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Status

Published in *Small Group Research*, Volume 25, Issue 6, Pages 770-794

Downloaded from:

http://www.onderwijskunde.ugent.be/nl/abstract_Structuring-asynchronous-discussion-groups-by-introducing-roles.htm

DOI:

10.1177/1046496408323227

<http://dx.doi.org/10.1177/1046496408323227>

Please cite as:

De Wever, B., Schellens, T., Van Keer, H., & Valcke, M. (2008). Structuring Asynchronous Discussion Groups by Introducing Roles: Do Students Act in Line with Assigned Roles? *Small Group Research*, 39, 770-794.

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Structuring Asynchronous Discussion Groups by Introducing Roles: Do Students Act in Line with Assigned Roles?

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Abstract

This study focused on the introduction of roles as a scripting tool in asynchronous text-based discussion groups. Five roles were selected: source searcher, theoretician, summarizer, moderator, and starter. Since existing research on role assignment often neglects to check whether the role assignment is successful, the main goal was to examine to what extent the participants enacted assigned roles. The study took place in the first year of a university course in Instructional Sciences ($N = 200$). Quantitative content analysis of students' postings was performed and logistic regressions revealed that all participants enacted the roles they were assigned. The participants generally did not neglect other activities while discussing. The introduction of roles appeared to be a successful structuring intervention.

Keywords: Role assignment; Asynchronous discussion groups; Computer-supported collaborative learning (CSCL); Content analysis

Introduction

In the age of lower hardware costs and broadband internet technology, online learning is increasingly popular. Networked computers and software for both synchronous and asynchronous communication are suitable for supporting collaborative learning. In computer-supported collaborative learning (CSCL), researchers, as well as practitioners, continue to explore instructional approaches in online learning environments. This study focused on one specific online learning environment, namely, asynchronous text-based discussions. The participants were in a first-year course in Instructional Sciences involving asynchronous discussion groups of 10 students. The aims of the discussion groups were to foster students' processing of the learning content and, by confronting them with authentic tasks, to promote discussion of the different concepts they encounter in the face-to-face sessions and the course manual. To achieve high-quality interaction, enhanced collaboration, and consequently knowledge construction through social negotiation, the students had assigned roles. Providing structure by assigning roles is an instructional approach that has been in use for some time, but we know little of its effects. A prerequisite for studying the impact of this intervention on knowledge construction is examining whether a structuring intervention is implemented successfully. In the present context, this entailed determining the extent to which students

enacted their assigned roles during discussions. Existing research on role assignment often neglects to check whether the role assignment itself is successful. This leads us to the main question of this study: Do students behave in a manner consistent with the assigned roles?

Roles as a Scripting Tool

Simply grouping individual students in asynchronous discussion groups does not necessarily lead to effective interaction or collaborative learning (Weinberger, Reiserer, Ertl, Fischer, & Mandl, 2005). These learning environments need a certain amount of structure. One specific technique for creating structure is to script them by assigning roles to different group members. Examples of relevant roles in an offline educational context are recaller, who discusses the main topics in a section of text, and listener or commentator, who comments on this discussion and detects possible errors or omissions (Buchs, Butera, & Mugny, 2004; Lambiotte, Dansereau, & O'Donnell, 1987; O'Donnell, Dansereau, Hall, & Rocklin, 1987).

Instructional approaches to collaborative learning entail assigning roles to students to support coordination and promote effective patterns of interaction. A number of positive effects ostensibly derive from particular roles. Groups in which roles are assigned can work efficiently, smoothly, and productively (Cohen, 1994); moreover, "the practical matter of having critical roles filled in meetings has direct implications for improving task performance and satisfaction" (Zigurs & Kozar, 1994, p. 277). Assigned roles can alleviate problems of nonparticipation or domination of interaction by one group member (Cohen, 1994).

Although the use of roles is not the most prominent approach to structure communication and collaboration in asynchronous discussion groups (Strijbos & Martens, 2001), a number of practical examples appear in published research. In an online setting described by Aviv (2000), learners are to encourage and facilitate each others' efforts to reach the learning goals via four assigned roles: helper, feedback provider, resource manager, and process reflector. Strijbos et al. (2004) introduced four roles to support work organization and communication among team members: project planner, communicator, editor, and data collector. Hara, Bonk, and Angeli (2000) introduced two roles in their asynchronous computer conferences in a graduate-level course. The starter was to initiate the discussion by asking questions related to specific readings, and the wrapper summarized the discussion on the readings for the week. Zhu (1996) also used this starter-wrapper technique in electronic discussions. Tagg (1994) developed a similar approach for exercises, with the aim of relating theoretical material to participants' experiences, using two roles: a topic leader, who was responsible for submitting an initial introductory exercise contribution, and a topic reviewer, who was responsible for summarizing the topic at the end. The topic leader appeared to serve a vital contextualizing function in moderating conferences. The role of moderator in computer-conferencing terms guides the discussions and stimulates participation and is generally highly valued (Mason, 1991). In informal learning in online communities, Gray (2004) found that "the presence of an online moderator helped the community evolve from a forum for sharing information to a community of practice where knowledge was constructed through shared learning" (p. 29). It appears, then, that in CSCL-environments, the role of online moderator may be critical for enhancing learning.

Aim of the Present Study

A number of previous studies have concentrated on introducing roles in online discussion groups. The aim of these studies has been to examine the effect on students' participation rates, their interaction patterns, group efficiency, the level of knowledge construction reflected in the discussion, and the like (Hara et al., 2000; Schellens, Van Keer, & Valcke, 2005; Strijbos et al., 2004). In most studies, however, there has been little, if any, attention to whether students enact the assigned roles appropriately. According to Cohen (1994), students

do not always enact assigned roles as directed. Hence, conclusions concerning the effects of role scripting may, in some instances, be unwarranted. Previous research (Schellens et al., 2005) on summarizer, moderator, theoretician, and source searcher roles, showed that only messages of students in the summarizer role resulted in higher levels of knowledge construction compared to students without role assignment. For the theoretician role, no differences emerged. Both the source searcher and the moderator role exhibited lower levels of knowledge construction. Another study concluded that only the summarizer role leads to higher levels of knowledge construction (De Wever, Van Keer, Schellens, & Valcke, 2007). However, to interpret these results correctly, we need studies focusing on validating enactment of specific role assignments, since the reported differences might be attributable to the different roles themselves or to the fact that students do not perform their assigned roles in line with expectations.

Verifying to what extent students enact assigned roles in collaborative learning is interesting from a practical point of view, since such information can be of value in making more informed decisions concerning which roles are both feasible and valuable to introduce in CSCL environments. Moreover, it is also important to shed a light on role performance from a theoretical and empirical point of view. As roles are introduced as an instructional approach to structure and to optimize online discussions, the question of whether students behave in a manner consistent with the assigned roles is important. If so, do they exclusively stick to these roles, or do they engage in other discussion activities as well?

The present study included five roles: starter, summarizer, moderator, theoretician, and source searcher. The inclusion of the starter and summarizer was based on past research regarding the starter-wrapper technique (Hara et al., 2000; Zhu, 1996). The moderator was selected on the basis of findings indicating that such a role is critical for enhanced learning in online contexts (Gray, 2004). Strijbos et al. (2004) suggest that when cooperative learning pedagogies, and more specifically roles, are used in higher education or online learning environments, they should be adapted to the specific context, as students in these settings vary considerably in prior knowledge, experience, and collaboration skills. Taking into account that the discussion groups in the course from which the participants came are organized to stimulate debate on theoretical concepts presented in the face-to-face sessions and course manual, we supplemented the starter, summarizer, and moderator roles with those of source searcher and theoretician.

The role of the source searcher seeks external information on discussion topics to stimulate others to go beyond the scope of the course material. It is a partial composite of the information giver described by Zigurs and Kozar (1994), the resource person described by Cohen (1994), and a specific activity assigned to the role of weekly participant by Zhu (1996), namely bringing related issues or newspaper articles to everyone's attention.

Students performing the role of theoretician were to introduce theoretical information from the weekly face-to-face session or the course material, and to ensure that all relevant theoretical concepts enter the discussion. This role is closely related to the specific goal of the online discussions in the present research setting, namely becoming familiar with the different theoretical concepts through discussing and solving tasks.

The summarizer was to post interim summaries during a discussion, while identifying any dissonance and harmony among the messages and drawing provisional conclusions. Moreover, summarizers were to post a final summary and conclusion at the end of the discussion.

The role of the moderator consisted of monitoring the discussions, asking critical questions, and inquiring for others' opinions. This involved pointing out questions and concerns that had yet to be answered (Zhu, 1996). Furthermore, one of the main functions of the moderator was encouraging participation (Gray, 2004).

The starter had the responsibility to start discussions by posting a number of contributions on which other students can build. The role further entailed adding new points during the discussions and reactivating interaction when discussions slacked off.

In the study, all students were to moderate, summarize, and add new discussion points, theory, and information. However, those with a specifically designated role were to enact the related behavior in an explicit and consistent way.

In view of the need to validate the fulfillment of specific role assignments in online discussion groups, we sought to determine empirically the extent to which students enacted the five assigned roles in accordance with the expectations associated with each. More specifically, we hypothesized that in comparison to other group members: (H1) students assigned the role of source searcher would mention and discuss significantly more sources; (H2) students assigned the role of theoretician would mention and discuss significantly more theoretical elements; (H3) summarizers would engage significantly more in summarizing and recapitulation of parts of the discussion; (H4) students assigned the role of moderator would post significantly more contributions comprising organizational or content moderating; and (H5) the contributions of the starter will include more new points instigating the discussion. In testing these hypotheses, we controlled for gender and educational degree.

Method

Participants and Context of the Study

Participants in the present study were students enrolled in a freshman course in Instructional Sciences ($N = 200$). The majority ($N = 182$) of the participants were female. A subgroup of 17 already had a bachelor degree. The remainder had degrees in secondary education. The students took part in 10-person discussion groups. Each discussion group addressed four consecutive discussion topics corresponding to chapters of the course manual: behaviorism, cognitivism, constructivism, and evaluation. Each topic covered a three-week period; students collaborated independently of time and location. Participation in the discussions was obligatory and the discussion score accounted for 25% of the course grade; the exam accounted for 75%. Each student had to contribute at least four times per discussion unit. As previously mentioned, the discussion groups were to foster students' processing of the learning content and, by confronting them with authentic tasks, to promote interaction concerning the different concepts covered in the face-to-face sessions and the course manual. One of the discussion assignments, for example, required the students to develop a checklist of essential criteria for determining whether learning environments are based on constructivistic principles. They were to use this checklist actively to decide "how constructivistic" a given learning environment was. In addition, they were to search for other learning environments to which they could apply their checklist, identify the constructivistic elements, and, if necessary, suggest changes to make the environment more constructivistic. Afterwards, students were to revise the instrument. The discussion tasks were the same for all groups.

Two staff members use two criteria for assessing performance: a quantitative criterion (5 out of 25 points) focusing on students' presence in the discussion, and qualitative criteria (20 out of 25 points) concentrating on the value concerning content. The number of messages was counted; this quantitative criterion was based on the fact that collaborative learning can only occur if students discuss the learning topics sufficiently (Schellens, Van Keer, Valcke, & De Wever, 2007). This required that students participate regularly, which implied that students would post at least four messages throughout the discussion, not only at the end. Second, the messages should be meaningful. Although social messages (e.g., "thank you" and "let's have a pizza") can be valuable for creating an attractive learning atmosphere, they are not sufficient

to produce collaborative learning. Hence, the qualitative criteria focused on whether students formulated their opinions, introduced arguments, and based their arguments on relevant sources. The students were aware that staff members would check whether they enacted their roles if they had a role assigned. The mean score for students who participated in all discussion topics was 12.06 on 25 (or 48.25%, min = 4.375, max = 20, $SD = 3.17$), which was comparable to the mean score for the exam, namely 39.62 on 75 (52.83%, min = 18.75, max = 56.25, $SD = 7.49$).

Design and Data Collection

In the study, every discussion group addressed two discussion topics with and two topics without role support. To control for time effects, the role-supported discussion topics were either the first or the last two considered. For the first role-supported discussion topic, five randomly selected students each had one of the five roles. The remaining students had no assigned roles. The roles rotated when the groups took up the next topic. That is, in the second role-supported discussion, assigned roles went to the students not having an assignment in the first role-supported discussion. Each student, then, had a role once. Students were to enact their roles in addition to providing their regular discussion input.

The roles were introduced and explained in a face-to-face session. All information concerning the discussion groups in general and the role descriptions in particular also appeared at a course-related website so that all students could retrieve the essential information online. In this way, we tried to observe and satisfy the following guidelines for assigning roles: “(1) make your assignment of the job to a specific member of each group public knowledge; (2) specify exactly what the person playing the role is supposed to do; and (3) make sure everyone knows what the role player is supposed to do” (Cohen, 1994, p. 96).

Quantitative Content Analysis

The data consisted of the transcripts for 20 discussion groups of 10 students for all four topics. Across the 80 discussions, there were 4,770 messages, and approximately 60,000 lines of text.

To analyze the role-related activities in students' contributions, we developed an analysis scheme identifying message characteristics for five dimensions: sources, theory, summaries, moderation, and new points. These dimensions relate to the five roles of interest. Although all students were to engage in communicative activities with such characteristics, those with assigned roles were to pay extra attention to the execution of the related activities. Indicators of different levels within role activation appear in Table 1. The coding of the messages and the scoring of students are two independent processes. For the coding, messages serve as unit of analysis and each message received one code for each dimension. For example, a message simply containing an URL to a website received code 1 (mentioning sources) on the source dimension. If the message also comprised a discussion of the website, it received code 2 (discussing sources) on the source dimension. When a message did not refer to external sources, it received code 0 (no sources).

Coding Strategy and Reliability

We trained five independent coders. After the training, they processed some transcripts together so as to develop skills and comfort with the process. Next, they independently coded the transcripts. We randomly selected 154 messages for all five to code to gauge the interrater reliability for message characteristics. Krippendorff's alpha (α) interrater reliability coefficients for the dimensions source, theory, summaries, moderation, and new points (respectively .73, .76, .66, .58, and .53) suggests fair to good agreement beyond chance (Neuendorf, 2002).

Table 1
Analysis Scheme Identifying Message Characteristics

Dimension	Characteristic (code)	Description
Source	No sources	Not referring to external sources
	Mentioning sources	Mentioning external sources
	Discussing sources	Actively using and discussing external sources
Theory	No theory	Not referring to theoretical concepts
	Mentioning theory	Mentioning theoretical concepts
	Discussing theory	Actively using and discussing theoretical concepts
Summary	No summary	Not summarizing information from other messages
	Minor summary	Summarizing information from a number of messages
	Extensive summary	Summarizing information from a substantial part of the discussion
Moderating	No moderating	No moderation tasks performed
	Organizational moderating	Organizational moderation tasks performed (e.g. planning)
Dimension	Characteristic (code)	Description
	Content moderating	Moderation task as regards content performed (e.g. compare different statements, weigh up different messages)
	Organizational and content moderating	Combination of both moderation tasks
New points	No new points	No new points added to the discussion
	New points introduced	New points added to the discussion

Statistical Analysis

The five dimensions of message characteristics served as dependent variables for our analysis. The first three dimensions (source, theory, and summaries) we treated as ordinal; moderation was treated as nominal, since organizational and content moderating cannot be ranked; new points dimension was dichotomous.

The roles assigned to the students served as the independent variable in our study. In addition, we controlled for the effect of gender and degree in education (bachelor degree, degree in secondary education). No interaction between these variables was assumed. The independent variable role type comprised 7 categories: (1) source searcher, (2) theoretician, (3) summarizer, (4) moderator, (5) starter, (6) no role, and (7) no-role condition. Students in the last two categories had no role. We distinguished between students without roles in a condition in which assigned roles were present (category 6: no role) and students in the no-role condition (category 7).

For the first three dependent variables (source, theory, and summaries) we used ordinal regression analysis. For the remaining two, moderation and new points, we employed multinomial and binary logistic regression procedures, respectively. Females, those with a degree in secondary education, and students in the no-role condition were a reference category for the regression analyses. We assessed the overall effect of the role type predictor by means of likelihood ratio tests (LRT). To correct for multiple tests, we used Bonferroni adjusted values for level of confidence. As for role type, we contrasted 6 categories with the reference category, and used a Bonferroni adjusted alpha level of .0083 ($= .05/6$). When reported, we supply the Bonferroni corrected alpha levels (e.g., $p < .0017 = .01/6$, $p < .0083 = .05/6$ or $p < .00017 = .001/6$).

Results

Descriptive Results

Of all contributions, 47.9% were from students in the no-role condition, 22.0% from students without a role in the role condition, and 30.1% from those assigned a role (i.e., approximately 6% per role). Students with a bachelor degree posted 10.3% of the contributions. Male students posted 7.7%. Table 2 shows the distribution among the categories of the five dimensions of message characteristics for students assigned the role of (1) source searcher, (2) theoretician, (3) summarizer, (4) moderator, (5) starter; (6) students without role assignment in the role condition; and (7) students in the no-role condition. In the following sections, we discuss the results for each dimension in more detail.

Table 2. Distribution of Message Characteristic Across Roles

Dimension	Category	Source searcher	Theoretician	Summarizer	Moderator	Starter	No role	No-role condition	Total
Source	No sources	64.4%	91.5%	95.4%	90.8%	92.1%	90.9%	90.7%	89.4%
	Mentioning sources	11.4%	3.9%	1.6%	4.8%	4.3%	3.5%	4.2%	4.4%
	Discussing sources	24.2%	4.6%	2.9%	4.4%	3.6%	5.7%	5.2%	6.2%
Theory	No theory	34.9%	24.6%	30.4%	34.3%	30.9%	30.3%	34.3%	32.3%
	Mentioning theory	41.2%	37.5%	51.0%	42.8%	42.1%	42.0%	40.7%	41.3%
	Discussing theory	23.9%	37.9%	18.6%	22.9%	27.0%	27.7%	25.0%	26.4%
Summary	No summary	98.3%	98.2%	67.1%	93.4%	97.8%	98.1%	95.6%	94.7%
	Minor summary	1.0%	0.7%	2.9%	2.2%	1.4%	1.4%	1.8%	1.6%
	Extensive summary	0.7%	1.1%	30.0%	4.4%	0.7%	0.5%	2.6%	3.7%
Moderating	No moderating	86.5%	81.9%	83.1%	64.9%	72.7%	86.1%	81.9%	81.6%
	Organizational	0.7%	0.7%	3.9%	5.9%	4.7%	1.4%	3.1%	2.8%
	Content	12.8%	17.4%	13.0%	27.3%	20.5%	12.2%	14.6%	15.1%
Dimension	Category	Source searcher	Theoretician	Summarizer	Moderator	Starter	No role	No-role condition	Total
	Organizational & content	0.0%	0.0%	0.0%	1.8%	2.2%	0.3%	0.5%	0.5%
New points	No new points	57.1%	57.7%	76.9%	58.7%	52.5%	59.2%	63.2%	61.0%
	New points introduced	42.9%	42.3%	23.1%	41.3%	47.5%	40.8%	36.8%	39.0%

Mentioning and Discussing Sources

Of the contributions, 89.4% did not mention or discuss sources. In 4.4% of the contributions, sources were mentioned, and in 6.2% of the postings, sources were discussed. No significant effect for gender emerged. However, there was a significant effect of educational degree: the specific parameters in Table 3 show that the odds of mentioning versus not mentioning sources and the odds of discussing versus mentioning sources were 1.67 times higher for students with a bachelor degree compared to students with a degree in secondary education (est = 0.510, *SE* = 0.144, *p* < .001).

The results support Hypothesis 1. The likelihood ratio test revealed an overall effect of role type ($\chi^2 = 152.371$, *df* = 6, *p* < .001). The odds of mentioning versus not mentioning and the odds of discussing versus mentioning sources were 5.44 times higher for students assigned the role of source searcher compared to students in the no-role condition (est = 1.694, *SE* = 0.144, *p* < .00017). The results also indicated that the odds of mentioning versus not mentioning sources and the odds of discussing versus mentioning sources were 2.31 times lower for students assigned the role of summarizer compared to students in the no-role condition (est = -0.837, *SE* = 0.293, *p* < .0083). No significant differences for the three other roles and for the students without roles in a role condition compared to the reference category emerged (see Table 3).

Table 3. Ordinal Regression Estimates for Mentioning and Discussing Sources

	estimate	SE	Wald	df	p	OR	OR ⁻¹	LB95%CI	UB95%CI
Gender									
Male	0.061	0.187	0.105	1	0.746	1.062		0.737	1.532
Female	ref. cat.								
Educational Degree									
Higher education	0.510	0.144	12.471	1	0.000	1.665		1.255	2.209
Secondary education	ref. cat.								
Role type									
Source searcher	1.694	0.144	138.766	1	0.000	5.439		4.103	7.209
Theoretician	-0.014	0.227	0.004	1	0.950	0.986	1.014	0.632	1.537
Summarizer	-0.837	0.293	8.167	1	0.004	0.433	2.308	0.244	0.769
Moderator	-0.041	0.224	0.033	1	0.855	0.960	1.042	0.619	1.490
Starter	-0.278	0.245	1.292	1	0.256	0.757	1.321	0.468	1.224
No roles	-0.028	0.131	0.047	1	0.828	0.972	1.029	0.751	1.257
Without roles	ref. cat.								

Mentioning and Discussing Theory

In 32.3% of the contributions, theory was not mentioned or discussed. In 41.3% of the messages, theoretical concepts were mentioned, and in 26.4%, they were actively discussed. The effect for gender was not significant. The odds of mentioning versus not mentioning theory and the odds of discussing versus mentioning theory were 1.29 times lower for students with a bachelor degree than for students with a degree in secondary education (est = -0.255, $SE = 0.091$, $p < .01$).

The expected positive effect of theoretician (Hypothesis 2) surfaced in the data. There was an effect of role type (LRT: $\chi^2 = 26.942$, $df = 6$, $p < .001$), and the odds of mentioning versus not mentioning theory and of discussing versus mentioning theory were 1.74 times greater for contributions from theoreticians compared to contributions from students in the no-role condition (est = 0.554, $SE = 0.122$, $p < .00017$). No other roles showed a significant effect at the .0083 (= .05/6) level (see Table 4).

Table 4. Ordinal Regression Estimates for Mentioning and Discussing Theory

	estimate	SE	Wald	df	p	OR	OR ⁻¹	LB95%CI	UB95%CI
Gender									
Male	-0.138	0.104	1.754	1	0.185	0.871	1.148	0.710	1.068
Female	ref. cat.								
Educational Degree									
Higher education	-0.255	0.091	7.816	1	0.005	0.775	1.290	0.649	0.927
Secondary education	ref. cat.								
Role type									
Source searcher	-0.114	0.118	0.925	1	0.336	0.893	1.120	0.708	1.125
Theoretician	0.554	0.122	20.462	1	0.000	1.740		1.369	2.212
Summarizer	-0.014	0.115	0.014	1	0.905	0.986	1.014	0.787	1.236
Moderator	-0.057	0.120	0.225	1	0.636	0.945	1.059	0.747	1.195
Starter	0.116	0.120	0.937	1	0.333	1.123		0.888	1.420
No roles	0.157	0.071	4.944	1	0.026	1.170		1.019	1.344
Without roles	ref. cat.								

Summarizing

Among the messages, 94.7% had no summaries, 1.6% had minor summaries, and 3.7% of the messages included extensive summaries. There was no significant effect for either gender or type of educational degree (see Table 5). The effect for the predictor role type was significant (LRT: $\chi^2 = 282.022$, $df = 6$, $p < .001$). More specifically, the effect of assigning a summarizer role was substantial (est = 2.442, $SE = 0.161$, $p < .00017$). In comparison to contributions in the no-role condition, the odds of minor versus no summaries and the odds of

extensive versus minor summaries were 11.50 times greater. In addition, Table 5 shows that the odds of minor versus no summaries and the odds of extensive versus minor summaries were 2.36 times less for contributions of students without roles in the role condition compared to students in the no-role condition (est = -0.859, $SE = 0.255$, $p < .0017$). The data, then, are largely supportive of Hypothesis 3.

Table 5. Ordinal Regression Estimates for Minor and Extensive Summaries

	estimate	SE	Wald	df	p	OR	OR ⁻¹	LB95%CI	UB95%CI
Gender									
Male	-0.143	0.258	0.310	1	0.578	0.866	1.154	0.523	1.435
Female	ref. cat.								
Educational Degree									
Higher education	0.175	0.208	0.702	1	0.402	1.191		0.792	1.791
Secondary education	ref. cat.								
Role type									
Source searcher	-0.916	0.465	3.885	1	0.049	0.400	2.499	0.161	0.995
Theoretician	-0.833	0.464	3.222	1	0.073	0.435	2.300	0.175	1.080
Summarizer	2.442	0.161	231.258	1	0.000	11.499		8.394	15.753
Moderator	0.469	0.267	3.074	1	0.080	1.598		0.946	2.698
Starter	-0.704	0.428	2.711	1	0.100	0.494	2.022	0.214	1.144
No roles	-0.859	0.255	11.345	1	0.001	0.423	2.362	0.257	0.698
Without roles	ref. cat.								

Moderating

Contributions including content moderating activities were more prevalent (15.1%) than either contributions comprising organizational moderating (2.8%) or contributions containing both forms of moderating (0.5%). The nominal regression estimates for these three categories (as compared to the reference category: no moderating, 81.6%) appear in Table 6. Again, no significant effect for gender appeared. The overall effect for type of educational degree was positive (LRT: $\chi^2 = 29.790$, $df = 3$, $p < .001$). The odds of organizational moderating and content moderating were 3.02 and 1.53 times higher for students with a bachelor degree compared to students with a degree in secondary education (respectively, est = 1.104, $SE = 0.220$, $p < .001$ and est = 0.424, $SE = 0.127$, $p = .001$). The overall effect of role type was also significant (LRT: $\chi^2 = 108.907$, $df = 18$, $p < .001$). These results are supportive of Hypothesis 4: Messages of moderators were 2.60 times more likely to include organizational moderating (est = 0.957, $SE = 0.294$, $p < .0017$), 2.37 times more likely to include content moderating (est = 0.861, $SE = 0.153$, $p < .00017$), and 5.55 times more likely to contain both forms of moderating (est = 1.713, $SE = 0.559$, $p < .0083$) compared to messages of students in the no-role condition. In addition to this finding, Table 6 also shows significant effects not assumed in Hypothesis 4. Students without roles in a role condition were 2.27 times less likely to perform organizational moderating activities (est = -0.817, $SE = 0.297$, $p < .0083$), and starters were 1.61 times more likely to perform content moderating activities and 5.31 times more likely to perform both moderating activities (est = 0.474, $SE = 0.165$, $p < .0083$ and est = 1.669, $SE = 0.523$, $p < .0017$, respectively). All estimates appear in Table 6. A few parameters were not estimated due to zero frequencies.

Table 6. Nominal Regression Estimates for Organizational, Content, and Organizational & Content Moderating

	estimate	SE	Wald	df	p	OR	OR ⁻¹	LB95%CI	UB95%CI
Gender									
Male									
[organizational]	-0.207	0.346	0.358	1	0.549	0.813	1.230	0.412	1.602
[content]	0.103	0.151	0.471	1	0.493	1.109		0.825	1.490
[org & cont]	-0.846	1.043	0.657	1	0.418	0.429	2.330	0.056	3.318
Female	ref. cat.								
Educational Degree									
Higher education									
[organizational]	1.104	0.220	25.255	1	0.000	3.018		1.962	4.642
[content]	0.424	0.127	11.140	1	0.001	1.528		1.191	1.960
[org & cont]	0.420	0.626	0.451	1	0.502	1.523		0.446	5.196
Secondary education	ref. cat.								
Role type									
Source searcher									
[organizational]	-1.452	0.722	4.046	1	0.044	0.234	4.271	0.057	0.964
[content]	-0.146	0.189	0.598	1	0.439	0.864	1.158	0.596	1.252
[org & cont]	–	–	–	–	–	–	–	–	–
Theoretician									
[organizational]	-1.320	0.722	3.344	1	0.067	0.267	3.745	0.065	1.099
[content]	0.274	0.172	2.550	1	0.110	1.315		0.940	1.841
[org & cont]	–	–	–	–	–	–	–	–	–
	estimate	SE	Wald	df	p	OR	OR ⁻¹	LB95%CI	UB95%CI
Summarizer									
[organizational]	0.245	0.323	0.577	1	0.448	1.278		0.679	2.404
[content]	-0.081	0.182	0.200	1	0.654	0.922	1.085	0.646	1.316
[org & cont]	–	–	–	–	–	–	–	–	–
Moderator									
[organizational]	0.957	0.294	10.579	1	0.001	2.604		1.463	4.636
[content]	0.861	0.153	31.699	1	0.000	2.366		1.753	3.193
[org & cont]	1.713	0.559	9.391	1	0.002	5.547		1.854	16.594
Starter									
[organizational]	0.576	0.314	3.350	1	0.067	1.778		0.960	3.294
[content]	0.474	0.165	8.253	1	0.004	1.606		1.163	2.220
[org & cont]	1.669	0.523	10.184	1	0.001	5.306		1.904	14.786
No roles									
[organizational]	-0.817	0.297	7.557	1	0.006	0.442	2.265	0.247	0.791
[content]	-0.259	0.116	5.010	1	0.025	0.772	1.296	0.615	0.968
[org & cont]	-0.477	0.660	0.524	1	0.469	0.620	1.612	0.170	2.261
Without roles	ref. cat.								

Adding New Points

Among all contributions, 39.0% included new points. We found no effect for gender. As to the impact of students' degree, a significant effect did emerge. The odds of introducing new points were 1.56 times smaller for students with a bachelor degree compared to students with a degree in secondary education (est = -0.442, *SE* = 0.107, *p* < .001). Furthermore, the predictor role type was significant (LRT: $\chi^2 = 46.450$, *df* = 6, *p* < .001). As hypothesized, students assigned the role of starter added significantly more (1.52 times more, see Table 7) new points in their contributions (est = 0.420, *SE* = 0.130, *p* < .0017). Moreover, students assigned the role of summarizer added significantly fewer (1.92 times less) new points in their contributions (est = -0.650, *SE* = 0.144, *p* < .00017). Table 8 provides an overview of the results. Significant effects are represented by '+' when positive, and by '-' when negative.

Table 7. Binary Logistic Regression Estimates for New Points

	estimate	SE	Wald	df	p	OR	OR ⁻¹	LB95%CI	UB95%CI
Gender									
Male	0.123	0.115	1.128	1	0.288	1.130		0.902	1.417
Female	ref. cat.								
Educational Degree									
Higher education	-0.442	0.107	17.079	1	0.000	0.643	1.556	0.521	0.793
Secondary education	ref. cat.								
Role type									
Source searcher	0.215	0.129	2.774	1	0.096	1.240		0.963	1.597
Theoretician	0.256	0.133	3.705	1	0.054	1.292		0.995	1.677
Summarizer	-0.650	0.144	20.299	1	0.000	0.522	1.915	0.394	0.693
Moderator	0.136	0.132	1.064	1	0.302	1.146		0.885	1.484
Starter	0.420	0.130	10.379	1	0.001	1.522		1.179	1.965
No roles	0.148	0.078	3.613	1	0.057	1.160		0.995	1.352
Without roles	ref. cat.								

Table 8. Overview of the Results Concerning Role Type

	Source	Theory	Summary	Moderation	New points
Source searcher	+++			/ / n.c.	
Theoretician		+++		/ / n.c.	
Summarizer	-		+++	/ / n.c.	---
Moderator				++ / +++ / +	
Starter				/ + / ++	+++
No role			--	- / /	
No-role condition	Reference category	Reference category	Reference category	Reference category	Reference category

Moderating column: Organizational / content / both forms of moderating

n.c.: not calculated

+++ and --- indicates $p < .001/6 = .00017$, ++ and -- indicates $p < .01/6 = .0017$, + and -

indicates $p < .05/6 = .0083$; pluses indicate positive effects, minuses indicate negative effects

Discussion

In CSCL research, interest in applying scripts to foster high-quality interaction and collaborative learning is growing. One specific type of scripting involves the assignment of roles to group members. To date, research has focused primarily on the impact of role assignment on a number of process or outcome variables. Verifying the implementation of the scripting intervention, however, has received limited attention. Failure to document that participants do, in fact, enact assigned roles along the lines expected renders reports of the effects of assigned roles difficult to defend. Hence, the main goal of the present study was to determine to what extent students enact assigned roles in asynchronous collaborative learning

discussion groups. More specifically, we explored the performance of source searchers, theoreticians, summarizers, moderators, and starters.

An analysis scheme identifying message characteristics captured the role-related activities in students' contributions to online discussions in an introductory course in Instructional Sciences. Logistic regression analyses revealed the relationship of the different roles to the five dimensions of message characteristics. In addition, we controlled for the effect of two background variables: students' gender and type of degree in education. The results showed no gender effect for any message characteristic dimension. Type of degree in education showed a significant effect in four dimensions: source, theory, moderation, and new points. More specifically, students with a bachelor degree added and discussed significantly more sources, referred to and commented significantly less on theoretical concepts, moderated significantly more, and added significantly fewer new points compared to those having a degree in secondary education. This might be attributable to the fact that students with a bachelor degree were more experienced in moderating discussions and had a greater tendency to engage in self-regulative behavior. However, this possibility requires further research.

With respect to the aim of validating the introduction of role assignments, the overall results indicate that the structuring intervention was successful. All students performed the activities related to their roles fairly well. Table 8 shows the significant positive effects on the main diagonal, relating to different hypotheses. Compared to students in the no-role condition, source searchers introduced and discussed significantly more discussion-related external sources, theoreticians referred to and commented on theoretical concepts significantly more, summarizers engaged significantly more in summarizing the ongoing discussion, moderators concentrated significantly more on both organizational and content moderating, and starters introduced significantly more new ideas to discussions.

As the contexts of CSCL studies introducing role assignments are diverse and most studies do not focus on the extent of role performance, it is difficult to compare the present results with the findings of previous research. However, Zhu (1996) discusses role performance of summarizers. Contrary to the present results, in which summarizers actually did engage in summarizing parts of a discussion and express provisional conclusions, Zhu reported that summarizers did not demonstrate the expected value of synthesizing the groups' understanding of readings; rather they read the discussion notes and reflected on them, but offered few insights (Zhu, 1996).

Table 8 also shows a number of additional effects not addressed in the hypotheses. More specifically, every plus or minus sign in the off-diagonal area indicates effects not assumed in advance. Since we expected students to pay explicit and additional attention to the assigned roles, without losing sight of activities related to the other roles, no signs should appear in the off-diagonal area. Pluses in the off-diagonal area indicate significant positive effects, meaning that students paid extra attention to activities that were not part of their own role, but fit in the role description of other students. Minuses in the off-diagonal area indicate significant negative effects, meaning that students paid less attention to activities that were not part of their own role compared to students in the no-role condition. One might worry that stimulating students to focus on one specific role would result in less attention to the activities related to other roles. However, this would imply that all off-diagonal cells in Table 8 would be minus signs. As can be observed, this was generally not the case.

Taking into account the plus and minus signs in the off-diagonal area (see Table 8), three different patterns could be distinguished. The first pattern is indicated by pluses on the main diagonal and no signs in the off-diagonal area. This pattern suggests students stick to the role-related behavior without paying less or more attention to the non role-related activities. Source searchers, theoreticians, and moderators were the perfect example of students' paying extra attention to their role without neglecting other discussion activities. They clearly fit this

first pattern: they all focused more on the activities expected on the basis of their assigned roles, but without losing sight of the four other dimensions.

The second tendency is indicated by pluses on the main diagonal and some pluses in the off-diagonal area. This suggests a focus on role-related behavior without paying less attention to the other activities but with extra attention on some other activities. Starters fit the second pattern. In addition to the role-related focus on adding new points and introducing new impulses to the discussion, starters also concentrated significantly more on content moderation issues than others not having assigned roles. From this, one might assume that students assigned the role of starter not only add new points to the discussion, but they also apply this information as input for content moderation issues. While performing such activities, starters shift to role of moderator. This finding is in line with research by Tagg (1994), who noticed that topic leaders (a role equivalent to starters) were inclined to perform contextualizing functions. As a consequence, one might argue that the role of starter in the present study was to some extent too closely related to the role of moderator. The role of starter might be a more relevant and more distinctive role when students have to introduce completely new discussion topics or select a discussion topic based on the course material or readings by their own (e.g. Hara et al., 2000; Zhu, 1998). However, the discussion topics were introduced by the instructor in the instructions for the discussion task. Taking into account the role overlap and the fact that no moderator was involved in studies exploring the starter-wrapper technique (Hara et al., 2000; Zhu, 1996), we might consider eliminating the starter role and assigning a few of its activities (e.g., reactivating interaction when discussions slack off) to the moderator.

The third pattern is characterized by pluses on the main diagonal and the occurrence of some minuses in the off-diagonal area. This indicates a focus on role-related behavior on the one hand and less attention being paid to certain other activities on the other hand. Students without roles in the role condition and summarizers fit this third pattern. They focused on their own role and paid less attention to the activities related to other roles. In addition to containing a significantly higher frequency of summaries, the contributions of the summarizer showed significantly fewer mentions of sources and new points. This negative effect, however, was not completely unexpected, since summarizing activities is contradictory to adding new points or relevant sources to the discussion. Although all students were to engage in all five types of activities, summarizers might lose track of other activities since the summarizing role may be quite demanding and focuses on goals opposite to other activities such as adding new points or sources.

Students without roles in the role condition find themselves in a specific situation. Although they do not have a role themselves, other students in their group enact assigned roles. At first, one might expect them to behave like students in the no-role condition. Our observations, however, indicate this not to be the case. Students without a role in the role condition posted fewer contributions containing summaries and organizational moderation issues than students in the no-role condition. An explanation for this finding may be that organizational moderation and summarizing can be clearly defined. They comprise specific and identifiable activities and, therefore, are more easily avoided by students not performing an assigned role possibly because they do not want to poach on someone's preserves. When students are in a role condition, they tend not to offer contributions that contain utterances of those enacting specific roles. This tendency might be reinforced by the fact that students do not feel a need to post a certain type of contributions when there are already sufficient contributions of this kind present in the discussion. For instance, if interim summaries are posted by the summarizer, there is no need for more summaries to be posted by students not assigned the role. However, further research, for instance, combining specific questionnaires

and stimulated recall interviews, is necessary to account adequately for students' underlying motives guiding their role behavior in detail.

We should carefully interpret the results for the moderating and new points dimension. Although chance corrected measures between .40 and .80 suggest fair to good agreement beyond chance (Neuendorf, 2002), future research should aim for higher reliabilities. In addition, future research could also focus more on investigating the quality of the role contributions in detail, for example by carrying out qualitative discourse analysis. In this way, we could explore the efficiency of moderators' discussion regulation, the correctness and relevance of theoreticians' discussed theory, the quality and relevance of sources introduced by source searchers, the accuracy of the summaries, and the distinctiveness of the new points introduced by the starter.

Conclusion

The scripting approach to collaborative learning in an online environment presented is potentially fruitful. The assignment of roles can be very useful in stimulating students to engage in certain activities. Our results show that students enacted the roles they were assigned. In addition, they generally did so without neglecting the activities related to the other roles. We have found strong support for introducing assigned roles as a successful structuring intervention. Thus research focusing on the impact of assigned roles on knowledge construction processes through social negotiation seems now to have greater warrant. A practical implication of this study is that assigning roles can be considered as a recommended scripting approach that could benefit asynchronous discussion groups.

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