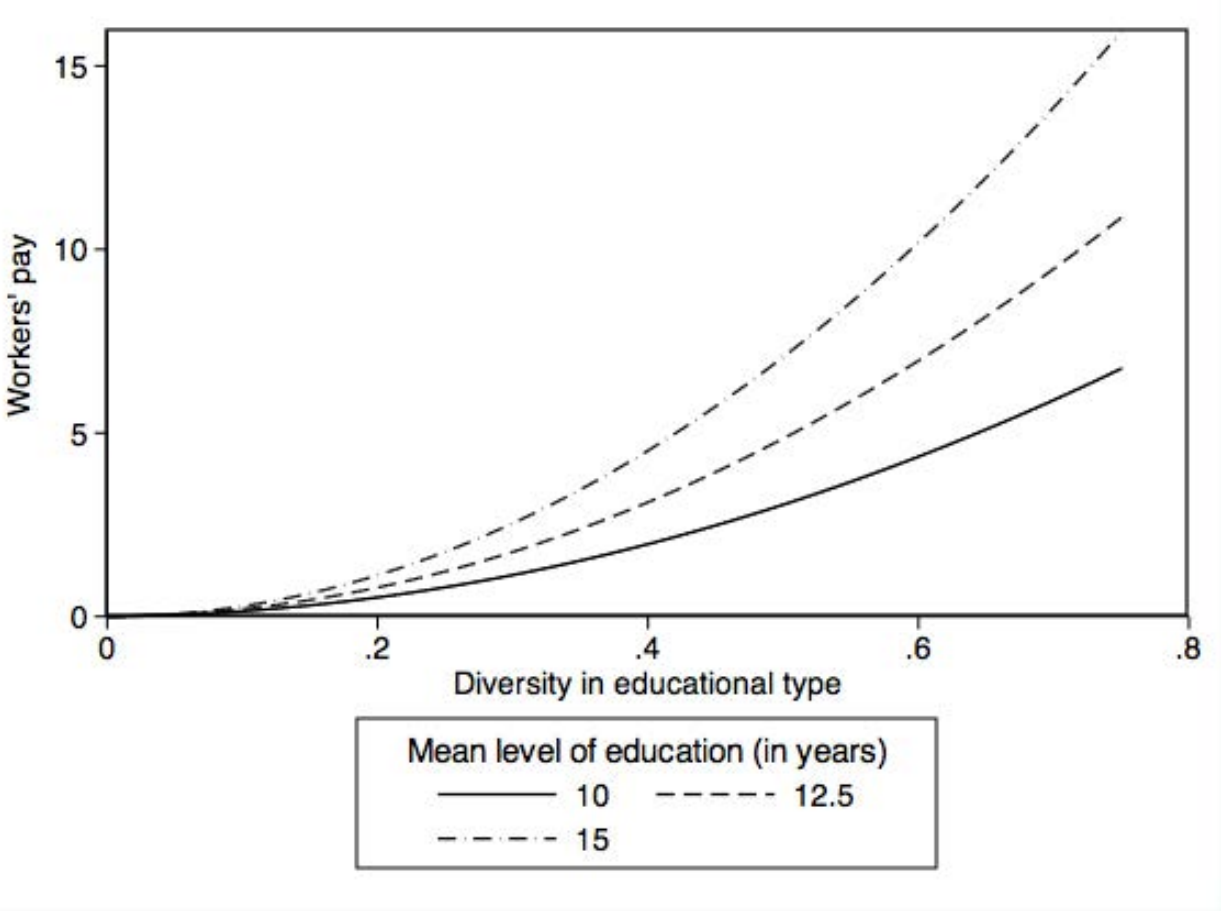

TABLE 1

List of Occupational Activities

Production-related activities
Manufacturing and processing of products
Activities in the construction sector
Fitting, operation, and maintenance of machinery
Restoration, crafts
Services
Definition of corporate targets and strategy
Accounting and personnel
Secretarial and office work
Other commercial and administrative functions
Logistics, staff duties
Evaluation, consultancy, certification
Buying/selling of basic materials and industrial goods
Retail sale of consumer goods and services
Research and development
Analysis, programming, operating
Planning, design, draftsmanship, layout
Passenger and goods transport and communications
Security, surveillance
Medical, nursing, and social functions
Personal hygiene, dress care
Cleaning and public hygiene
Teaching activities
Hotel, catering trade work, housework
Culture, information, recreation, sports, and leisure
Other activities

TABLE 2

Means, Standard Deviations, and Correlations[a]

Variable	Mean	s.d.	1	2	3	4	5	6
1. Pay	7,239.00	3,740.00						
2. Educational level diversity	0.11	0.06	.01					
3. Educational type diversity	0.25	0.23	.32	.51				
4. Mean level of education	12.71	1.77	.53	-.10	.47			
5. Task complexity	0.81	0.39	.33	-.15	.20	.43		
6. Length of time	0.32	0.47	-.08	-.02	.01	.03	-.04	
7. Type of activity	0.30	0.46	-.25	.04	-.32	-.40	-.21	-.08

[a] n = 900,686. All correlations are significant on $p < .01$.

TABLE 3

Results for Workers' Pay[a]

Variable	Model 1a	Model 1b	Model 1c	Model 1d	Model 1e	Model 1f	Model 2f	Model 3f	Model 4f
Educational level diversity	0.26***		-0.16***		0.10**	0.08*	0.03	0.03	0.03
Educational type diversity		0.12***	0.16***		0.05	0.90***	0.75**	0.96***	0.77**
Educational type diversity squared		0.11	0.10		0.09	-1.74***	-1.28**	-1.33*	-0.87
Mean level of education				0.05***	0.05***	0.05***	0.05***	0.05***	0.04***
Educational type diversity × mean level of education						-0.06**	-0.05**	-0.07**	-0.05**
Educational type diversity squared × mean level of education						0.13***	0.10**	0.10*	0.06
Controls for group composition in terms of other demographics							YES		YES
Controls for organizational composition in terms of education and other demographics								YES	YES
R2	0.55	0.56	0.56	0.57	0.57	0.57	0.59	0.58	0.60

[a] n = 900,686

* $p < .05$, ** $p < .01$, *** $p < .001$

TABLE 4

Results for Moderators of the Relationship between Educational Type Diversity and Workers' Pay[a]

Variable	Model 5f	Model 6f	Model 7f
Educational level diversity	0.73***	0.09*	-0.15**
Educational type diversity	0.68**	0.90***	0.87**
Educational type diversity squared	-1.52**	-1.72***	-1.43*
Mean level of education	0.05***	0.05***	0.05***
Educational type diversity × mean level of education	-0.05**	-0.06**	-0.06**
Educational type diversity squared × mean level of education	0.11**	0.14***	0.11**
Task complexity	0.15***		
Educational level diversity × task complexity	-0.72***		
Educational type diversity × task complexity	0.11*		
Educational type diversity squared × task complexity	0.15		
Length of time		-0.05***	
Educational level diversity × length of time		-0.03	
Educational type diversity × length of time		0.07*	
Educational type diversity squared × length of time		-0.11	
Type of activity (production-related activities)			-0.08***
Educational level diversity × type of activity			0.67***
Educational type diversity × type of activity			-0.12
Educational type diversity squared × type of activity			-0.16
R2	0.58	0.57	0.58

[a] n = 900,686

* $p < .05$, ** $p < .01$, *** $p < .001$