







Group 1 and 3. Although Group 2 spent nearly as much time sense-making as Group 1, this was not distributed equitably between group members. As shown in Fig. 5, one of the students did most of the sense-making. This student also talked 65% of the time (Fig. 3). Similarly, one student spent more time documenting than the others, one of whom spent 0 minutes documenting (Fig 5).

*Finding 6: Group 2 spent less time working together on the same task than Groups 1 and 3.* Collectively, Group 2 spent only 5.9 out of 10 minutes working together to complete a single task. When one or two students were experimenting or sense-making, for example, the other group members were engaged in documentation or off-task behaviors. This group worked together much less time than either Group 1 or 3, which worked collectively on the same task for 10 and 9.1 minutes, respectively (Fig.6).

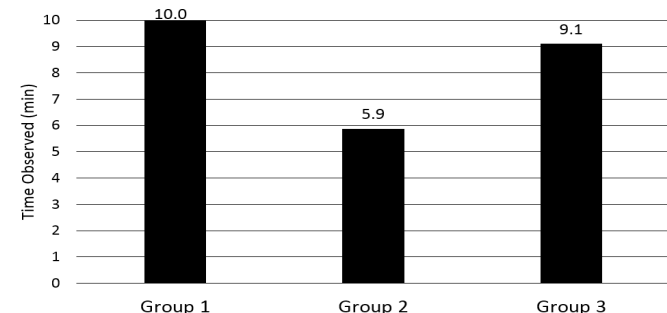


FIG 6: Time groups spent working on the same task.

## V. CONCLUSIONS

In this study, all of the teacher-researchers rated Group 1 as effective (Fig. 1). Group 1 was the group that demonstrated the most equity of voice (Fig. 3), spent a higher percentage of time speaking (Fig. 2), spent the most amount of time sense-making (Fig. 4), and all their time working on the same task (Fig. 6). By selecting Group 1 as effective in their snap judgments, teacher-researchers may place high value on the qualities Group 1 exhibited: the time spent sense-making, high equity of voice of each group member and time spent on the same task. Each member of Group 1 engaged in comparable amounts of time sense-making (Fig. 5), indicating that teachers may also value equitable types of contributions. Equitable

contributions may also indicate that each member had a vested interest not only in their own understanding, but of that of the group as well.

Four of the five teacher-researchers classified Group 2 as *ineffective* in their snap judgments (Fig. 1). This group only spent 51% of the time speaking to one another (Fig. 2), and of that time, member contributions were not equitable (Fig. 3). Group 2 showed the highest values in experimentation, documentation, and off-task behavior (Fig. 4). Further analysis reveals that an imbalance in the amount of time each member engaged in the different coded behaviors existed. The inequitable contributions may be due to the apparent distribution of self-selected group roles. The selection of Group 2 as *ineffective* by teacher-researchers may have been due to the high level of off-task behavior, which may have led to the oversight of other potentially valued behaviors. Group 3 was split amongst the teacher-researchers' snap judgments, presenting a complex set of behaviors and qualities. It may be worth noting that the group rated as effective (group 1) had 3 members while the group rated as ineffective (group 2) had 4 members. Additionally, it might be of value to investigate the use of distributed group roles compared to shared group responsibilities structure as seen in Group 1.

Further analysis could be used to develop a methodology to assess group dynamics, as well as develop interventions to promote and cultivate effective group work. Such interventions may be leveraged to promote the skills and behaviors valued by teachers and observed in effective groups. Additionally promoting and improving these valued group attributes may lead to higher mastery levels and increased retention of physics concepts. Our findings suggest the snap judgments about group effectiveness made by teachers may align with group characterizations that tend to demonstrate higher sense-making, greater equity of voice, and more equitable contributions.

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