Pandemic Impacts on Assessment of Undergraduate Research

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ABSTRACT

Were assessments of undergraduate researchers in a 10-week summer computing research experience impacted by the pandemic? We compare three cohort years: (1) pre-pandemic (in-person REU; prior to pandemic onset), (2) in-pandemic (remote REU, post-onset during ongoing pandemic), and (3) post-pandemic (in-person REU, post-onset with pandemic in the background). We discuss two forms of 5-point assessment ratings. First, we examine assessments of research skills on 34 questions, with a repeated measure of 3 assessments per cohort year at the beginning, middle, and end of their experience. Then, we examine assessment of presentation skills collected at the beginning vs. the end of the experience for pairs of students in all cohorts, considering 13 rating questions. Students' performance was assessed higher pre-pandemic. Also, being remote impacted completion performance. Lastly, effects linger after a return to in-person experiences, indicating adjustment challenges.

1 EXTENDED ABSTRACT

Introduction We address a documented lack of scholarship comparing remote and in-person undergraduate research, and explore if there are lingering effects influenced by the pandemic. We compared three cohorts, with approximately 10 students each, covering both factors (in-person vs. remote, and pre- vs. post-pandemic onset) using rating-based assessment of students. We study aggregate, anonymized ratings of research skills (assessed individually), and of presentation skills (assessed in pairs) examining two questions:

RQ1 Does research skills indicate differences for (a) remote vs. in-person, and (b) before vs. after the pandemic onset?

RQ2 Do presentation skills indicate differences for (a) remote vs. in-person, and (b) before vs. after the pandemic onset?

Method For RQ1, we examined mentor reports (MRs) in which faculty rated student research skills (computing research skills, knowledge, practices, and menteeship skills), using 3 repeated measures (program beginning, middle, end) referred to as MR1, MR2, and MR3. We considered per-year averages of 34 questions using a 5-point rating scale; 5 being highest. For RQ1a, we used the in-pandemic, remote year (Y2) as reference point. We annotated each question for if it had the *lowest, middle, or highest* average rating with respect to the other two cohorts, also noting high/low ties, and identified the most frequent category per MR. For RQ1b, we did this too with the pre-pandemic, in-person year (Y1) as reference.

For RQ2, we examined 13 presentation skills ratings. Student pairs explained their project early (lightning talk), and reported back at the end (achievement talk). Per talk, we used the remote year or the initial pre-pandemic year as reference and coded each item on whether it had the *lowest, middle, highest* average assessment (noting ties). One-way ANOVA compared the assessment per question per talk; for RQ2a the remote (Y2) vs. in-person (Y1 and Y3) and for RQ2b pre-pandemic (Y1) vs. after pandemic onset (Y2 and Y3). A visual Tukey test was examined for differences ($p < 0.05$).

Results and Discussion For RQ1a, for the remote reference year, while *middle* had the max count for MR1 and MR2 (11 and 17 items, of 34), *lowest* dominated the count for MR3 (16), indicating that when remote, skills did not grow as well as for in-person. This may reflect slower progress or impact on quality of deliverables. Prior work suggests that while teams function online, achieving cohort networking and bonding is difficult. There are also not informal opportunities for cross-team chat or comparisons like in a lab. Three questions about time-management/reliability hinted at remoteness as an obstacle for time-management or accountability when not co-located or in the same time zone as one's teammate. For RQ1b, in contrast, the most frequent rating for MR3 in the pre-pandemic year was *highest* (11 of 34) indicating the pre-pandemic cohort excelled, perhaps as it was in-person and had no post-pandemic after-effect.

For RQ2a, considering the remote year as reference showed that the lightning talk was distributed across *highest* and *lowest*, but no item had *highest* for the achievement talk. For RQ2b, the contrast is striking–for the early talk again around half of items were *highest* while for the late talk all were, indicating clear growth. Also, for RQ2a, comparing remote vs. in-person, there was a significant difference in three items for the lightning talk and in five for the achievement talk. For RQ2b, comparing pre vs. post pandemic onset, the lightning talk had two significant items while the achievement talk showed a consistent statistical trend with all items showing significance. For in-pandemic and post-pandemic only, post ratings are the lowest for 8 items for the latter. Apparently, after-effects from the COVID-19 era lingered, indicating that being remote both impacted skills and adjustability issues after returning to in-person.

Conclusion Skills growth in undergraduate research appears to benefit from in-person experiences where cohorts can network and engage in social team-building. In-person mentor-mentee interactions may also assist in meeting expectations and access to cohort bonding can motivate excelling together. We noted some after-effects. The pandemic disruption can have skills impacts and adjusting back is not necessarily immediate.