# Finding Chaotic Behaviour Gap in Crowdsourcing Learning Model

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## ABSTRACT

This study takes a conceptual look at the issues that come with using crowdsourcing models, specifically learner behavior. In the field of learning, chaos behavior is not given enough academic attention, particularly in crowdsourced learning models. The outcomes of this study should serve as the foundation for follow-up research that is either empirical or quantitative. The void in the research that must be filled before the following study may be conducted. A Systematic Literature Review, often known as an SLR, was carried out for the purpose of determining validity and eligibility. The PRISMA method is utilized by SLR to make certain that review answers are dependable and inspire self-assurance. For the purposes of the literature review, each of the Scopus (S), Google Scholar (GS), and Semantic Scholar (SS) databases contained a maximum of one hundred articles that were published in the same year range. The appraisal of the literature is only marginally relevant to the topic of chaos in education. Research on pandemics and post-pandemics is limited, especially when compared to crowdsourcing. This argument is predicated on scant research, particularly in regard to these two topics. This creates a significant gap in the research, despite the fact that research on both subjects offers fresh material for future writing. Specialists are required to manage crowdsourced learning to prevent unnecessary waste. Because it may result in misunderstanding among the classes and other unfavorable outcomes if the initial curation process is carried out with insufficient or the incorrect type of content. In order to prevent anarchy, moderators of crowdsourcing projects need to pay constant eye to data traffic.

***Keywords :*** *Chaotic behavior, Crowdsourcing, Chaos, Online Learning*

## INTRODUCTION

The application of collaborative learning in online learning is currently a growing trend in educational studies (Fu & Hwang, 2018; Liao et al., 2014; Pluta et al., 2013). This is because its application today seeks more involvement from students than the role of teachers or commonly referred to as student-centered learning. One application of collaborative learning in online-based learning that is considered innovative and quite successful is the crowdsourcing model (Al-Jumeily et al., 2015; Weld et al., 2012).

However, the crowdsourcing model that can be classified as a constructive learning model because it has freedom and irregularity in solving a problem has some obstacles in its implementation. Crowdsourcing models that are commonly applied with wiki-type media can be successful with the monitoring of a super moderator who can direct learners into individuals who are passionate and help each other (Engstrom & Jewett, 2005; Karachiwalla & Pinkow, 2021), but also vice versa can make individuals act "anarchist" in the learning process or discouraged in the middle of the ongoing process.

Anarchist behavior that is often not realized suddenly arises from learners in the end and must be overcome by teachers or lecturers as moderators in the crowdsourcing learning process. Behavior that can cause chaos in the learning crowd is often referred to as chaos behavior (Murphy, 2002), which can ultimately hurt the learning process in general. So that in the implementation of Crowdsourcing, chaos behavior should be overcome by teachers and lecturers so as not to become obstacles.

Crowdsourcing itself, in addition to being one of the alternatives in the learning model, its application is also an inspiration for learners to be able to make the learning process more varied (Buecheler et al., 2010; Zhang et al., 2021). Especially during the pandemic, which resulted in many modifications to the online learning process, innovation is needed in it. Crowdsourcing as an alternative to learning has also been shown to increase the motivation of learners in the learning process (Al-Jumeily et al., 2015; Gajek, 2020).

This paper theoretically examines the obstacles that may occur in the application of crowdsourcing models, especially from the behavior of learners. The behavior of individuals who are in a system can suddenly become uncontrollable, and influencing each other can immediately destroy the model. But with proper handling, these obstacles should be used as a strength, no longer a weakness that must be avoided.

Empirically, research on chaos behavior in learning is still very minimal, especially in relation to crowdsourcing learning models. So it is expected that the results of this study can be the initial basis before conducting follow-up research empirically or quantitatively. In the end, it can be found the research gap that is sought before the next study.

## LITERATURE REVIEW

Crowdsourcing is a model that is open to a specific group to complete a certain job, solve a composite problem, or contribute ideas to a particular issue (Gajek, 2020). It is also defined as the "participatory online activity," including a group of community participants of "variable knowledge, heterogeneity, and number," aimed at accomplishing duty through intentional work (Al-Jumeily et al., 2015). This model application for collaborative problem solving is innovation and potentially wider solution related to the common collaboration model (Engstrom & Jewett, 2005).

Essentially, it is anticipated that the implementation of Crowdsourcing will result in the creation of a more reasonable online learning model, which, when supported by vigorous competition and rewards for students, will also increase student motivation during the learning process (Borst, 2010). It is therefore anticipated that, in addition to increased motivation, there will always be a significant improvement in the quality of learning resources as a result of the learners' development of content.

In the application of Crowdsourcing, a good collaboration model can exist with moderators who are regarded as having the same level of knowledge and consumption as each solution contributor (Kittur et al., 2009). However, if the implementation of crowdsourcing includes one or more "super" and highly regarded moderators, the application can become a mess that must be avoided at all costs. When this occurs, it is certain that the behavior of students who are supposed to complement each other's learning resources will become disorderly and unmanageable.

Behavioral chaos in a situation, in general, occurs only occasionally and does not recur. The chaos can be an unexpected action; for example, learners who suddenly despair and stop for a moment but at a certain period of time can be active and excited again. This kind of behavior is one part of chaos theory, a study that studies unexpected behavior in a system that is certain, simple, and has certain limits (Kellert, 2008; Murphy, 2002).

Chaos is defined as the sensitive requirement of an initial condition (W. Smith & Higgins, 2003). Chaos should also not be assumed by random circumstances but rather directed at a dynamic but non-linear condition of a system (Kellert, 2008). The chaos, which was officially introduced in 1989 (P. Smith, 1998), eventually developed into a theory that applies not only in science but also in social sciences (Kiel & Elliott, 2004). In chaos theory, the behavior that causes chaos is expressed as chaotic behavior (Kellert, 2008). Chaotic behavior not only occurs in individuals but can also occur within a group. This can happen if one's chaotic behavior causes others to be disturbed and, at the same time, makes other members of the group also give rise to unexpected behavior or chaotic behavior that is affected by each other (Llora & Cordero, 2016; Ward & West, 1994). According to chaos theory, there are universal representations of complexity. Nonetheless, the cultural fecundity of these ideas is a collaborative achievement. The invention of the metaphor "butterfly effect" is an intriguing instance of this collaboration (W. Smith & Higgins, 2003).

## METHOD

The method carried out in this study is a traditional literature review which aims to get a comprehensive background of a particular topic that can then identify the gap between previous research and current problems (Bruette & Fitzig, 2017). So, in this case, the search for literature is limited to the discussion of chaos theory related to learning because the theory of chaos is dominated by the field of physics or pure science. In addition, the understanding of the literature search about chaos is also required to be related to crowdsourcing learning because chaos theory itself is more applied to learning involving many parties at the time of its implementation.

Limiting literature searches to Google Scholar, Semantic Scholar, and Scopus. A Systematic Literature Review (SLR) was conducted, which attempted to collect data from diverse research sources, particularly peer-reviewed journal publications, in order to account for their validity and eligibility. In adopting SLR, the PRISMA approach is utilized, which has been demonstrated to be an effective solution in SLR-based research (Shamseer et al., 2015). PRISMA, which was initially utilized in the health sector (Page et al., 2021),can also be utilized in the field of education; hence, it is a suitable tool for this study.

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses, or PRISMA, is a way to do systematic literature reviews by putting the most important research

questions at the top of the list (Page et al., 2021). So that the answers that come out of the review can be trusted and give high levels of confidence. PRISMA uses at least 27 recognizable checklists to choose which articles will be chosen for further analysis.

In this study, journals with the three keywords, which are: " chaotic chaos behaviour learning education", "crowdsourcing education" and combination both of them, were chosen by filtering three index databases: Scopus, Google Scholar, and Semantic Scholar. Then, more filtering is done by ignoring search results in the form of book chapters and types of articles from other literature reviews. This is done to get articles that actually have applied research based on the research questions at the beginning.

Next, check each filtered article to see if it is available in full-text format and has a working link so that it can be read and analyzed. Also, the articles are put into groups based on the algorithm or method used, so that both differences and similarities between the articles can be found. The analysis that comes next is based on the results of each check of this article. In short, table 1, which is an altered version of the PRISMA framework, shows the results of completing the PRISMA checklist.

**Table 1.** Method checklist for PRISMA

| **Method for PRISMA** | |
|---|---|
| Eligibility criteria | From 2009 to 2022 with relevance with education content |
| Information sources | S = Scopus<br>GS = Google Scholar<br>SS = Semantic Scholar |
| Search strategy | From a three keywords: " chaotic chaos behaviour learning education", "crowdsourcing education" and combination both of them, |
| Selection process | After filtering using eligible criteria, then filtering out by title. Then it omits any literature review articles and also omits any theoretical review. |
| Data collection process | Using Publish and Perish v 8, and repeat at least three times to ensure search results. Then export the result to Excel for further filtering process, and split them for each information source. |
| Data items | Merely for education themes, most of chaotic and chaos articles are coming from engineering and crowdsourcing articles are coming from management and software engineering field. Thus, they all are filtered manually |

| | |
|---|---|
| Synthesis methods | - Grouping the result from each database and observing each article from its abstract<br>- If abstract shows literature review or theoretical comparison, omit it<br>- Grouping is carried out based on the greatest similarities - The results of the subsequent grouping are further analyzed and then unified between databases<br>- The results of the grouping reviewed were based on an abstract and full-text paper in order to determine the level of heterogeneity and homogeneity to answer the research question |

## RESULT AND DISCUSSION

### PRISMA Result

Using the Publish and Perish application version 8 and the keywords described in the preceding section, the initial selection was made. The first keyword search for the Scopus (S) database returned a total of 10 articles published; the Google Scholar (GS) and Semantic Scholar (SS) databases were each limited to 100 articles published in the same year range. Next, preliminary filtering is performed based on titles and abstracts to evaluate if the article's content does not come under the category of literature review or comparison theory, and if the article involves the actual application of education. From the first filter, 15 articles from SS and 41 from GS were obtained, while from Scopus there was not a single article related to education. From a total of 56 articles, they were then grouped based on themes related to online learning to get gaps with crowdsourcing topics. Furthermore, for the second keyword, the initial results were obtained from 400 articles, with details of 200 from Scopus, 100 from SS and 100 from GS. The first filter of redundant article elimination resulted in 362 articles which were further re-sorted based on relevance to the educational theme, resulting in 169 articles, with details of 18 from Scopus, 84 from SS and 67 from GS. An overview of this first choice is shown in Figure 1 as the PRISMA flow, which is the basis for the PRISMA-based systematic literature review.

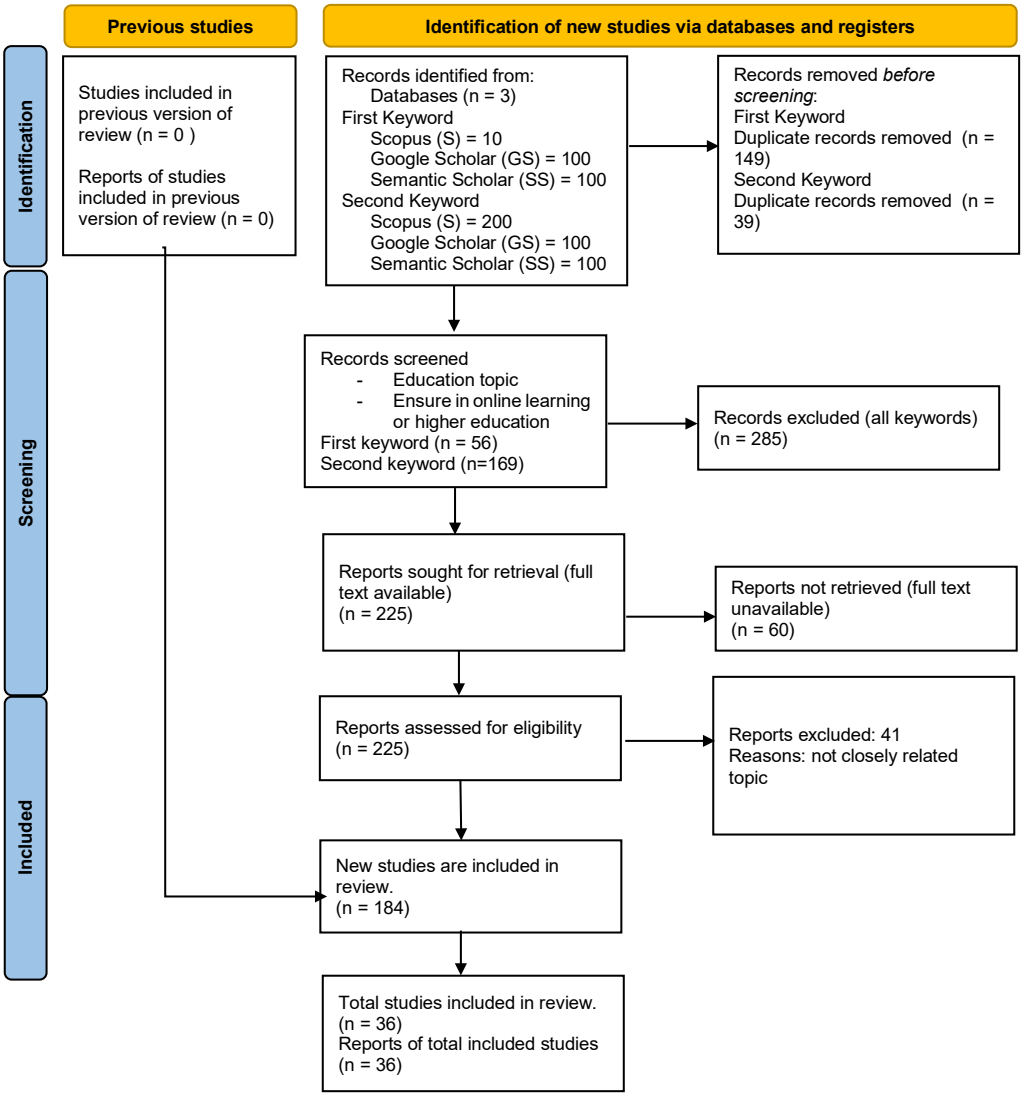


Figure 1. PRISMA flow framework

## Discussion

Chaotic behavior in an environment, especially in the application of crowdsourcing models, can occur due to several reasons, including the existence of moderators who are very super, so it can cause learners to give up or despair because they feel that the moderator can cancel the entire content for no apparent reason. The condition of learners who are generally skeptical about the potential success of remote collaboration (Alghasab et al., 2019). This is due to the perception of learners who generally assume that the learning process with a collaboration model will only be successful if the team members face to face with each other

face to face. The potential chaos that can be generated is that learners can blame each other if there is an irregularity in the collaboration process.

When the implementation of crowdsourcing is carried out, there is a potential for chaos to be created as a result. The application of crowdsourcing itself basically still does not have a clear framework in its application in online learning, so a stronger theoretical framework is still needed before being tested (Prpic et al., 2015). Crowdsourcing itself is expected to provoke learners to innovate openly (Bücheler & Sieg, 2011), but on the other hand its application requires experts who are able to control the content in the learning process (Anderson, 2011). In addition, good curation is also needed so that learning content as a result of crowdsourcing does not become garbage for other learners (Weld et al., 2012).

There is no equal reward for learners likewise (Borst, 2010). This has been shown to weaken the extrinsic motivation of learners in following the crowdsourcing model as well as causing despair in the next process. From the description, it can be concluded that the implications of chaotic behavior in the application of Crowdsourcing are behaviors of despair that can arise unexpectedly and can directly affect other learners. However, the potential emergence of chaotic behavior can theoretically be prevented by some of the following preventive measures, which are: (1) Provide commensurate rewards for learners so that they get constant extrinsic motivation in undergoing crowdsourcing learning models. The reward in question is more in the form of appreciation, value in the subject of courses, or non-money awards, because it has a much more positive effect than awards in the form of money in the implementation of crowdsourcing models (Kittur et al., 2009), (2) Provide direction to moderators so as not to be superior but rather act rationally in deciding whether content can be approved or not in crowdsourcing learning outcomes, and (3) motivating learners that the collaboration model with crowdsourcing models that are generally applied without face-to-face can work well. This is to eliminate skepticism from learners about the sustainability of the implementation of this model.

Another thing that happens from the results of this literature review is the lack of research that has a high impact factor, especially regarding chaotic behavior in the scope of education. In fact, the topic of chaotic behavior is currently very necessary, especially during the post-pandemic period, because online education that has been passed in the two years of the pandemic period leaves many chaotic events in the classroom due to the shock of learners who never thought that such an event would happen (Muñoz et al., 2022) . On the other hand,

the pandemic period has also resulted in adaptations that must be passed quickly in the learning process. In fact, this is still continuing until after the pandemic which in the end also gave birth to many new opportunities in the learning process in the new normal era (Geng et al., 2021).

Meanwhile, research involving crowdsourcing themes looks more, especially those involving online learning and its variants. However, crowdsourcing research in the field of education, especially during the pandemic and post-pandemic, is still very minimal and looks less than other themes related to online learning. This creates a research gap in both the crowdsourcing theme and the chaotic behavior theme which is actually very closely related but there is still a lack of research that discusses them, both in terms of literature review, theoretical framework or empirical research in the field.

## CONCLUSION

It can be concluded that the most prominent and potential chaotic behavior in the application of crowdsourcing models is despair. However, according to its definition, chaotic behavior only appears occasionally and generally does not repeat itself, assuming that at the time of emergence, the behavior is immediately given appropriate treatment. On the other hand, chaotic behavior is still recognized to be very difficult to measure quantitatively. However, its appearance can be immediately suspected of its existence and should be able to be overcome immediately. Especially in the application of crowdsourcing models that consist of various groups and are collaborative, the emergence of chaotic behavior must be addressed immediately so that learning outcomes can be more optimal.

When using a crowdsourcing model for learning, it's also very important to make sure that experts are moderating the process so that no material is wasted. Because if there isn't enough or the wrong kind of material during the initial curation process, it can cause chaos in the class, which can lead to things that aren't good. So that moderators in the online learning process using crowdsourcing must really pay attention to data traffic so that the learning process can avoid chaos situations.

In the meantime, from the perspective of literature evaluation, chaotic behavior is a fairly minor topic in education. In contrast to the theme of crowdsourcing, which is more abundant in terms of quantity, research concerning the pandemic and post-pandemic periods is still quite limited.

Almost no research exists at the time this article is created on this topic, especially if it involves these two topics. This creates a substantial study gap, and in the end, research on both themes still provides unique material for future writing.

## REFERENCE

Al-Jumeily, D., Hussain, A., Alghamdi, M., Dobbins, C., & Lunn, J. (2015). Educational crowdsourcing to support the learning of computer programming. *Research and Practice in Technology Enhanced Learning*, *10*(1). https://doi.org/10.1186/s41039-015-0011-3

Alghasab, M., Hardman, J., & Handley, Z. (2019). Teacher-student interaction on wikis: Fostering collaborative learning and writing. *Learning, Culture and Social Interaction*, *21*(December 2018), 10–20. https://doi.org/10.1016/j.lcsi.2018.12.002

Anderson, M. (2011). Crowdsourcing Higher Education : A Design Proposal for Distributed Learning. *Journal of Online Learning and Teaching*, *7*(4), 1–8.

Borst, I. (2010). Understanding Crowdsourcing. In *ERIM PhD Series in Research in Management* (Vol. 221). http://repub.eur.nl/res/pub/21914/EPS2010221LIS9789058922625.pdf

Bruette, V., & Fitzig, C. (2017). The Literature Review. In *Identity, Conflict and Cooperation in International River Systems* (Vol. 24, Issue 1, pp. 20–35). Routledge. https://doi.org/10.4324/9781351156127-9

Bücheler, T., & Sieg, J. H. (2011). Understanding science 2.0: Crowdsourcing and Open Innovation in the scientific method. *Procedia Computer Science*, *7*, 327–329. https://doi.org/10.1016/j.procs.2011.09.014

Buecheler, T., Sieg, J. H., Füchslin, R. M., & Pfeifer, R. (2010). Crowdsourcing, open innovation and collective intelligence in the scientific method: A research agenda and operational framework. *Artificial Life XII: Proceedings of the 12th International Conference on the Synthesis and Simulation of Living Systems, ALIFE 2010*, 679–686.

Engstrom, M. E., & Jewett, D. (2005). Collaborative learning the wiki way. *TechTrends*, *49*(6), 12–15. https://doi.org/10.1007/bf02763725

Fu, Q. K., & Hwang, G. J. (2018). Trends in mobile technology-supported collaborative learning: A systematic review of journal publications from 2007 to 2016. *Computers and Education*, *119*(January), 129–143. https://doi.org/10.1016/j.compedu.2018.01.004

Gajek, E. (2020). Crowdsourcing in language learning as a continuation of CALL in varied technological, social, and ethical contexts. *CALL for Widening Participation: Short Papers from EUROCALL 2020*, *2020*(2020), 75–80. https://doi.org/10.14705/rpnet.2020.48.1168

Geng, Y., Huang, P. Sen, & Huang, Y. M. (2021). Crowdsourcing in nursing education: A possibility of creating a personalized online learning environment for student nurses in the post-COVID era. *Sustainability (Switzerland)*, *13*(6). https://doi.org/10.3390/su13063413

Karachiwalla, R., & Pinkow, F. (2021). Understanding crowdsourcing projects: A review on the key design elements of a crowdsourcing initiative. *Creativity and Innovation Management*, *30*(3), 563–584. https://doi.org/10.1111/caim.12454

Kellert, S. H. (2008). *Borrowed Konowledge*. The University of Chicago Press.

Kiel, L. D., & Elliott, E. (2004). Chaos theory in the social sciences foundations and applications. In *Chaos Theory in the Social Sciences*. University of Michigan Press.

Kittur, A., Lee, B., & Kraut, R. E. (2009). Coordination in collective intelligence: The role of team structure and task interdependence. *Conference on Human Factors in Computing Systems - Proceedings*, 1495–1504. https://doi.org/10.1145/1518701.1518928

Liao, J., Wang, M., Ran, W., & Yang, S. J. H. (2014). Collaborative cloud: a new model for e-learning. *Innovations in Education and Teaching International*, *51*(3), 338–351. https://doi.org/10.1080/14703297.2013.791554

Llora, M., & Cordero, J. F. (2016). Using Chaos Theory As a Framework To Explain the Nature of Complexity in Contemporary Organizations. *Revista Economía y Política*, *23*(1997), 39–56. https://doi.org/10.25097/rep.n23.2016.03

Muñoz, C. B., Murillo Zamorano, L. R., & Sánchez, J. Á. L. (2022). *Crowdsourcing during COVID-19*. Routledge. https://doi.org/10.4324/9781003290872

Murphy, R. P. (2002). *Chaos Theory*. RJ Communications LLC.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. In *The BMJ* (Vol. 372). https://doi.org/10.1136/bmj.n71

Pluta, W. J., Richards, B. F., & Mutnick, A. (2013). PBL and Beyond: Trends in Collaborative Learning. *Teaching and Learning in Medicine*, *25*(SUPPL.1). https://doi.org/10.1080/10401334.2013.842917

Prpic, J., Melton, J., Taeihagh, A., & Anderson, T. (2015). MOOCs and crowdsourcing: Massive courses and massive resources. *First Monday*, *20*(12). https://doi.org/10.5210/fm.v20i12.6143

Shamseer, L., Moher, D., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ*, *349*(jan02 1), g7647–g7647. https://doi.org/10.1136/bmj.g7647

Smith, P. (1998). *Explaining Chaos*. Cambridge University Press.

Smith, W., & Higgins, M. (2003). Postmodernism and Popularisation: The Cultural Life of Chaos Theory. *Culture and Organization*, *9*(2), 93–104. https://doi.org/10.1080/14759550302803

Ward, L. M., & West, R. L. (1994). Technical Commentary ON CHAOTIC BEHAVIOR. *PSYCHOLOGICAL SCIENCE*, *5*(4), 232–236.

Weld, D. S., Adar, E., Chilton, L., Hoffmann, R., Horvitz, E., Koch, M., Landay, J., Lin, C. H., & Mausam. (2012). PersonaLized online education - A crowdsourcing challenge. *AAAI*

*Workshop - Technical Report*, *WS-12-08*, 159–163.

Zhang, X., Xu, G., Sun, Y., Zhang, M., & Xie, P. (2021). Crowdsourcing learning as domain adaptation: A case study on named entity recognition. *ACL-IJCNLP 2021 - 59th Annual Meeting of the Association for Computational Linguistics and the 11th International Joint Conference on Natural Language Processing, Proceedings of the Conference*, 5558–5570. https://doi.org/10.18653/v1/2021.acl-long.432