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Using the realist perspective to link theory from qualitative evidence synthesis to quantitative studies: Broadening the matrix approach

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ABSTRACT

Background: This study describes an approach for the use of a specific type of qualitative evidence synthesis in the matrix approach, a mixed studies reviewing method. The matrix approach compares quantitative and qualitative data on the review level by juxtaposing concrete recommendations from the qualitative evidence synthesis against interventions in primary quantitative studies. However, types of qualitative evidence syntheses that are associated with theory building generate theoretical models instead of recommendations. Therefore, the output from these types of qualitative evidence syntheses cannot directly be used for the matrix approach but requires transformation. This approach allows for the transformation of these types of output.

Method: The approach enables the inference of moderation effects instead of direct effects from the theoretical model developed in a qualitative evidence synthesis. Recommendations for practice are formulated on the basis of interactional relations inferred from the qualitative evidence synthesis. In doing so, we apply the realist perspective to model variables from the qualitative evidence synthesis according to the context-mechanism-outcome configuration.

Findings: A worked example shows that it is possible to identify recommendations from a theory-building qualitative evidence synthesis using the realist perspective. We created subsets of the interventions from primary quantitative studies based on whether they matched the recommendations or not and compared the weighted mean effect sizes of the subsets. The comparison shows a slight difference in effect sizes between the groups of studies. The study concludes that the approach enhances the applicability of the matrix approach.

1 INTRODUCTION

The importance of syntheses of social science studies for evidence-based policy and practice is well established in previous research (eg, Dixon-Woods[1] and Petticrew[2]). Gough and Thomas[3] distinguish between aggregative and configurative synthesis methods. Aggregative synthesis methods mainly "add up" data from multiple, similar primary studies and are closely associated with testing theories or hypotheses. A common purpose of aggregative syntheses is to test theories by comparing the effect of an intervention with a different intervention or no intervention.[3] Configurative synthesis methods are closely associated with questions that generate theory or explore existing theory.[3] Most synthesis studies lie somewhere on the aggregative-configurative continuum.

In a qualitative evidence synthesis, qualitative or mixed-method studies are synthesized and can be used for aggregation as well as configuration. Several papers have addressed the description and potential of qualitative evidence synthesis methods (eg, the previous studies[4-7]). These methods can provide answers to questions focusing on "why" and "how" causal intervention mechanisms work and can generate hypotheses. Also these methods can be used to synthesize the experience of social entities by participants.[8, 9] Qualitative evidence syntheses can strengthen the explanatory power of primary qualitative studies[10, 11] and enhance their use value.[12]

Several authors have argued that synthesis of both quantitative and qualitative research could lead to a more diverse understanding of a topic.[13-19] In mixed studies reviews, extracted findings from quantitative, qualitative, and mixed method primary studies, all concerning one topic, can be combined on the review level. Qualitative research can contribute to a mixed studies review in several ways. Dixon-Woods, Fitzpatrick, and Roberts[20] discuss the possible roles that qualitative research can play in mixed studies reviews, ie, (1) as a precursor to quantitative work, selecting quantitative data or refining the review question; (2) providing data for a synthesis, using qualitative primary studies in a systematic review; (3) explaining quantitative findings by providing contextual information on an intervention; and (4) turning evidence into practice by providing information on the implementation of recommendations from reviews.

A standardized procedure for combining quantitative and qualitative evidence on the review level, using qualitative research to turn evidence into practice, is established by the Evidence for Policy and Practice Information and Coordinating Centre in London.[15, 21, 22] This method is called the "matrix approach" and is used to answer questions that focus on effectiveness, appropriateness, and barriers and facilitators for implementation of interventions. The approach explores correspondence between qualitative and quantitative evidence by tabulating the findings in a matrix. The matrix links the findings from qualitative studies about a certain topic with other quantitative evidence on the effectiveness of an intervention. In the examples of this approach (eg, the previous studies[23-27]), the matrix represents the correspondence between the 2 sources of data. Considering these examples, the matrix approach is a promising method that allows integration of estimations of effectiveness with qualitative understanding.[22]

1.1 Matrix approach

The matrix approach contains 3 main steps in which quantitative and qualitative evidence are combined:

1. The qualitative evidence synthesis has the purpose to develop recommendations. These recommendations are inferred from the descriptive themes identified from the primary studies. For example, in Thomas et al,[22] the qualitative evidence suggests that children do not see eating healthily as their responsibility, and an inferred recommendation is that interventions to improve child eating should focus on the taste of fruit and vegetables, rather than their health benefits. Such recommendations function as a starting point in the comparison of quantitative and qualitative data. The quantitative synthesis systematically collects all quantitative studies on the topic and extracts the data from the studies. All quantitative studies are then assessed for the extent to which they have incorporated the established recommendations in the intervention design or content.
2. To visualize the comparison, a matrix is produced that shows the recommendations in the columns and the relevant outcome measures from the quantitative studies in the rows. In this way, the researcher is able to identify the matches and absence of matches between the primary quantitative studies and the recommendations from the qualitative evidence synthesis.
3. Furthermore, the researcher can compare the effect sizes of those quantitative studies that match the recommendations and those that do not. Statistical tests within a meta-analysis setting can determine whether there is a difference between groups of studies incorporating the recommendations and those that do not. Altogether, the matrix approach can generate explanations and so inform policy and practice while also providing input for future research.

A qualitative evidence synthesis might aim to develop recommendations, but unfortunately, not all types of qualitative evidence syntheses generate findings that are directly fit for use in the matrix approach. Qualitative evidence synthesis studies vary in the type of findings they generate. Finfgeld-Connett[28] examined the findings of 100 qualitative evidence syntheses and distinguished between “isolated findings” and “findings in relationship,” where the latter is associated with theory building. The most configurative type of findings in relationship are theoretical models. In this case, relationships between 2 variables are integrated in a theoretical model and can be understood in context. Qualitative evidence syntheses that are primarily aimed at building theoretical models might be particularly difficult to use as input for, for example, the matrix approach. These types of syntheses raise a challenge for the transformation of findings into recommendations that are conceptually clear and concrete. There is a major gap between these types of output and the concrete recommendations that the matrix approach requires. The use of multiple and diverse methodologies in a mixed studies review would be necessary to allow for the combination of these sources.

The incorporation of the realist perspective[29] in the matrix approach could possibly account for the gap between output from theory-building qualitative evidence syntheses and the concrete recommendations for the matrix approach. Realist perspective acknowledges the particular functions that variables have in theoretical models by using the context, mechanism, and output (CMO) configuration. The realist perspective could assist in the explication of relationships derived from the output of theory-building qualitative evidence syntheses. This paper aims to explore

the possibility of using a theory-building qualitative evidence synthesis for input to the matrix approach by applying the principles of CMO configuration. It attempts to answer the following question: How can findings from a theory-building qualitative evidence synthesis be transformed so that they can serve as input for the matrix approach? Section 2 describes the realist perspective and explains all steps of the approach proposed in this paper using a worked example. The findings section presents the results of the comparison of the recommendations with the quantitative studies. The paper concludes with a reflection on the results of this exploration.

2 METHODOLOGICAL APPROACH

2.1 Applying realist perspective

Realist perspective[29] is a methodological orientation that is widely applied in, among other fields, evaluative inquiry.[30] It entails the quest to understanding "what works" in social interventions by using a specific logic of inquiry: It states that to generate a certain outcome, we have to understand the underlying mechanism that leads to the outcome while considering the context in which that happens.[31] In realist evaluation, CMO configurations are hypothesized and tested by focusing on the question "what is it about this intervention that works for whom in what circumstances?" The CMO configuration can be considered as a theory-driven approach because it first "frames" the factors in the intervention into the CMO configuration by coming up with a programme theory and then uses that to guide the evaluation.

Realist synthesis[31] is a form of realist evaluation that makes use of existing literature for the generation of a programme theory using the CMO configuration. This programme theory is then tested using other literature. For the current study, we use the CMO configuration from the realist perspective to frame an existing theoretical model of contextual factors, mechanisms, and outcomes from the qualitative evidence synthesis. We will do so aiming to shed light on an existing theoretical model from an existing qualitative evidence synthesis using the CMO configuration, rather than constructing new theory for testing with other literature as practiced in the realist synthesis. This is the first step of the transformation of the theoretical model into recommendations that will be applied to the theoretical model constructed from a qualitative evidence synthesis on students' views on collaborative learning in primary and secondary education.

- Step 1Deriving recommendations from the model

Step 1 of the approach proposed in this paper constitutes the application of the CMO configuration to an existing model from a qualitative evidence synthesis. The rationale behind this step is that theoretical models from qualitative data constitute causal mechanisms of sequence and associations. The themes that have emerged in the synthesis of the qualitative studies relate to each other and influence each other. In connection, these themes function comparable to the CMO configuration. The theoretical model holds the sequence of events framed in the CMO configuration, which allows us to isolate particular "programme theories" from the theoretical model.

We illustrate this step using a theoretical model from the theory-building qualitative evidence synthesis of Van Grootel, Boeije, Janssen, and Van Wesel.[32] In this review study, qualitative studies concerning students' views on collaborative learning in primary and secondary education have been synthesized. Collaborative learning was defined as a learning activity from which multiple participants, sharing a communal learning goal, benefit. The research team appraised the 22 included studies for quality and coded and synthesized the studies' results according to the principles of thematic synthesis.[33] The research resulted in a theoretical model describing students' views on collaborative learning with 2 analytical themes, 3 descriptive themes, and several subthemes. Figure 1 depicts the theoretical model that emerged from the data.

[FIGURE 1.]

The theoretical model describes the relation found between the 2 analytical themes: heterogeneity and self-regulation. The 2 analytical themes both hold 1 separate descriptive theme (inclusiveness and value), and they share 1 descriptive theme (positioning). The 3 descriptive themes consist of 2 or 3 subthemes each. The study describes the analytical theme heterogeneity as the variability among students in, for instance, knowledge, skills, and backgrounds. The other analytical theme, self-regulation, is explained as students taking responsibility for managing their own learning process. The descriptive theme inclusiveness is a way of dealing with heterogeneity among peers and refers to the collaboration of all students. Three environmental factors facilitated inclusiveness: Teachers assessed students in the collaboration, prepared students for the collaboration, and monitored the collaboration of students. Additionally, successful computer support helped students to enjoy the activity and to feel included. The descriptive theme positioning refers to the process in which students learn about the various capabilities of their peers and use this knowledge in the collaborative process. Three factors constitute positioning: Students dealt with grouping by themselves or the teacher, experienced feelings of safety, and were more or less engaged in the collaborative learning process. The subtheme engagement, in turn, consisted of 2 subsubthemes: involvement and role diversity. Students reflected on the descriptive theme value of collaborative learning for their future learning process in the light of the development of their self-regulating skills. Students mostly liked collaborative learning because they were able to create knowledge together, and felt that they had learned, to a certain degree, how to deal with peers in a collaborative learning process.

We have used the structure of the theoretical model for analytical themes, descriptive themes, and subthemes to apply the CMO configuration. The contextual factors, mechanisms, and outcomes are based on the subthemes and descriptive themes in the theoretical model. The contextual factors assessment, preparing and monitoring, computer support, grouping, safety, and engagement trigger specific mechanisms in the participating students. They feel a certain level of inclusiveness and start positioning themselves and others. These mechanisms result in the outcomes that they meet certain cognitive and social learning ends: creating knowledge and dealing with peers. Figure 2 shows all relations in the framework.

- Step 2Specifying relations

[FIGURE 2.]

The development of the recommendations for the matrix requires explicit specification of the type of relations among the contextual factors, mechanisms, and outcomes. The review team now interprets how and which parts of the theoretical model should be isolated to specify concrete recommendations. The first author interpreted the relations between contextual factors and mechanisms as holding under the condition of another contextual factor. Recommendations made based on theoretical models from qualitative evidence syntheses can therefore consist of moderation effects: statements of relations between 2 variables depending on a third variable.

The collaborative learning example contains these moderation effects. To illustrate this, we consider 4 of the 6 contextual factors (assessment, preparing and monitoring, grouping, and engagement) that influence the mechanisms which in turn influence an outcome variable: low-level interaction (see Figure 3). Low-level interaction can be interpreted as an example of dealing with peers. It refers to the instances in which students interact with each other by asking a question without asking for elaboration or instances in which they give an answer without elaboration. To be as specific as possible about the effects, we use the 2 subsubthemes of engagement as separate contextual factors (involvement and role diversity, C6a and C6b, respectively). We inferred an effect from assessment (contextual factor 1 or C1) on low-level interaction through inclusiveness depending on the value of involvement (C6a). Furthermore, we inferred an effect from role diversity (C6b) on low-level interaction through positioning depending on the value of preparing and monitoring (C2). Finally, we inferred an effect from the level of grouping (C4) on low-level interaction through positioning depending on the value of involvement (C6a). Moderating effects are shown with dashed arrows. Table 1 shows the formulation of the recommendations that are based on the specification of moderation effects as described above. (Note that recommendations for other context-mechanism-outcome pathways could also be developed; the recommendations have been limited to these few moderation effects for clarity of the demonstration of the approach.)

- Step 3Comparing the recommendations to the quantitative studies

[FIGURE 3.] [TABLE 1]

After formulation of the recommendations, the regular steps of the matrix approach can be followed. At this point, we compare the recommendations to the quantitative studies to create the matrix. This point is a regular step in the matrix approach; however, the interventions described in the quantitative studies now have to include 2 factors instead of just one. The descriptions of interventions must explicitly mention the inclusion of both contextual factors in the intervention to match a recommendation, but the intervention does not necessarily have to manipulate one or both contextual factors to be selected as a match to the recommendation.

The quantitative dataset in the collaborative learning example consists of 106 studies concerned with collaborative learning in primary and secondary education. We scored whether or not the recommendations match the information in the study designs in the quantitative dataset. For example, for recommendation 1, we checked whether the intervention mentioned that there was some form of assessment or feedback provided to students that focused on the collaborative process. Interventions that included this in their design were then checked for the inclusion of

some kind of effort by the intervention to keep students involved during the process. Table 2 shows the number of primary quantitative studies matching each contextual factor and each recommendation.

[TABLE 2]

Many quantitative studies in our dataset included only 1 contextual factor, but not both contextual factors that constitute the moderation effect. Most of the quantitative studies (70 out of 106) indeed matched at least 1 contextual factor, yielding a total of 185 matches. As expected, a smaller number of 37 of the 106 quantitative studies matched at least 1 recommendation (specific combination of 2 contextual factors), for a total of 43 matches.

- Step 4Quantitative analysis of the subgroups

In the matrix approach, the recommendations of the qualitative evidence synthesis are compared to the interventions to create subgroups of studies. These subgroups are then used as input for the meta-analysis of the quantitative studies. The approach proposed in this paper also allows for a meta-analysis using the quantitative studies that included the recommendations in their interventions as subgroups. To see whether the studies incorporating the recommendations were more or less effective than the studies that only incorporated 1 or no contextual factor, we compared the mean effect sizes of these groups of studies. We compared moderation effects to direct effects and the absence of effects.

Table 3 shows an example from the collaborative learning case in which the analysis reveals a possible moderation effect of recommendation 2 (including C6b and C2; role diversity and preparing and monitoring) on the dependent variable low-level interaction. We used a random effects meta-analysis of variance to compare the group of studies that did not take into account C6b and C2 (Group 0) with the group of studies that only took into account C2 (Group 1) and with the group of studies that took into account recommendation 2 (Group 2). There were no studies in our dataset that only took C6b into account. The descriptive statistics show that there is a slight difference between the 3 groups. Because of the low sample sizes, these differences are not significant: Q_b (2, 34) = 1.26, P = .53.

Group 0 shows a very small decrease in low-level interaction. Group 1 shows no effect. Group 2 shows a small negative effect. These results suggest that there may be no main effect of preparing and monitoring on low-level interaction, but there may be a small interaction effect of preparing and monitoring and the presence of role diversity in the type of task students are involved in on low-level interaction. These results show that the inference of moderation effects from a qualitative evidence synthesis can be relevant, and they give rise to the idea that interventions including these recommendations might have a different weighted effect size.

3 DISCUSSION

The matrix approach enables the reviewer to compare findings of qualitative evidence and quantitative studies. The matrix approach reveals the extent to which the qualitative and quantitative evidence differs. Meta-analysis is known to identify research gaps,[34] and the combination of quantitative studies and qualitative

evidence synthesis makes the matrix approach also very useful for that purpose. In addition, the matrix approach serves a theory-generating purpose[22] by including the views of participants in the quantitative evidence-base, which could lead to more appropriate and effective interventions. This study adds to the matrix approach that the formulation of moderation effects based on the qualitative evidence synthesis allows us to be even more specific about the process preceding an outcome. This study broadens the applicability of the matrix approach by creating the possibility for theory-generating qualitative evidence syntheses to be used as input.

The approach fits well within a realist perspective of science. According to Bhaskar,[35] we seek to understand the underlying structures and mechanisms that produce outcomes, but cannot observe them directly. Instead, we are limited to the domain of the "empirical" and can only observe events and patterns of events, rather than what gives rise to them. Importantly, we understand that the context within which the intervention is implemented contains the conditions by which outcomes are generated, and it is these properties of the context—which we call mechanisms—that give rise to the outcomes we observe. In the example above, we cannot observe the mechanism "inclusiveness" but generate theory through the thematic synthesis about how we expect such a mechanism to operate (if indeed, it is a good way of understanding what gives rise to the specified outcomes). However, as we can never observe the mechanisms directly, we must use empirical research to see whether our hypothesized mechanisms behave as expected under the conditions we specify; ie, we test this through the subgroup analyses in the matrix. Thus, by using a mixed studies approach, we are able to develop understanding about unobservable "generative mechanisms" through the qualitative studies, which is confirmed or falsified through the subgroup analyses of empirical quantitative studies.

A potential drawback of the method is that finding studies that match the recommendations may be more difficult when the recommendations are formulated in terms of moderation effects, so involving 3 variables instead of 2. It may result in quantitative analyses on subsets that have small sample sizes. The generalizability of the results from the quantitative analysis in this study was limited by the small sample sizes of the subsets, partly because of the variety of dependent variables in the quantitative dataset. We expect that researchers interested in subset analyses will encounter these problems when using this method, as meta-analyses in social science research often suffer from a lack of standard outcome measures.[36] Conversely, the assumption that the relation can be explained using only 2 explanatory variables might be an oversimplification of reality. Moderation effects alone might not cover the complexity of underlying mechanisms leading to a particular outcome. They account for only 3 variables, whereas interventions might sometimes be embedded in multiple complex social systems[31] that require a larger number of explanatory variables and different types of interactions. The limitation of possible small sample sizes may make the method less useful for reviewers who are mainly interested in hypothesis testing of large theoretical models, for example, those tested using structural equation meta-analysis models.[37, 38] Besides, the limitation to 3 variables may increase the possibility of oversimplification. Taken together, new research applying this method is called for to learn more about the applicability of this approach with various types of review aims and theoretical models.

The explication of variables and relations in the realist synthesis framework increases the level of difficulty of the approach that is discussed in this study. But multiple

methodologies are necessary to transform the results of a qualitative evidence synthesis into the recommendations that are required in the matrix approach. However, it also is a strong point of this approach because the framework forces the reviewer to show for exactly which variables and relations the quantitative dataset is examined. Consequently, it increases the transparency and auditability of the method. The method provides the possibility to cluster quantitative studies based on more specific information on the relations between independent variables. The method will therefore be particularly useful for reviewers who are mainly interested in the mechanisms of (complex) interventions, for example, interventions containing multiple mediators and moderators, multiple outcome measures, feedback loops, or synergy between components (eg, the previous studies[39-47]). There has been a call for mixed studies review methods that account for complex interventions.[48, 49] New reviews of complex interventions applying this method could shed more light on its value for the evaluation of complex interventions and more generally, on its value for mixed studies reviewing.

4 CONCLUSION

This study has shown that it is possible to use output from a theory-building qualitative evidence synthesis as input to the matrix approach. The framework from realist synthesis, identifying contextual factors, mechanisms, and outcomes, assists in explicating the relations found in the theoretical model into concrete recommendations. Taken together, this study implies that accounting for the moderation effect of contextual factors, rather than merely for the direct effect of one or more contextual factors, might indeed better explain—or at least hypothesize—why an intervention works in which context.

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FIGURES AND TABLES

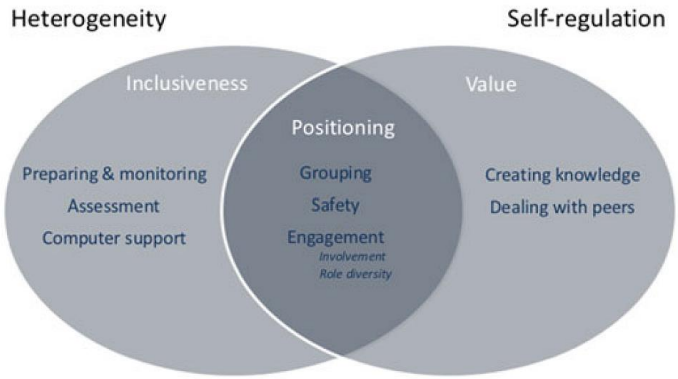

FIGURE 1 Graphical representation of constructed model including 2 analytical themes, 3 compartments (descriptive themes), and subthemes per compartment [Colour figure can be viewed at wileyonlinelibrary.com]

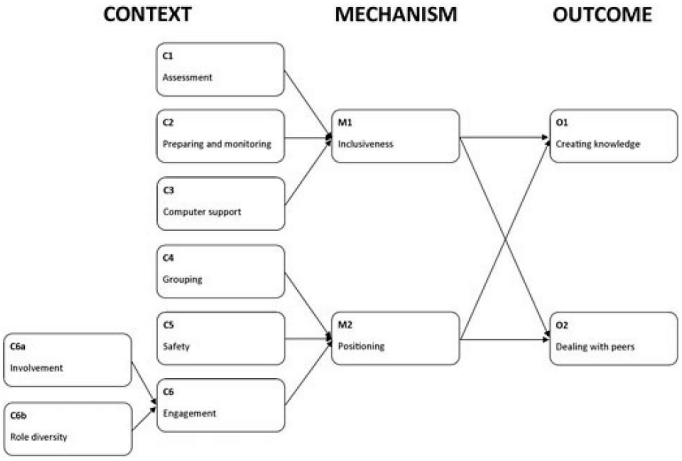

FIGURE 2 Contextual factors, mechanisms, and outcomes in collaborative learning inference

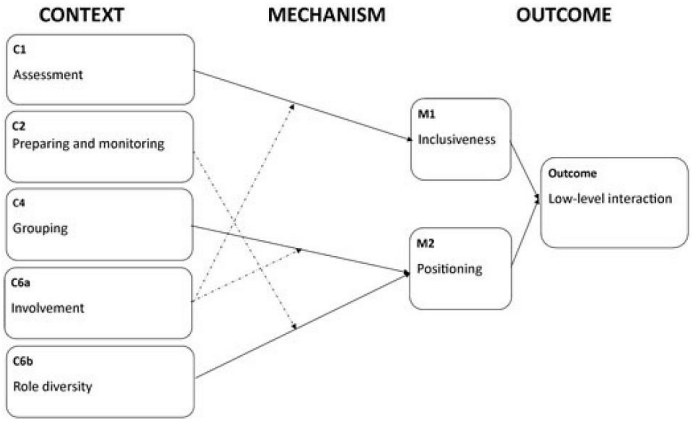

FIGURE 3 Moderation effects in collaborative learning with low-level interaction as the outcome

Table 1. Recommendations based on the theoretical model

Recommendation	
1. C1, assessment; C2, preparing and monitoring; C4, grouping; C6a, involvement; C6b, role diversity.	
1	Assess the collaborative process (C1) under the condition that the teacher keeps students involved (C6a) during the collaborative process
2	Create role diversity in the type of task students are in (C6b) under the condition that students are prepared for the collaboration (C2)
3	Create heterogeneous groups (C4), under the condition that the teacher keeps students involved (C6a) during the collaborative process

Table 2. Matches between qualitative evidence synthesis (QES) recommendations and quantitative studies

	Contextual Factors and Combinations	Number of Matches
1. Each quantitative study could have more than one match; therefore, the number of matches exceeds the number of studies. 2. C1, assessment; C2, preparing and monitoring; C4, grouping; C6a, involvement; C6b, role diversity.		
Contextual factors (total n = 185)	C1	22
	C2	44
	C4	55
	C6a	44
	C6b	20
Recommendations (total n = 43)	1	6
	2	16
	3	21

Table 3. Results meta-analysis of variance comparing groups on "low-level interaction"

Group	Mean Effect Size (Transformed Fisher Z)	*P* Value Mean Effect Size	Standard Error	Q_w Statistic	*P* Value Q_w Statistic	N
1. Group 0, studies that did not take into account C6b (role diversity) and C2 (preparing and monitoring); Group 1, studies that only took into account C2; Group 2, studies that took into account recommendation 2 ("create role diversity in the type of task students are in (C6b) under the condition that students are prepared for the collaboration (C2)").						
0	−0.03	.71	0.09	9.92	.62	13
1	0.00	.96	0.07	18.06	.32	17
2	−0.16	.21	0.13	9.51	.15	7