# Cognitive Presence in Minecraft Online Discussion Forums: How Question Framing Affects Subsequent Discussions

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## Abstract

As online discussion forums are increasing in size and popularity, we see the potential of informal online forums in promoting learning. The relationship between question framing and subsequent discussions found within online forums for the video game Minecraft suggests opportunities for discussions to generate higher level of critical thinking. Questions found within the forum were analyzed by the Cognitive Presence Tool proposed by Garrison et al. [2]. We propose that seeding forums with appropriate question structures may be useful for framing as well as improving community-regulated learning.

## Author Keywords

Online discussion; Minecraft; online learning; cognitive presence; questioning.

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## Introduction

Discussion forums are evolving as a new technical tool adopted by institutions as a learning medium for online, distributed learning [2,4]. As online learning increases, effective methods for discussions are needed. Improvements on how participants ask questions may be a useful scaffold for online learning, considering the fact that guided online discussions can positively affect the learning happens in these spaces [1,4,8,9].

We explore the use of question framing as a means for guiding community-regulated learning in the context of Minecraft related forums. Our study aimed to learn whether there are distinct patterns of questions in Minecraft online discussion forums, and, if these questions result in different learning outcomes, to identify what types of question promoted a wide range of learning activities. These goals were addressed by examining posting transcripts retrieved from two online Minecraft discussion forums on Redstone. The results show that divergent questions can be more valuable in online education in terms of promoting higher order thinking. This opens the dialogue for improvements in questioning in forums.

## Related works

Similar to the way questioning can promote good student-teacher interactions in traditional education contexts (i.e. classrooms) [9], in online forums, well-written questions can help to engage participants in critical thinking [4,9]. Good questions are the ones that catalyze discussion in their responses; instead of "I agree", answers accompanied by further questions increase the depth of discussion and thus promote high-level learning.

While studies have sought strategies for effective online discussion [1,9], these efforts have only been focused on formal forums created solely for educational purposes. In this study, we exploited a digital video game, *Minecraft* to test the hypothesis of question structure.

### Affinity spaces

Video games have become a global pastime and their communities of players have developed large and active sites for learning. Online videos, forums, and wikis have been created to help players share their knowledge and practices; players must regularly engage in online learning in order to embark on new projects, keep up with official version changes, or adjust to user-created modifications deployed to community servers. These interest-driven spaces, or "affinity spaces" [3] promote discussion, sharing, and learning. Studying ways questions are asked in these spaces may be useful to evaluate and leverage the learning that occurs within them.

*Minecraft*'s popularity makes forums related to it the target of our study. Since its release in 2011, it has sold over 17.5 million copies worldwide [10]. Though its graphics are simplistic, its design is elegant, allowing players to create almost any desired structure by combining different low-fidelity blocks and placing them in the virtual world [6]. We looked specifically at Redstone, a building object in *Minecraft* that can be used to create logic-dependent inventions, such as computers or factories. As Redstone operates like a wire that can carry electricity or a switch that can be turned on and off, it is also complicated. This complexity has spurred users' engagement in online discussions that subsequently lead to learning.

### Cognitive presence

To evaluate learning promoted by *Minecraft* discussion forums, we apply Garrison, Anderson & Archer's *Model of Inquiry* [2]. The framework identifies cognitive presence - "the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry" (p.9) - as one of the key factors in effective online learning. Per the framework, "critical thinking or inquiry is a process that begins with trigger events and followed by exploration, integration and resolution." We wanted to know what types of question structure can prompt high-ordered thinking process, and to what extend does this happen.

## Methodology

We chose discussion threads from two online forums – *Hypixel* and *Reddit. Hypixel* and *Reddit* were chosen because they included a forum sub-section dedicated to questions about *Redstone*. Selected threads are those dated within one year, sized around 8 - 20 comments.

Forum posts are randomly chosen to be transcribed and coded. Through iterations of reviews for similarity, we came up with three types of questions for each forum. We then collect more posts that fit with these categories and apply Garrison et al.'s model to determine which one can promote the highest cognitive in learning. The data was coded by every segment, or "thematic unit" [7], and multiple codes were allowed. Five threads for each category of question title were selected and coded, totaling 271 forum posts for *Hypixel* and 253 for *Reddit*.

The three types of question titles were listed under two main categories, based on the function of the thread title's question [5]: **expanding** (question which promotes divergent thoughts. i.e. **Type 1**: question on how to perform a procedure that can have many different correct answers; **Type 2**: a general topic to catalyze discussion) and **centering** (question which promotes convergent thinking. i.e. **Type 3 (*Hypixel*)**: question that addresses an instance of task or filter responders by technical terms; **Type 3 (*Reddit*)**: question about concepts and game mechanics that have a few definite answers).

| | Type 1 (Expanding) | Type 2 (Expanding) | Type 3 (Centering) |
|---|---|---|---|
| Hypixel | - How do I make a left click detector in minecraft? | - Enchant with give | - I need command block experts |
| Reddit | - How to output a signal from a Minecraft with a chest | - Water-proof Piston Clocks | - Exactly how does a Minecraft CPU work? |

**Table 1**: Examples of question chosen by title categorizations

We observed that questions of expanding type appear overwhelmingly more than centering type in *Hypixel* and *Reddit Minecraft* discussion forums. As discussion forums are also used as repositories for information [8], participants look up for information before posting. The tendency to copy the style of previous posters of the same topic lead to self-regulation, which, in this case, the dominance of effective questioning methods. Our categorization is driven by this fact; in particular, though the wordings of **centering questions** vary

greatly, they are less common and thus not divided into sub-types like **expanding questions**.

| Category | Description | Examples taken from data |
|---|---|---|
| Triggering | Learner identifies or recognizes an issue or dilemma. | "What's wrong with this command? I've decided to spawn a "Combat Smith" using dropped items, but it doesn't seem to work." |
| Exploration | Learner's shift between private, reflective individual world and the social expression of ideas. | "That would be done using WorldGuard or a similar plugin on a server." |
| Integration | Learner constructs meaning from the ideas generated in the exploratory stage, which is inferred from communication. | "That honestly is a lazy command. That wouldn't be accurate, and when you do so that would kill EVERY entity which is an item around." |
| Resolution | Learner tests previous ideas/hypotheses, synthesize information critically. | "This is how it was solved, thanks to /u/Khaotine!" |

**Table 2**: Coding Categories, Description & Examples adapted from Park (2009).

We used Garrison's model to classify the post contents. Each post is placed into one of four categories: (1) **Triggering** (asking questions), (2) **Exploration** (searching for and offering information), (3) **Integration** (construction of possible solution), (4) **Resolution** (critical assessment of solution). Through this analysis, we identified several main themes.

## Preliminary Findings

In *Hypixel* forums, qualitative analysis of cognitive presence showed that threads in Procedural Questions (Type 1) were similar, regarding the proportions and ordered magnitude of cognitive phases. In particular, three of the five threads exhibited all four cognitive phases (one thread did not show Integration and one thread lack of Triggering). In all five threads, Exploration phase accounts for the most number of posts, followed by Integration, Triggering and Resolution respectively.

General topic questions (Type 2) were similarly consistent: all five threads lacked evidence of a Resolution phase; four out of five threads show the presence of three cognitive phases, within which Exploration phase has the most percentage, followed by Triggering and Integration.

Analysis of Questions directed at particular groups or tasks (Type 3 *Hypixel*) did not show a distinct pattern in cognitive presence. Only one thread showed presence of all four cognitive phases; absences of a cognitive phase vary within the others and percentage of each phase did not follow a clear pattern.

| Sub-category | Type 1 (items-%) | Type 2 (items-%) | Type 3 (items-%) |
|---|---|---|---|
| Triggering | 8.2 | 18.6 | 15.6 |
| Exploration | 64.7 | 75.7 | 71.9 |
| Integration | 20 | 5.7 | 10.9 |
| Resolution | 7.1 | 0 | 1.6 |

**Table 3**: Comparison of cognitive phases between question types (Hypixel)

| Sub-category | Type 1 (items-%) | Type 2 (items-%) | Type 3 (items-%) |
|---|---|---|---|
| Triggering | 8.8 | 15.9 | 17.6 |
| Exploration | 66.7 | 75 | 64.7 |
| Integration | 15.7 | 2.3 | 9.8 |
| Resolution | 8.8 | 6.8 | 7.8 |

**Table 4**: Comparison of cognitive phases between question types (Reddit)

Results for Procedural Questions (Type 1) *Reddit* threads are similar to that of *Hypixel.* Three out of five threads exhibited all four cognitive phases (two threads lacked of Resolution phase). In all five threads, Exploration phase accounts for the most number of posts, followed by Integration, Triggering and Resolution respectively.

General topic questions (Type 2) in *Reddit* were not inductive to higher-ordered cognitive presence: only one thread shows Integration phase and two threads show Resolution phase.

Questions about Concepts or Game mechanisms (Type 3 *Reddit*) showed a wide variation of learning phases. Each thread showed respectively one, two, three and four cognitive phases.

Although Type 3 from both forums (since they are differently framed and ask about different topic) bring about different cognitive phases at different proportions, they both did not follow a clear pattern. This unpredictability suggests difficulties in improving centering questions to leverage online discussion.

In addition, we should be careful when looking at total numbers presented in Table 3 and Table 4. In particular, while the average percentages for cognitive phases of Type 3 questions from both forums show that this type can generate thinking in high-order levels (Integration and Resolution), this is only due to the fact that threads within this type vary greatly from one another.

## Discussion & Conclusions

First, the correlation between question type/ cognitive presence suggests that appropriately tuned question prompts might not only improve learning but also help create desired outcomes from discussion. Our findings agree with Muilenburg and Berge's claim [5] that questions that lead to divergence rather than convergence tend to produce richer online discussions. Expanding questions, in the context of *Minecraft* forums about Redstone can be more consistent in generating types of discussions and may also evoke a wider range and higher-level of cognitive presence than centering questions. We also notice that postings with question that further elaborates the title by giving specific examples of in-game encounters reduce clarification comments (listed under Triggering phase). Questions that contain posters' thinking process, poster's background or prior knowledge help knowledge establishment (that is, reaching Resolution phase with fewer number of comments), but not the vitality and diversity of learning activities in the discussion thread.

Our study underlines design opportunities to improve informal online discussion forums to promote learning. However, we recognized that this can be challenging, consider the diversity of users' background and the abundance of possibilities for creation in Minecraft. Any

suggestions for creating better questions should be able to address each poster's contextual experience with the video game.

Second, preliminary results suggest the utility of cognitive presence in sorting discussion forum threads by question type and differentiating forum responses. The predominance of postings in Exploration and small percentages in high-level cognitive phases (Integration and Resolution) concur with Park's [7] and Meyer's [4] replication of the same framework to formal discussion spaces; suggesting that the learning process in informal online forum discussions is comparable to that in educational forums.

Considering the scope of the study presented, data should be carefully generalized and interpreted. In particular, we have only looked at a relatively small sample size (five threads in examining each type of question) compared to the number of threads in these two forums, whose order of magnitude is of 1000. We suggest that more data is needed to rigorously and expansively characterize informal forum discussions.

## Acknowledgements

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