Research Opportunities for Science Educators (ROSE)

Organizers

Jeff Rack, CCB, A&S
Steve Cabaniss, CCB, A&S
Eva Chi, CBE, SoE
Carolyn Hushman, EdPsy, CoEHS
Susan Atlas, CCB, A&S
Sarah Rascon, Program Coordinator

Version: 1.00 **Date: March 27, 2025**

Mission

The ROSE Program energizes and enhances science teaching in New Mexico by leveraging the research resources of the University of New Mexico (UNM) and the educational resources of the State of New Mexico Public Education Department (PED). The central activity is an authentic research experience in which teachers (ROSE Scholars) join ongoing projects for first-hand participation in discovery-based research. The embedded Scholars see firsthand "how science is done" and the interdependence of various disciplines and subfields while working with faculty and student researchers. Scholars are selected based on the underrepresented minority (URM) and economically challenged student populations of their schools and their own scientific interests and background. They return to their classrooms bringing new ideas, tools and enthusiasm to share with students. From this core experience, ROSE will assist Scholars statewide in building a community to share experiences and educational resources.

ROSE will

-improve the quality of science education in NM schools by refreshing knowledge and inspiring confidence in middle and high school teachers

-forge connections between UNM and schools by acquainting teachers with university resources and educating UNM faculty on issues facing the schools

-incorporate K-12 and higher education faculty into a collaborating community of STEM educators statewide.

ROSE Annual Report for 2024

Executive Summary

ROSE continues to provide high-quality research experiences to science teachers from across New Mexico, improving their content knowledge and confidence while helping to build ties across the STEM education community.

The fourth summer of the ROSE program attracted over 70 applicants and brought 28 of these to UNM as Scholars (increase from 22 in summer 2023). Most (85%) of the Scholars teach at schools with over 70% minority enrollment, and most (>60%) teach at schools with >50% economically challenged students. About 80% of the Scholars teach at schools outside the Albuquerque metropolitan area. Scholars worked on research projects with an expanding faculty pool of 21 mentors from Arts and Sciences, Engineering, Pharmacy, Medicine and Education and Human Sciences.

The summer research session ran for five weeks from Monday June 10 to Friday July 12, 2024; roughly 3/4 of the Scholars stayed in the UNM (University of New Mexico) dormitories. Research projects ranged from the computational sciences (molecular modeling, evolutionary theory) to molecular synthesis, to organismal biology and ecology. Scholars presented their results to each other as posters which could be taken back to their classrooms for the academic year; in addition, tours allowed Scholars to visit other UNM labs and hear from other mentors about the longer-term research goals. Scholars also toured the Museum of Southwestern Biology and attended workshops on grant proposal writing and research mentoring.

Contact with Scholars continued during the academic year to variable degrees, including campus visits and online discussions. In the follow-up survey in Fall 2024, all responding Scholars indicated that ROSE had changed the way they teach, with new classroom activities and approaches and increased self-efficacy regarding teaching science concepts (50%) and practices (67%). Most (87%) indicated that ROSE increased their motivation to teach science, and one Scholar wrote that “I walked into the summer burned and questioning my life choices. I left ROSE excited for the upcoming year and teaching high school science.”

ROSE organizers continued to pursue a stable funding model with the state of New Mexico, requesting expansion funds from the HED (Higher Education Department) RPSP (Research and Public Service Program). However, no additional HED funds were obtained and PED (Public Education Department) will not provide ROSE funding in FY25. ROSE now has a formal reporting path to the UNM office of research and has hired a quarter-time program coordinator to assist with logistics, but lack of stable funding is a threat to the continuation of the program.

Priorities for the coming year include establishing a stable, ongoing funding model, developing methods for Scholars to implement more research-based activities in their classrooms, and developing longer-term methods to evaluate program impact on teachers.

I. History

ROSE began as a pilot project in 2021 to provide statewide outreach to public schools and their science classes by embedding teachers into authentic research projects at UNM. With support from NM PED, eight science teachers from across New Mexico came to join ongoing research projects in UNM's department of Chemistry and Chemical Biology (CCB) for 4 weeks in summer. The number of applicants (40) and teacher responses (overwhelmingly positive) encouraged UNM and PED to continue and expand the program.

In 2022, the program secured increased funding from the Math and Science Bureau of PED and from the HED RPSP program (categorical funds for Teacher Pipeline) which permitted an expansion to 20 teachers (Scholars), most of whom were housed in UNM dorms for the 5-week summer session. A quantitative survey approach was used for program assessment, and both Scholars and faculty mentors had very positive responses.

The 2023 research session hosted 22 Scholars for 4 weeks, and the mentor group included faculty from 3 A&S departments (Chemistry, Biology, Earth Sciences), Chemical and Biological Engineering and Pharmacy. In the October follow-up survey, Scholars responded that ROSE had changed the way they teach, reporting increased self-efficacy regarding teaching science concepts (67%) and practices (89%). Following the summer session, ROSE proposed a more formal organizational structure reporting to the OVPR.

The program continues to evolve in response to feedback from Scholars and other stakeholders, hoping to significantly benefit improve the STEM education ecosystem by improving the skills, confidence and enthusiasm of science teachers across New Mexico.

II. Publicity and Scholar Recruitment

The website (https://UNMROSE.unm.edu) served as the principal outward 'face' of the ROSE program through the recruitment period and the summer research session. Photos and PI research descriptions were updated as new items became available, and lists of Scholars were posted for each summer session. News stories ran on the departmental website before the summer research session and on the UNM news site after the summer session.

Advertising for the 2024 session began in Fall 2023 and included a table display at the annual NMSTA conference (October 2023 at San Juan College in Farmington) as well as online mechanisms. A preliminary advertisement (informational, but no online application available) ran in PED's STEM Connect newsletter in October of 2023. The first advertisements containing the online application link ran on the NMSTA website in January and early February 2024 and in STEM Connect during the same period (text for all ads can be found in Appendix A). Also in late January, recruiting emails were sent to the 2021 and 2022 Scholars and to superintendents of all NM school districts (including charters). Both the NMSTA and STEM Connect newsletter are 'opt-in' channels which teachers must sign up for; we have not found a comprehensive email list for science teachers in NM.

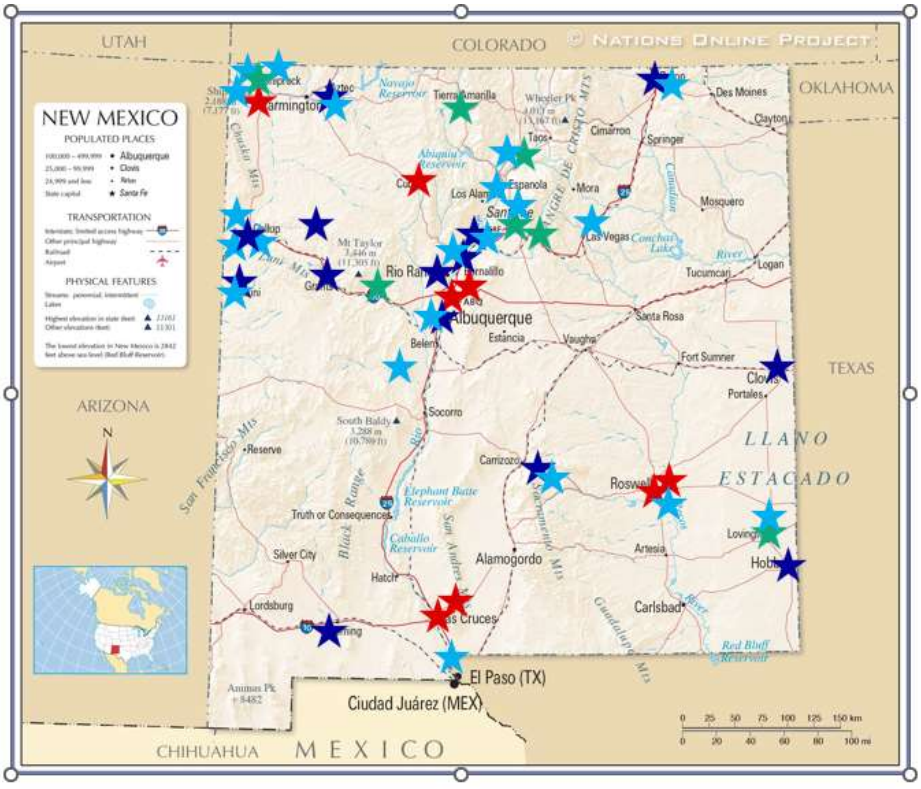
III. Scholar Selection

The ROSE online application for summer 2024 went 'live' on January 15 with a best consideration date of March 1. The first round of application acceptances had a target date of March 17 to be followed by Scholar acceptances on March 29. The application used Survey Monkey and was operated by UNM ROSE organizers.

We received 80 completed applications by the best consideration date (Appendix C), the largest number yet for this program. The organizing committee evaluated applicants based upon student demographics at their schools, geographic distribution, professional preparation, the ability of PIs to accommodate returning Scholars and short-answer questions about motivations. Demographic data obtained from the NM PED STARS site (https://webnew.ped.state.nm.us/bureaus/information-technology/stars/) included percentages of Hispanic and Native American student populations, English language learners and economically challenged students. Professional preparation data included self-reported academic degrees, years taught and subjects currently/recently taught.

Acceptance emails were sent to 25 applicants on March 13 asking for a response by March 29; responses were overwhelmingly (90%) positive. Additional acceptances were sent out in April, as funding became more definite. Of the 30 applicants who accepted offers from ROSE, two eventually declined due to changes in their summer plans.

Geographic distribution: The 2024 Scholar cohort of 28 teachers (Appendix D) represented schools from across the state, including 14 returning Scholars from Shiprock, Alamo Navajo reservation, Rio Rancho, Santa Fe, Bernalillo, Gallup, Santo Domingo, Raton, Penasco,



Aztec, Lovington, Valencia county and Albuquerque. The 14 new Scholars included 4 from southern NM (Anthony, Capitan, Roswell, Gadsden) and others from Los Lunas, Espanola, Kirtland, Las Vegas, Zuni, Chama, Shiprock and Albuquerque. Two Scholars teach at Albuquerque schools, with four others teach in the metropolitan area (Bernalillo down to Belen). While the majority of Scholars teach in the northern half of the state, the presence of 5 Scholars from southern NM represents a higher number than in previous years.

Student demographics: The 2024 Scholars typically teach at schools with high percentages of Hispanic, Indigenous and/or economically challenged students, all groups cited in the Yazzie-Martinex decision of 2018. Six of these schools had >90% Indigenous students, while 9 schools had >80%. Seven of the schools have over 80% Hispanic enrollment, while 11 had >60%. Eight of the schools had over 90% economically challenged students, while about half had over 50%. In addition, 14 of the schools enrolled >20% English language learners. (The numbers do not include the students at Alamo Navajo Community School, since PED does not post statistics for schools run by the Bureau of Indian Education).

IV. Summer Research and Cohort Activities

The 28 Scholars of the 2024 cohort were matched with 21 faculty mentors from across campus (Appendix E). This represents a ~40% increase in the number of mentors versus 2023, and includes the new participation of faculty from the CoEHS (Exercise Science) and Medicine (Biochemistry). Relative to 2023, the number of A&S mentors increased from 6 to 10 and the number SoE mentors increased from 4 (all in Chemical and Biological Engineering) to 7 (including new mentors from Mechanical Engineering and Civil and Environmental Engineering). Seven mentors were women, unchanged from 2023.

The summer research session ran for 5 weeks from June 10 to July 12, one week longer than in 2023. Out-of-town Scholars moved into the UNM housing (de Vargas Hall) on the UNM campus on Sunday June 9. The first day (June 10) included program orientation, safety training and a welcome reception in the University Club; new Scholars also met their mentors in person. Beginning June 13, Scholars joined ongoing research projects which were their principal occupation for the duration of the session. Research projects ranged from the computational sciences (molecular modeling, evolutionary theory) to molecular synthesis, to organismal biology and ecology. Specific projects and Scholar/mentor pairings are given in Appendix E.

To encourage interactions among the Scholars and to broaden their exposure to UNM faculty and activities, Scholars were asked to attend a series of activities. These cohort activities included weekly coffee breaks (Tuesdays) and lunches (Fridays) to promote social interactions and informal exchanges of knowledge and an evening reception at the Maxwell Museum with fellows in the TODOS program (Noyes Scholars, science teachers from across NM). A more formal activity was scheduled each Friday afternoon:

a) a presentation on writing grant proposals by CoEHS professor and TODOS PI Deena Gould.

b) a presentation on the US Crystal growing competition, in several which Scholars have participated and Jeff Rack is an organizer (https://www.uscrystalgrowingcompetition.org/).

c) a presentation on student research projects from Scholar Leah Felty (V Sue Cleveland HS), who has attended the STEAM-H workshop led by Karen Kinsman and who has mentored a number of successful students in research challenge competitions.

d) a guided tour of the Museum of Southwestern Biology, a research museum with controlled public access, given by docent Breanna Kappel.

e) tours of faculty research labs and facilities to allow Scholars to see and hear about research outside of their own projects.

The summer session concluded Friday, July 12, with poster presentations by the Scholars on their summer research (poster titles in Appendix E). Posters were displayed in the atrium of the UNM Science and Math Learning Center; Scholars were encouraged to keep the posters afterwards for display in or near their classrooms. The session included a catered lunch and closing comments by the organizers and PED Math and Science Bureau Director Shafiq Chaudhary. The session was attended by ~60 UNM students and faculty in addition to the Scholars and organizers and also by NM Senator Harold Pope.

V. Ongoing connections with Scholars

Following the summer research session, we communicated with Scholars (2021 to 2024 cohorts) through periodic group emails and some induvial Zoom meetings and class visits. The emails typically centered on ROSE-related activities, but also mentioned other meetings and activities of organizations like the NMSTA and American Chemical Society. Readership as measured by opened emails was high (>80%), but responses were much lower (~10%). Scholars were encouraged to arrange class Zoom visits by UNM faculty and students.

VI. Funding

ROSE received support from several different sources and mechanisms in 2024, including direct payments to ROSE, payments to Scholars, and in-kind organizational support.

NM PED paid the 5-week stipends of 16 Scholars directly, $6,000 each for a total of $96,000. These payments from the PED Math and Science Bureau were requested and granted on a non-recurring basis and are not expected to be repeated in 2025.

The NSF CISTAR grant (lead UNM PI Abhaya Datye) paid the stipends for three Scholars who worked on CISTAR research (total $18,000). This grant also provided funding to bring the Scholars to UNM campus in October for a research meeting.

The Central Consolidated school district paid the stipend for one Scholar teaching in that district ($6,000; another Scholar from the same district was paid by NSF).

UNM operating funds for the 2024 summer session were obtained from the HED RPSP program Teacher Pipeline Initiative. For FY24 and FY25, $100K annually was allocated to ROSE. Because ROSE expenditures are centered on the June-July period, program expenses are more easily monitored on a CY (calendar year) basis, and a budget for CY 2024 is attached as Appendix I.

UNM expenditures for CY 2024 included $42K for Scholar stipends, $38K for on-campus housing and parking, $27K for graduate student "lab mentor" awards, $9K for salaries (staff coordinator and faculty stipend), and $7K for hospitality (space rental, catering). Miscellaneous expenses included lab safety equipment, poster printing, off-campus housing for CISTAR Scholars, conference participation and minor supplies. Total UNM expenditures in CY 2024 were $130K.

Total ROSE cost for CY 2024, combining UNM expenditures with PED, NSF CISTAR and district stipend support, was $250K not including in-kind contributions by UNM faculty and staff (especially before the hiring of Sarah Rascon coordinator in June). The overall per-Scholar cost of $9K is largely (~90%) direct costs for Scholar stipends, housing, and mentoring, with roughly 10% of the funds going to logistics, hospitality, etc.

Based on this $9K per Scholar cost, the HED RPSP funds supplemented by the $50K received from the OVPR for FY25 should allow a program size of 16-17 Scholars in summer 2025. This estimate is significantly lower than the 28 Scholars hosted in 2024, and it ignores fixed costs of administrative work and inflation in housing prices; a more realistic figure might be 12-13 Scholars. However, if additional funds can be obtained from federal sources (research grants) and/or from school districts, a larger Scholar cohort may be possible.

ROSE continues to pursue increased RPSP funding from the NM HED. For FY24, ROSE received $100K through RPSP categorical funds for teacher pipeline activities. UNM approved and requested expansion funds for FY25 ($366,833 in addition to the $100K in categorical funds for a total of $466,833 requested), but this was not approved by the legislature (RPSP FY25 application form and presentation slides included here in Appendix F. Another expansion request in the same amount was submitted in 2024 for FY26 and approved by UNM for inclusion in the request to the state. In December 2024, HED included a teacher pipeline amount of $275K for FY 2026 in their budget request to the NM legislature.

VII. Organization

The organizational proposal submitted last year to the OVPR was approved in Spring 2024. The ROSE program will report to Assistant VP for Research, currently Prof. Melissa Emery Thompson. Reports will continue to be distributed annually to the OVPR, the Provost's office and the relevant deans (A&S, SoE, CoEHS and CoP) as well as the NM PED Math and Science Bureau.

To lift some of the logistical and administrative burden from the CCB departmental staff, ROSE was allowed to hire a part-time program coordinator. Together with the NSF PREC grant overseen by Dr. Mark Walker, a 0.50 position (funded equally at 0.25 by ROSE and PREC) was

created and advertised in Spring 2024. Ten applications were received by April 1 and 4 candidates were interviewed in mid-April. An offer was extended to Sarah Rascon, who accepted the position and began on June 6. Specifics of the search process are summarized in Appendix H.

VIII. Assessment Process and outcomes

Program assessment consisted of a series of Scholar surveys and PI surveys during and after the summer session (summary report is attached as Appendix J). Results were summarized as:

1. The ROSE Scholars overwhelmingly had positive things to say about their experiences with ROSE and with their lab groups. They would come back again.
2. The PIs were overwhelmingly positive about hosting a ROSE scholar
3. For the majority of ROSE Scholars, reported little to moderate amounts of research experience prior to ROSE
4. The average ROSE Scholars has 14 years of experience teaching STEM, and has a degree in Education. Half of the Scholars reported a LEVEL II teaching license. All had at least one endorsement in science or math.
5. This experience has impacted their ability to address the practices of science and engineering standards, the activities in their classroom, and the amount of open ended inquiry with their students.

Surveys were written, conducted and summarized by Prof. Carolyn Hushman, Professor of Educational Psychology and Associate Dean for Research in the College of Education and Human Sciences. Scholars were asked to complete 4 surveys in Qualtrics- a welcome survey at the start of the summer session (31 completed), a mid-point survey two weeks later (30 completed), an endpoint survey in July (11 completed) and a final survey in December (10 completed).

Classroom teaching impact of the ROSE experience is significant. Scholars teach over 100 students a year, on average (3,679 total students were taught by this year's ROSE scholars). All of the Scholars responding in October reported that they changed the way they teach due to their ROSE experience, including new examples, new activities and the use of open-ended inquiry. Most teachers reported an increase in self-efficacy regarding teaching science concepts (69%) and practices (85%). One Scholar wrote "Doing research in a wet lab changed the way I include science practices in my class…no more graphic worksheets trying to mimic real science. and then to put into posters and presenting them is amazing and makes me more confident. I can't wait to host and make the STEM nights for families in school this year!"

The ROSE experience also changed how teachers see themselves. Survey responses showed 18% increase in agreement with the statement "I am part of the STEM workforce in New

Mexico". Most (87%) teachers agreed or strongly agreed that ROSE left them more motivated to teach science. One Scholar wrote that "I learned how scientists think, how to solve problems by thinking outside the box, and I learned/re learned why I love teaching science!"

Survey feedback on program logistics was helpful, and included information on recruiting, teacher motivation, and preparation for the summer. Teachers learn of the ROSE program from administrators, other teachers, and PED communications; they apply in order to improve their science knowledge and personally experience research. Most (75%) teachers felt they had enough information about logistics and stipends before the start of the summer program, but at the midpoint, 67% of teachers reported they were overwhelmed by the research and equipment in their lab (this decreased to 24% at the end of the session). Some teachers specifically requested more advance information housing and parking.

Finally, ROSE is changing how Scholars interact with their students. One Scholar wrote that "It was hard to be the learner and not the leader! The graduate student I worked with was fabulous, and listening to him made me remember how important it is to break complex ideas down clearly for a learner. I also appreciated feeling inadequate at the beginning as many students do when they start chemistry." Another concluded that "I now have a better understanding of the research being done at UNM and can 'sell' the idea for those students who are not sure why STEM is a good way forward."

For the PI Survey, 13 PIs completed the initial survey, five completed the end of program survey. PIs were overwhelmingly looking forward to hosting a teacher in their lab, and expressed being nervous about the short amount of time or not being helpful to the teacher. At the end of the experience, survey results showed an overwhelmingly positive experience for both the lab group and the PI. Teachers contributed to the research by being good communicators and detailed oriented. It was suggested these surveys should go to the individuals in the groups directly working with the teachers and not the faculty PI.

Acknowledgements- ROSE organizers gratefully acknowledge support from the New Mexico Public Education Department (PED), the NM Higher Education Department (HED), the National Science Foundation (NSF) and the University of New Mexico (UNM).