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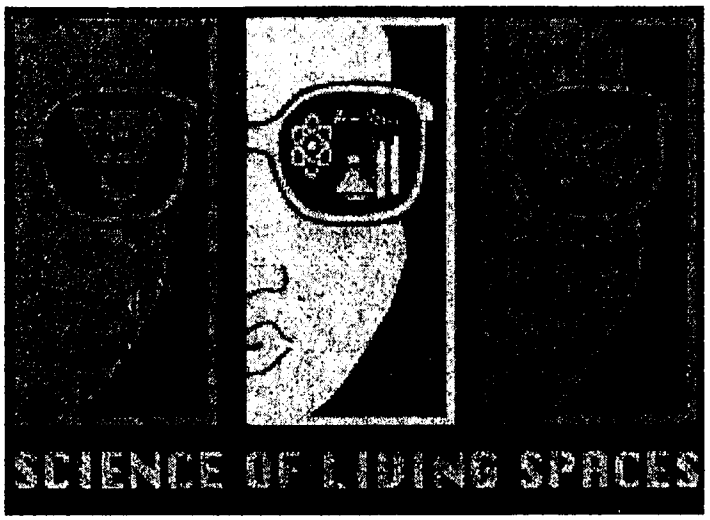
ABSTRACT

The Science of Living Spaces program provides girls aged 11-13 increased access to and awareness of the possibilities inherent in pursuing careers in science, engineering, and mathematics. Objectives of the program include expanding career knowledge and opportunities; increasing participants' knowledge of and exposure to science, engineering, and mathematics through real-life projects in computer science, engineering, physics, chemistry, biology, and mathematics; overcoming stereotypic and irrational beliefs, socialized feelings, and attitudes that have a negative impact on women's selection of careers; and evaluating the project's success through the development of a guidebook on the implementation of the program so that it can be replicated. Appendices contain daily activities schedule, description of project activities, information for teachers, evaluation form, student and parent materials, and project specific measures. (Contains 25 references and 7 tables.) (DDR)



THE SCIENCE OF LIVING SPACES: WOMEN IN THE ENVIRONMENT OF THE 21ST CENTURY

AN EVALUATION AND GUIDE BOOK

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The Science of Living Spaces:

Women in the Environment of the 21st Century

INTRODUCTION

Current research on career development indicates an increased interest in science-related careers by women. Yet labor force statistics reveal an under-representation of women in the sciences (National Science Foundation, 1982). In addition, higher education statistics indicate that the proportion of women in the sciences decreases at each level of degree, salary, and academic rank (The Chronicle of Higher Education, 1995). Some theories of occupational choice (Holland, 1985; Super, 1980) would attempt to explain the statistical data as women's lack of interest in science-related careers. However, research by Koski & Subich (1985) found that some young women actually entered traditional occupations while indicating interest in more non-traditional careers (i.e., science, engineering, etc.)

If educators are to encourage women to pursue careers-- particularly science-related careers--consistent with their interests, educators must first understand the factors that influence females' vocational choices. Research on female career interests has investigated several factors that impact women's career choices. Factors identified as influencing females' career choices are: attitudes toward careers (Matthews & Tiedeman, 1964); abilities, interest and personality characteristics (Kirk, 1975; Erlick & LeBold, 1975; Bledsoe, 1978; Burroughs, Turner & Turner, 1984); academic course success (Chipman & Thomas, 1985; Dunteman, Wisenbaker & Taylor, 1979); parent and peer support (Cartwright, 1972; Falkowski & Falk, 1983; Breakwell, Fifeshaw & Devereux, 1988); home vs. career conflicts (Smith, Stroup & Coffman, 1975; Burrough, Turner & Turner, 1984); gender self-concept (Gottfredson, 1981; Galejs & King, 1983; Pryor, 1987), and occupational knowledge (DeFleur & Menke, 1975; Grotevant & Durrett, 1980; Yanico & Milbauer, 1983), etc.

Still, factors impacting career choice are complex and often more difficult to discern for females interested in science-related careers. McLure & Piel (1978) found that even though young girls expressed interest in science and technology careers, few decided to pursue these interests. They concluded that girls interested in science often have doubts about combining family life with a science career, lack information about steps in preparing for a science career, and see few examples of the important role women can play in science. As well, early studies of adolescent girls' interest in science used late adolescent girls, 15-19 year olds. If educators and counselors are to channel young girls' career interest in science, intervention programs will be required at earlier levels, particularly when girls are exploring and making tentative career choices. Also, if such programs are to be successful, they must be coupled with an awareness of the relative strengths of various factors on women's career selection. The Science of Living Spaces: Women in the Environment of the 21st Century program is a model program designed to encourage girls to consider Science, Engineering and Mathematics (SEM) fields as a career.

GOALS OF PROGRAM

The Science of Living Spaces program provided young girls (between 11-13 years old) increased access to and awareness of the possibilities inherent in science, engineering and mathematics careers. The specific objectives of the program were:

1. To expand career knowledge and opportunities, and provide role models of women in SEM areas;

2. To increase the participants' knowledge of and exposure to Science, Engineering and Mathematics through examination of real-life projects in four different areas of SEM: Computer Science and Engineering, Physics, Chemistry and Biology, and Mathematics;

3. To help participants overcome stereotypic and irrational beliefs, socialized feelings and attitudes that negatively impact women's selection of SEM careers; and

4. To evaluate the project's success, preparing a guidebook on the implementation of the program, disseminating information about the project so that it can be implemented elsewhere, and refining the project so that it can be continued at Christopher Newport University (CNU) after NSF's support has ended.

PROGRAM LOCALE

The host institution for this program was Christopher Newport University located on the Virginia Peninsula, an ideal area for this type of project. Nearly a half million people populate the Peninsula, with concentrations of minority groups including Native Americans, Asians, and African-Americans (30.7% of the population as contrasted with18.7% statewide). It is the dominant center for high tech development in Virginia--outside the Washington, D. C. area. As well, Christopher Newport University is near NASA Langley Research Center and Jefferson Lab (formerly the Continuous Electronic Beam Accelerator Facility; CEBAF), both of which are transforming a region surrounded by rural counties.

Christopher Newport University, as the host institution, was uniquely well-qualified to offer a model project to encourage young women's interest in Science, Engineering and Mathematics. First, the institution has a well-earned reputation for innovative programs and a history of excellence in science and mathematics education. CNU was the lead institution in one of three major collaborative efforts for restructuring school science and mathematics within the Commonwealth of Virginia to be funded through NSF. CNU has implemented the following projects: School Science Comes Alive (funded by NASA)--for elementary school students and teachers at predominantly minority schools; Minorities Institute for Regional Access to Careers Leading to Engineering and Science (MIRACLES)--for seventh grade minority students in Science and Engineering; Girls and Mathematics Equal Success (GAMES, originally funded by NSF and now an independent offering of CNU)--for middle school girls in Math; EXCEL, for seventh and eighth grade minorities in Science; and V-QUEST--a

collaborative effort to restructure school science and mathematics. Secondly, CNU's strength lies less in its successfully funded and implemented projects than in the women scientists leading this project. The Steering Committee that assisted in the planning of this proposal consisted of a racially-mixed group, all eight of whom are women holding doctorate degrees, drawn from the department of Psychology and from the College of Business, Science and Technology (formerly the College of Science and Technology). See Appendix A for a short biography of each of these women. Finally, the theme--Living Spaces in the 21st Century--was one that was both interesting and useful to girls and sufficiently attractive to parents to overcome the negative stereotypes associated with course work and careers in Science, Engineering and Mathematics.

PROGRAM DESIGN

The Science of Living Spaces: Women in the Environment of the 21st Century was a year-long program in which the participants (24 middle school female adolescents) examined concrete problems that allowed the girls to see: 1) the accessibility of SEM problems, 2) the relevance of science to their daily lives at an age when most girls are losing interest in these topics, and 3) the attractiveness of SEM careers. The heart of the program was the three-week, residential summer program. The students participated in a wide variety of activities during their three-week stay at CNU. All activities and projects were related to the theme of Living Spaces in the 21st Century. On campus, the girls worked collectively and individually solving problems related to the four major SEM areas targeted by this program. Women scientists from non-academic institutions came to CNU to discuss their careers as well as to provide hands-on problems for the students to solve. Off-site field experiences supplemented the on-campus activities. Girls visited national laboratories and other science institutions to talk to female scientists.

The participants lived at CNU from Monday to Friday for each of the three weeks. A van took the girls close to their homes at the end of each week, and picked them up at

the beginning of each week. To encourage participants to return to CNU at a time when they may have felt homesick (surprisingly, none of the girls expressed any homesickness), the second and third weeks began with off-site field experiences. The second week began with a visit to Busch Gardens where the girls studied the scientific principles that the rides demonstrated. The third week began with a trip to Colonial Williamsburg where the girls explored concepts of 18th century living spaces, medicines, and sciences. In total, there were several parts to the summer schedule: careers, ethics, visits from scientists, self-esteem building, collaborative science, technology application, and specific off-site experiences. See Appendix B for program format, a description of specific activities, and a copy of the schedule for the three-week residential program.

The summer program was supported by a school-year program. Before leaving for the summer, girls were placed in Design Groups. These design groups, composed of four girls who attended the same school, were supposed to meet regularly during the school year to work on their spring projects--designing a Mall. To ensure these groups would meet, several safeguards were built in: (1) each group was placed under the guidance of a teacher who was receiving in-service credit for her/his work ; (2) students were assigned mentors (undergraduate science and mathematics majors) with whom to communicate through email; and (3) design groups were to send via email a report of its Mall progress to the Steering Committee. However, problems with the email accounts hindered this process. Although the schools intended to have email capability, technical delays affected all of the schools to varying degrees. Thus, email capabilities were not established until Spring, 1996. As a result of the email delay, the fall meeting was used to provide students an opportunity to work on their projects, discuss problems, and find solutions to their problems with their mentors and the project supervisors. Still, parents indicated that the delay in email communication was a main frustration for the girls. To overcome the disconnected feeling that some of the girls were experiencing, the program director visited each school early in the Spring semester. The Spring meeting was the

culmination of the year-long project. Students were given an opportunity to do last-minute construction on their designs. The students presented their projects to their parents, mentors, and teachers. A female manager of a local mall was invited to attend the meeting and served as a judge for the Mall designs. Designs were awarded first place, second place, third place, and honorable mention. Each girl received a gift certificate to the local mall based on their award placement.

An added strength of the program was the active involvement of parents and teachers. A training program was required for teachers, parents, and project personnel (mentors and project supervisors.) The training courses were taught by a school psychologist experienced with girls of this age. The training differed for each group, since each group had a different relationship with the participants and different backgrounds. For parents, the training provided valued information about barriers to girls' interest in science, how to encourage girls' interest in science, and how to make science relevant to girls of this age. As well, the training attempted to minimize the perceived threats to a young girls' choosing and pursuing SEM careers.

Science teachers, however, face different problems. Consequently, for teachers, the training addressed the unconscious, ingrained habits of encouraging boys and discouraging girls in science classes and how, in these actions, teachers may unconsciously impact girls' decisions to avoid SEM careers. Teachers were given effective methods for recognizing and overcoming the subtle preferences given to boys in the sciences. As well teachers were given an opportunity to provide suggestions for the improvement of the program. One suggestion offered by a teacher was to have one teacher each week (someone familiar to the students) accompany the girls through the summer program. This suggestion was incorporated into the program design and teachers from each of the three schools remained with the girls for one week. To encourage teacher involvement, the county school systems involved approved recertification credit for participation in the project . Thus, after successful completion

of the training and their Fall and Spring responsibilities, teachers were awarded rectification credit and an honorarium. See Appendix C for teacher information sheets and contracts.

For project supervisors (instructors and mentors), the training included research on girls in the classroom, activities on appropriate behavior for girls, and instructional strategies for enhancing motivation. In general, the training helped all of those involved with the student to understand the issues that girls in middle schools face as they choose whether to undertake the course work that will allow them one day to enter SEM careers. See Appendix D for copies of the Evaluation Forms (results included) used to assess the training sessions.

RECRUITMENT

Science teachers in Isle of Wight and Charles City counties, the two counties involved, informed all seventh and eighth grades. These two counties are rural communities, and were chosen because youngsters from rural communities have fewer opportunities to view women in science, and because these communities are characterized by both a large minority and an economically disadvantaged population. Additionally, the conservative nature of families in Virginia's rural populations erects barriers for females against preparation for a SEM career

To generate interest, the Science of Living Spaces' program director visited each middle school, discussed the program with the principal, and performed science demonstrations with prospective participants. Interested students were encouraged to complete the application form which included: (1) a teacher recommendation, (2) a letter of support from a parent or guardian, (3) a release form for student's recent grades, and (4) a short essay explaining the students interest in the summer program. See Appendix E for a copy of the application with accompanying forms, and the program overview.

Based on the applications and grant restrictions, twenty-four female adolescents were chosen as participants in the Science of Living Spaces program. The girls ranged

in age from 11-13 years, with a mean age was 11.9 years. Girls represented a wide range of socio-economic backgrounds.

The program was aimed at average to above average students because these students are most likely to choose and succeed in SEM careers, if they are sufficiently encouraged. While the minimum G.P.A. for the program was 2.0, the average G.P.A. for participants was 3.31/4.00. Subjects were also screened for high levels of interest in SEM careers. However, girls who indicated interest in other careers were also selected and given the opportunity to participate in this year-long program. Table 1 reports the collected demographic data for the participants.

PROGRAM EVALUATION

The evaluation of the Science of Living Spaces program was multifaceted and used both qualitative and quantitative assessment techniques. The evaluation included (1) standardized measures to assess the general content, and (2) project specific measures to assess the specific content of the projects. Each aspect of the program was evaluated. In general, the program was evaluated using a pre-test/post-test design.

A. Measures

Standardized measures: Several standardized instruments were used. Self-concept was measured using the **Tennessee Self-Concept Scale (TSCS)**. The TSCS is a standardized self-administered instrument measuring "self-concept and self-criticism" (Raid and Fitts, 1994). The test consists of 100 self-descriptive statements that the respondent uses to create a self-picture. The **TSCS** yields a multidimensional view of self-concept, including physical self, moral-ethical self, personal self, family self, social self, identity, self satisfaction, and behavior. The results of the TSCS was used to assess changes in self-esteem/self-concept of the participants.

Academic intrinsic motivation was measured using the **Children's Academic Intrinsic Motivation Inventory (CAIMI)**. Academic Intrinsic Motivation is defined as enjoyment of school learning characterized by an orientation toward mastery, curiosity,

persistence, and the learning of challenging, difficult and novel tasks. The **CAIMI** (which was used by an early NSF-sponsored program at CNU) is a forty-four question self-report inventory measuring children's intrinsic motivation for school learning. The **CAIMI** has five scales, four of which measure intrinsic motivation in reading, math, social studies, and science. The fifth scale measures intrinsic motivation as a general orientation toward school learning. Items in the general scale are similar in content to those in the subject area scales. The instrument has been tested for internal consistency, retestability, and bias. The results indicate that "reliability has been demonstrated, with no differences found as a function of race, sex, or IQ" (Gottfried, 1986). The Science and Math sections of the tests were used to assess the girls' attitudes and abilities in these areas.

Career interest patterns were assessed using the **Self-Directed Search Career Explorer (SDS**; Holland & Powell, 1994) and girls' occupational choices. The **SDS Career Explorer** is a version of Holland's **Self-Directed Search (SDS;** 1994) designed to be used primarily with middle or junior high school students. The **SDS Career Explorer** is a self-administered assessment of students' career interest patterns, yielding results which parallel Holland's classification system. Holland's classification of vocational personalities organizes these individual differences using six general categories: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C). In addition, career interest patterns were assessed by asking subjects to indicate their most desired occupational choice. These career interest patterns were classified using Holland's vocational personality types. The SDS Career Explorer provided valuable information regarding participant's knowledge, awareness, and exploration of her own career interest. Because individuals in 7th and 8th grade are concrete, this self-administered, self-scored, and self-interpreted instrument provided the valuable "hands-on" information about career interest.

Project Specific Measures: Several project specific measures were designed by the

program evaluator. The **Demographic/Descriptive Profile Assessment** is a profile assessment instrument developed to determine an initial profile of the students in regard to SEM careers, interests, attitudes, and awareness. For convenience, the Demographic/Descriptive Profile Assessment was included as a part of the application. Each participant was asked questions about career aspirations, educational interests, hobbies, and significant others. This information was used to help us evaluate the impact of the overall program on the above mentioned areas. Refer to Appendix E for the application.

The **Knowledge/Skills Building Assessment** is a self-administered multiple choice questionnaire used to assess knowledge of and exposure to project specific content. Each project leader was asked to develop multiple choice questions about the kind of information she expected the girls to understand as a result of participation in that session. Since one of the specific goals of the project was to increase participants' knowledge of and exposure to Science, Engineering and Mathematics through examination of real-life projects, simple tracking of participant's knowledge/mastery of SEM was necessary.

The **Parent/Teacher Assessment** is an assessment instrument developed to obtain parents' and teachers' assessment of the girls' abilities. As part of the parents' training session, parents were asked to assess their daughters' behavior, feelings, and attitudes towards science. On a scale of 1 (poor) to 4 (Excellent), parents were asked to rate their daughters' maturity level, ability to think independently, problem-solving skills, self-esteem, study skills, and excitement about learning. The second part of the parental assessment asked parents to rate their daughters', on a scale of 1 (low) to 5 (high), interest in science, mathematics, engineering, as well as their scientific and mathematical ability. As part of the application process, the girls were asked to obtain teacher

recommendations. Using a scale of Excellent to Poor, teachers were asked to assess the girls' maturity level, study skills, problem-solving skills, ability to think independently, and excitement about learning.

The **General Assessment** instrument was an attempt to obtain feedback on the specific aspects, activities, and projects in the program. At the end of each week and during the Spring meeting, the girls were given a simple evaluation sheet. The girls were asked to rate a specific project of the day using a Likert-scale response and/or to rate the impact of the women scientist on their general beliefs about and attitudes toward SEM. These sheets used a format which required simple responses (numerical and written). This instruments used a similar format to accommodate the cognitive styles and abilities of seventh and eighth graders.

Please see Appendix F for references for the standardized measures, and copies of the project-specific measures - including final assessment forms.

B. Data Analysis

Mean, standard deviation and t-tests were used to analyze the pre-test/post-tests data. The Likert-scaled responses were analyzed using means and percentages.

C. Results/Discussion

The Science of Living Spaces was evaluated extensively. Every aspect and component of the program was evaluated. The results of the assessments will be discussed based on the various components of the program and the program's expected outcomes. Some aspects of the evaluation process required participants to return the assessment forms to the program evaluator. This yielded low response rates on some outcome measures, given the already small sample size (n =24). In cases where low response rates resulted in limited data analysis, the results were not reported.

1. Training Programs. Table 2 presents results of the parents' evaluation of their training program. Overall, the parents' average rating of satisfaction with the seminar was 4.48. In general, parents felt the training provided important information about the

purpose of the Science of Living Spaces program, research on girls in the sciences, earnings for women, and inhibitors and enhancers in girls' interest in SEM careers. Overall, 94.5% of the parents indicated that the seminar raised their awareness of the factors that impact their daughters' selection of careers in science, engineering, and mathematics. Of those parents indicating the seminar did not raise their awareness, they did not indicate what other information would have been helpful to their understanding of the factors influencing girls' selection of SEM careers.

The training session for project staff--student mentors, supporting teachers, and project supervisors-- received equally high ratings. Table 3 presents the results of the evaluation. Overall satisfaction with the seminar was 4.63. On average, student mentors and supporting teachers gave higher ratings than the project supervisors. This difference in rating could be due to the project supervisors' greater level of experience with programs of this nature and a better overall understanding of the Science of Living Spaces program.

2. Science and Math Interest. The CAIMI was used to assess girls' intrinsic motivation in four subject areas: reading, math, social studies, and science. Table 4 presents the means, standard deviations, and t-test results for each of the scales of the CAIMI. Since the program was designed to specifically impact girls' interest in science and math, greater attention was given to these two scales of the CAIMI. Pre-test/Post-test comparisons did show a slight increase in girls' scores on these two scales. However, results of the t-test indicated the difference was not significant. The lack of a significant difference on these two scales could be explained by the screening process. Many of the girls in the program were selected because of their expressed interest in science. When parents were asked to assess the girls' interest in math and science, parental assessment did indicate a significant difference in the girls' math interest. Parents' post-program ratings of girls' interest in math was significantly higher than their pre-program ratings of girls' mathematics interest. Since parental assessments are secondary and subjective,

the results from these analyses should be viewed with caution. Additionally, girls were asked to assess their interest in taking more math and science courses. Ninety-six percent (96%) of the girls did indicate they were extremely to very interested in taking more science and math courses at the conclusion of the program. As well, 96% of the girls indicated that they did like science more as a result of the Science of Living Spaces program.

3. Self-Concept. Several indices were used to assess the impact of the program on girls' self-concept/self-esteem. The TSCS was the standardized self-assessment instrument used to evaluate changes in self-esteem. Table 5 presents the mean, standard deviations, and t-test results for each of the scales of the TSCS. Since Roid & Fitts (1994) indicate that the Total Score (also referred to as the Total Positive Score) is the single most important score on the TSCS because it reflects the overall level of self-esteem, greater attention was given to this scale. A cursory examination of the means indicates a slight increase in the total score between testing conditions; however, t-test results, $t(23) = 1.20$, $p > .05$, did not yield a significant change in self-esteem. However, project specific measures did indicate some significant changes in self-esteem across testing conditions. Parents were asked to rate their daughters' self-esteem prior to participation in the program and at the conclusion of the program. T-test results, $t(23) = 2.63$; $p < .05$, indicated a significant difference in parental assessments. Parents rated their daughters' self-esteem higher after participating in the program.

4. Career Interests. Career interest patterns were assessed using the SDS Career Explorer and other forms of self-report. Table 6 reports the means and standard deviations for the six subscales of the SDS Career Explorer. Since science and mathematics careers are heavily weighted on the Investigative and Conventional subscales, greater attention was given to these two subscales. In both pre-test and post-test conditions, girls reported the highest average on the Investigative subscale. The means (pre-test and post-test) for the conventional scale were not as high as expected.

This is consistent with the girls greater interest in science-related careers than mathematics-related careers. An examination of the pre-test/post-test for each subscale of the SDS Career Explorer indicates an increase on the Investigative scale across testing conditions, but not the Conventional scale. A comparison of the Conventional scale means reflects a small decrease on this scale. In both cases, the differences were not significant. In addition, students were asked to name the career they think they would most enjoy. Using Holland's classification scheme (RIASEC), 75% of the 24 girls selected occupations whose first letter code/classification was consistent with Investigative and Conventional personality types (hence: science, engineering and mathematics careers.) On post-test assessment, sixty one percent (61%) of the girls reported a better than 50% chance of entering a SEM career, with another 35% indicating at least a 50% chance of selecting a SEM career.

5. Enjoyment of Program Sessions. At the end of each week, girls were asked to rate the activities in which they engaged. Girls gave average to above average ratings for each of the activities. Table 7 presents the mean ratings for each activity.

6. Anecdotal Results. Throughout the program, the parents, girls, teachers and mentors were asked to comment on the program and its impact on the participants, and to make suggestions for change or improvement. The session leaders and program organizers also informally evaluated the program. The results of this information were generally very positive.

The program organizers felt that there were several strong points that should be continued in another program:

1. The summer session was quite successful. Some of the aspects contributing to the success were: the variety in the topics (e.g., Chemistry, Physics, Computer Science, Math, Veterinary Science, etc.), the kinds of sessions (e.g., field trips, visits from scientists, small groups, science across the curriculum, etc.); the hands-on nature of the sessions; using both CNU's and the

community's strengths in terms of field trip choices, speakers, and session leaders; engaging the school systems early in the process; creating a rigorous application process (which made the girls proud that they had been selected and excited to participate); hiring a school psychologist experienced in that age group for training (we used her as a consultant throughout the program also); requiring resident advisors to live with the girls, and using experienced resident advisors; and including a series of career sessions to help the girls determine what they want to do and what kind of preparation they need in high school to do it (most of the outside speakers also addressed their personal career preparation in their introduction).

2. Having the participants live on campus was a good idea. This residential program was much more successful than previous, similar non-residential programs. Transportation problems, friends, and other distractions that might prevent participation were eliminated. Also, the girls were excited about staying in a dormitory, and felt it gave them a real college experience. Evening activities were structured games that introduced the girls to each other quickly. There were also movies, and quiet time. Almost all of their time was planned; few choices were given to the girls, but this seemed to work well.
3. The sessions were almost all extremely successful from the point of view of keeping the girls' interest. We felt that this was a result of thorough engagement of the girls in each session, and a good choice of topics and speakers. Some of the most popular sessions were the "building" sessions in which each girl built a working model solar car and a working lamp that they took home (some girls were still using their lamp a year later), and a working robotic arm from Lego parts (the Lego kits stayed at the University). Next time, we might have even more construction sessions.

4. Giving the girls t-shirts with the Science of Living Spaces logo to wear on field trip days made them easier to identify. Because the program was considered an honor for the girls, they did not object to wearing them. Also, creating a web page with pictures of the girls was exciting for them.

The comments below are a sample of the participants' feelings about the impact of the Science of Living Spaces program on their behavior:

1. "I believe this program helped set my future and get me more interested in science"
2. "This program has had a positive affect on my behavior. I like science and math better than before I started this program. I hope there will be more programs like this."
3. "This program has influenced me to go to college and showed me what college is like on the inside."
4. "At first science was just a subject and most of the things we learned at school included men and rarely women. Now I have found out how women can participate in science and be successful with it!"

Generally, parental statements were also positive. Parents indicated some basic changes in the girls as a result of their participation in the program. Parents commented about greater self-confidence, increased drive to go to college, more interest in school (particularly science), more consideration given to careers, and in some ways more boredom in school science classes. Below are some parental comments and suggestions for future programs:

1. "I'd like to see 'refresher sessions' for the girls. They are coming up on some difficult years and a few nudges or reminders about opportunities available to them would be beneficial!"
2. "Need more hands on after initial program and a more defined follow through including teachers, parents, and community as support system."

3. "I was very excited she was selected. However, the final project chose to work on would not have been my idea of what they were exposed to during the program. The materials were not given to the group early on and the teacher or teachers did not make an effort to meet until the very last. Lack of communication was the biggest problem. The concept of exposing young girls to science, math or engineering careers is good! I highly recommend the programs such as these, but a better follow-up is needed!"
4. "Everything was great with the program. My only suggestion is more contact from mentors or school contacts so the girls interest stay strong and encouragement stay high."
5. "It was a great program!"
6. "We were very pleased with this program, our daughter was very excited and carried over a lot of knowledge attained while here. We'd like to see more of this type of program and hope that it will expand into more projects.

Overall, teachers were very positive in their ratings of the program. Teachers from two schools indicated consistent contact with the girls. On average, teachers indicated formal or informal interaction with the girls at least once a week. One teacher did not respond to the final teacher evaluation. Teachers rated the girls' maturity level, study skills, excitement about learning, and overall achievement as "good". Since the aforementioned behaviors were not rated by different teachers before and after participation in the program, effective comparative analyses were not possible.

Mentors performed a midterm and final evaluation on their mentees (the 24 participants). Evaluations were received for twenty-one girls at midterm and 11 girls at final evaluation. Midterm evaluations revealed limited information due to email problems. Most of the mentors based their comments on the three-week summer residential program. On a scale of 1 (low) to 5 (high), mentors were asked to rate

mentees' excitement about SEM, interest in SEM careers and problem solving skills. Mentors' overall rating on those behaviors was 4.33. Limited response rates hindered comparative analyses. See Appendix G for copies of the Teacher's Midterm and Final Evaluation forms, and Mentor's Midterm and Final Report forms.

SUGGESTIONS/RECOMMENDATION:

The Science of Living Spaces: Women in the 21st Century program was extremely successful in meeting its goals and objectives. The participants and their parents reported greater interest in science-related careers. Moreover, girls reported that encountering women scientists played a significant role in helping them to overcome some of the stereotypic views and encouraged them to look more positively at the contributions of women in the sciences. Notwithstanding the positive aspects of this program, several recommendations/suggestions must be considered when thinking about instituting similar-type programs.

1. **Provide more direction for mentors.** Mentors were chosen largely because of their undergraduate major in Math and Science. In addition, mentors were given a general training session on possible activities for early adolescent girls. Observations do seem to indicate that additional screening criteria for selecting mentors may be necessary. For example, it may be important to consider mentors who have worked with this age group. General observations revealed that mentors who have experience working with this age group provided more appropriate activities and had greater insight on the girls.

2. Provide better email access for girls. If email is going to be an essential mode of communication and contact with the girls during the school year program, it will be necessary to ensure these capabilities can be provided by the schools or by some other fashion. Consideration should also be given to a more formal monitoring system by the teachers also. This would increase teacher participation during the year and, if the system were online, give the girls more exposure to computers.

3. More school-year activities. The Science of Living Spaces program provided two sessions during the school year. For these sessions, girls were required to return to the University for two half-day sessions on Saturdays. Most parents felt two sessions were not sufficient. Parents suggested greater contact. Future programs may benefit from monthly meetings. These meetings will provide some structure to the program and ensure the teachers are providing sufficient supervision.

4. Greater involvement of people within the community. Since this program was a University-based program, there was very little community involvement during the school-year program. Parents often felt there were limited resources available to them in the local community. The increased school-year activities should possibly incorporate greater local community involvement. This would provide adequate resources for the parents, and help the community become more involved in the school systems (after program completion).

5. Adult supervision of each design team. Each mall design team was placed under the supervision of the teacher for that school. Many teachers were involved in the daily activities of school and unable to provide adequate supervision. It may be important to get parents more involved in the design team. Assigning conscientious parents to each design team will provide additional support to the teachers and allow the parents to become more involved in the process.

6. Greater accountability for teachers. During the summer program, teachers were required to attend for one of the three weeks. This was not an original component of the Science of Living Spaces program; however, it was suggested by one of the middle school teachers and incorporated into the summer component of the program. Teachers were provided some instructions about their role in the mall design; however, specific responsibilities were not delineated. It may be necessary for project supervisors to schedule joint meetings with the teachers and design team members. This would ensure greater commitment/ accountability from the teachers.

7. Greater community publicity. If programs like Science of Living Spaces are going to be successful and continue beyond the initial funding, it will be necessary to have greater community publicity. Greater community publicity serves multiple purposes: (1) it is an excellent avenue for information dissemination; (2) it increases enthusiasm for the project participants; and (3) it provides an opportunity for community support, financially and otherwise. Local newspapers were contacted at every point in the project, but no coverage resulted. More aggressive marketing needs to be employed.

8. Long-term interventions & follow-up. If programs of this nature are to be successful, long-term intervention is required. Research findings indicate that short-term intervention strategies do not have lasting effects. Thus, if educators intend to increase women's pursuit of science-related careers, studies suggest long-term intervention and follow-up programs. Short-term programs are successful in planting the initial seeds of interest; long-term programs provide greater opportunities for reinforcement and encouragement.

DISSEMINATION

The Science of Living Spaces program has been presented at several regional and national conferences. Several alternatives are being considered as possible sources for future publication of this program (e.g., Career Assessment Journal, ERIC). As well, this program has a web page. See Appendix H for a more complete reference listing.

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Tables

Table 1

Demographic Data for Science of Living Spaces Participants

1. Race

A. White	20/ 83%
B. Black	4/ 17%

2. Grade

A. Seventh grade	14/ 58%
B. Eighth grade	10/ 42%

3. Planned to go to college 24/100%

4. Parental Education

	Father	Mother
Graduated high school	30.4%	34.8%
Some College, no degree	30.4%	26.1%
Bachelor's degree	26.1%	34.7%

Table 2

Evaluation Results for the Parents Training Program

Question 1 (N=24)

To what extent did the following program contribute to your understanding of the importance of the Science of Living Spaces program?

		Rating				
	Mean	Great	Good	Fair	Poor	No
A. Purpose of the program	4.43	43.5%	56.5%			
B. Research on girls in the sciences	4.52	56.5%	39.1%	4.4%		
C. Earnings of Women	4.52	52.2%	47.8%			
D. Goals for Girls	4.39	47.8%	43.5%	8.7%		
E. Inhibitors and Enhancers	4.48	56.5%	34.8%	8.7%		

Question 2 (N=24)

Did the information presented in this seminar raise your awareness of the factors impacting your daughter's selection of careers in science, engineering, and mathematics?

Yes	95.6%
No	4.4%

Question 3 (N=24)

Overall, how would you rate your satisfaction with this seminar?

	Ratings				
Mean	(high)5	4	3	2	1 (low)
4.48	56.5%	39.1%	4.4%		

Table 3

Evaluation Results for Project Staff's Training Seminar

Question	Student Mentor	Supporting Teacher	Project Supervisor	Overall
To what extent did the following information contribute to your understanding of the importance of the "Science of Living Spaces."				
A. Research on Girls in Classroom	4.83	4.80	4.63	4.74
B. Activity on appropriate behavior for girls	4.66	4.80	4.38	4.58
C. Adolescence and Adolescent Girls	5.00	4.80	4.38	4.68
D. Locus of Control	3.33	4.20	3.67	3.53
E. Instructional Strategies for enhancing motivation	4.83	4.60	4.50	4.63

	Response	
	Yes	No
Did the information presented in this seminar raise your awareness of the factors impacting girl's selection of careers in science, engineering, and mathematics?	100%	

Question	Student Mentor	Supporting Teacher	Project Supervisor	Overall
Overall, how do you rate your satisfaction with this seminar?				
Mean	4.66	4.80	4.50	4.63
5 (High)	66.7%	80.0%	50.0%	63.2%
4	33.3%	20.0%	50.0%	36.8%
3				
2				
1 (Low)				

Table 4

Means, Standard Deviations, and T-test scores for the Children's Academic Intrinsic Motivation Inventory

	Pre-test		Post-test		t-test
Subscales	M	sd	M	sd	
Math	49.29	9.34	51.63	8.47	.57
Social Science	52.71	8.21	52.29	8.71	.86
Science	56.63	7.93	57.96	8.48	.27
Reading	57.21	11.51	57.83	9.80	.39
General	55.33	9.98	53.62	12.12	.80

Table 5

Means, Standard Deviations, and T-test for the subscales of the Tennessee Self-Concept Scale

	Pre-test		Post-test		t-test
Subscales	M	sd	M	sd	
Total Positive Score	47.25	12.14	49.33	14.25	1.20
Self-Criticism	46.54	11.68	46.67	12.67	.04
Identity	47.33	13.35	49.00	14.29	.73
Satisfaction	48.08	13.44	50.46	11.43	1.38
Behavior	45.67	10.40	49.17	11.81	2.12
Physical Self	46.71	12.37	49.71	13.85	1.48
Moral Self	48.21	12.56	51.00	15.12	1.25
Personal Self	47.42	11.74	50.42	12.66	1.69
Family Self	50.13	10.34	49.33	11.26	.59
Social Self	44.96	9.75	46.50	9.40	.83

Table 6

Means and Standard Deviations for the six subscales of the

SDS Career Explorer

	Pre-test		Post-test	
Subscales	M	sd	M	sd
Realistic	20.21	11.21	25.54	13.43
Investigative	30.83	9.93	33.71	11.09
Artistic	26.79	10.52	27.54	12.19
Social	25.38	12.32	26.42	14.33
Enterprising	21.29	11.63	21.29	13.52
Conventional	25.21	13.21	22.25	13.81

Table 7

Mean rating of three-week summer program activities[1]

Activity	Mean Rating by week of occurrence		
	First week (n=8)	Second week (n=8)	Third week (n=8)
Robots	4.80	4.86	4.50[2]
Computers	4.75	4.63	4.86
Building	4.80[2]	5.00	4.25
English	4.43	4.71	4.57
P.E.	4.13	4.00	4.14
Art	3.50	3.86	4.63
	(n=24)	(n=24)	(n=24)
Digital Signals	3.00		
Wiring your house	3.22		
How to lie with numbers	3.33		
Binary Numbers	3.54		
Chemistry and Food	3.58		
Visit from NASA chemist		4.38	
The Medical Profession	3.86		
Careers	4.00	3.92	3.52
Self-Esteem	3.92	4.08	4.30
CEBAF Participatory	4.04		
Richmond Math and Science	4.78		
Building a Solar House		4.83	
Designing Buildings		3.83	
Measuring Greenhouse Gases		3.71	
The Fragile Environment	4.08		
Polymers		4.61	
Busch Gardens		5.00	
NN Shipbuilding		3.88	
Visit to NASA		3.88	
Visit from NASA astrophysicists			4.04
Visit to CEBAF		3.71	
VIMS		4.83	
Movement in Dinosaurs			3.87
Colonial Williamsburg			3.43
Virginia Living Museum			4.00
Mall Project			4.30

[1] Minor differences in session titles exist between this list and the schedule in Appendix B; these differences are due to last minute changes that were not reflected in the printed schedule.
[2] Several responses are missing.

Appendix A

BIOGRAPHY OF PROJECT SUPERVISORS

1. Anna Bampton, assistant professor of mathematics, received her B.S. in Electrical Engineering and Math from Duke University, her M.S.E.E. from Stanford University, and her Ph.D. in Electrical Engineering from Duke University. She teaches both math and computer engineering courses. Her area of research was Magnetic Resonance Imaging. Dr. Bampton co-directed the program.

2. Kathleen Brunke, an assistant professor in the department of Biology, Chemistry, and Environmental Science, teaches Chemistry at CNU. She received her B. S. from Portland State University, and her Ph.D. from Montana State University. Her research is in the chemistry of wetland plants. Dr. Brunke has taught for over ten years, and actively participates in community related science projects.

3. Stavroula Gailey, a professor of Mathematics at CNU, received her A.A. form Warren Wilson college; a B.A. from University of North Carolina, Asheville; and M.A. from Western Carolina University; and an Ed.D., University of North Carolina, Greensboro. Dr. Gailey's area of expertise is mathematics education. For the past seventeen years, she has been training pre-service and in-service mathematics teachers for K-12. At CNU, she teaches the mathematics for teachers and mathematics education courses. She has also taught mathematics in grades 4-12. Dr. Gailey presents workshops at N.C.T.M. and other meetings on a regular basis.

4. Shelia Greenlee, an associate professor of Psychology, received her B.A. from Norfolk State University, and her M.A. and Ph.D., The Ohio State University. Dr. Greenlee is a Developmental Psychologist. Her research has been on Career Development. Dr. Greenlee has taught for over twelve years. She is actively involved in campus and community related projects. Dr. Greenlee served as project evaluator and co-principal investigator.

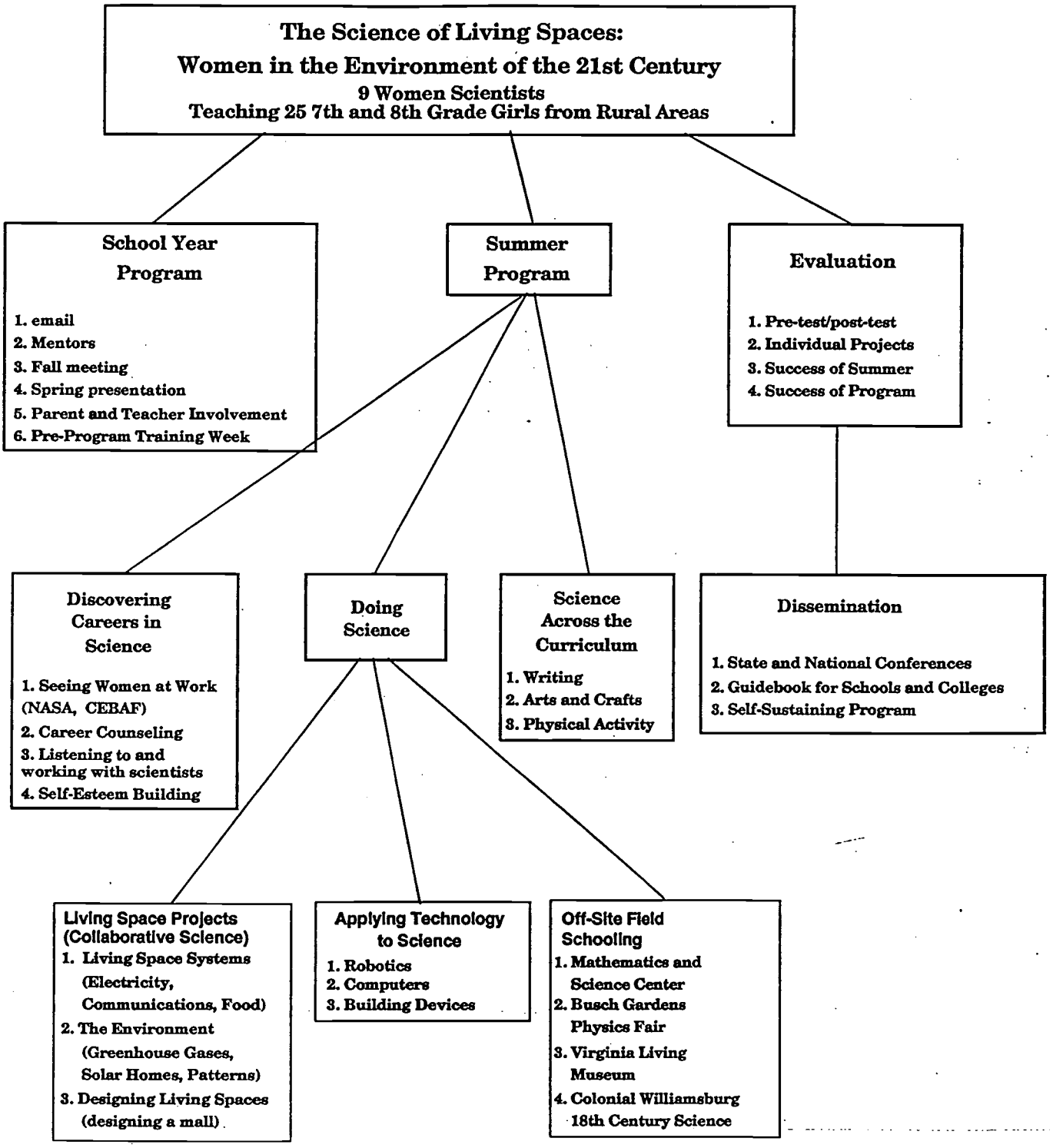
5. Lynn Lambert, assistant professor of Computer Science, received her B.A. from Wellesley College, M.S. from Shippenburg University, and Ph.D. from the University of Delaware. Dr. Lambert performs research in Natural Language Understanding. She has taught computer science courses at CNU for over four years. Dr. Lambert was the director and principal investigator for this project.

6. Z. Liz Li is an assistant professor of Physics at Christopher Newport University, and performs research at Jefferson Lab (formerly CEBAF). She earned her B. S. from Nankai University, and her Ph.D. from Virginia Polytechnic Institute and State University. Her research area is Computational Physics with a concentration in Nuclear Physics. Dr. Li is currently serving on the organization of Hampton University graduate studies at Jefferson Lab, and has worked at the Summer institute for Teacher Enhancement.

7. Charlotte Otts is an assistant professor of Biology and Geology at CNU. She received her B.A. and M.A.T. from the University of North Carolina, her M.S. from North Carolina State University, and her Ph.D. from the University of Arizona. Her research interests involve loco-motor mechanics of fossil mammals. She has been involved in several science education projects, and is actively involved in getting more women and minorities into the Sciences.

8. Jane Webb received her B.A. and Ph.D. from Tulane University. She will oversee the off-site field visits, and the collaborative science projects. An associate professor of Physics and Computer Science, Dr. Webb has been at CNU for twenty years and has received numerous grants from the NSF as well as the NEH, the Virginia Foundation, the Chesapeake Bay Foundation, and other sources. She sits on the Board of the Virginia Marine Resources Commission. Her area of research is science and public policy and her latest work has focused on the impact of scientific discourse on public policy.

Appendix B



Time		Activity
Date:	6/19/95	
8:00 AM	9:00 AM	Welcome
9:00 AM	10:30 AM	Computers
9:00 AM	10:30 AM	Building
9:00 AM	10:30 AM	Robots
10:30 AM	10:45 AM	Break
10:45 AM	12:15 PM	Pretests
12:15 PM	1:15 PM	Lunch
1:15 PM	2:45 AM	Binary Numbers, ASCII
2:45 PM	5:00 PM	English
2:45 PM	5:00 PM	PE
2:45 PM	5:00 PM	Art
5:00 PM	6:00 PM	Preparation for Richmond Trip
6:00 PM	6:30 PM	Dinner
7:00 PM	8:15 PM	Mentors and RAs
Date:	6/20/95	
7:30 AM	8:30 AM	Breakfast
8:30 AM	3:30 PM	Richmond Math and Science Center
3:30 PM	4:00 PM	Break
4:00 PM	6:00 PM	Bonnie Brown, DVM: Heartworms
6:00 PM	6:30 PM	Dinner
Date:	6/21/95	

Time	Activity
7:30 AM - 8:30 AM	Breakfast
8:30 AM - 10:00 AM	Building
8:30 AM - 10:00 AM	Robots
8:30 AM - 10:00 AM	Computers: Intro to Suns
10:00 AM - 10:15 AM	Break
10:15 AM - 11:45 AM	Chemistry and Food
11:45 AM - 12:45 PM	Lunch
12:45 PM - 2:45 PM	CEBAF Participatory Seminar
2:45 PM - 5:00 PM	PE
2:45 PM - 5:00 PM	Art
2:45 PM - 5:00 PM	English
5:00 PM - 6:00 PM	Self-Esteem
6:00 PM - 6:30 PM	Dinner
7:00 PM - 8:30 PM	Mentors and RAs

Date: 6/22/95

2:45 AM - 3:00 AM	Break
7:30 AM - 8:30 AM	Breakfast
8:30 AM - 10:00 AM	Building
8:30 AM - 10:00 AM	Computers: Bioquest
8:30 AM - 10:00 AM	Robots
10:00 AM - 10:15 AM	Break
10:15 AM - 11:45 AM	Wiring your House

Time	Activity
11:45 AM - 12:45 PM	Lunch
12:45 PM - 2:45 PM	What is Engineering? (SWE)
3:00 PM - 4:30 PM	How to Lie With Statistics
4:30 PM - 6:00 PM	Digital Signals
6:00 PM - 7:00 PM	Dinner
7:30 PM - 9:00 PM	The Medical Profession

Date: 6/23/95

7:30 AM - 8:30 AM	Breakfast
8:30 AM - 10:00 AM	Computers
8:30 AM - 10:00 AM	Building
8:30 AM - 10:00 AM	Robots
10:00 AM - 12:15 PM	PE
10:00 AM - 12:15 PM	Art
10:00 AM - 12:15 PM	English
12:15 PM - 1:15 AM	Lunch
1:15 PM - 2:45 PM	Careers
2:45 PM - 3:00 PM	Break
3:00 PM - 4:30 PM	Robots
3:00 PM - 4:30 PM	Building
3:00 PM - 4:30 PM	Computers

Date: 6/26/95

8:30 AM - 9:00 AM	Welcome Back

Time	Activity
9:00 AM - 10:30 AM	Robots
9:00 AM - 10:30 AM	Building
9:00 AM - 10:30 AM	Computers
10:30 AM - 10:45 AM	Break
10:45 AM - 12:15 PM	Exploring SEM Careers
12:15 PM - 1:15 PM	Lunch
1:15 PM - 2:45 PM	Physics: Building a Solar Home
2:45 PM - 5:00 PM	Art
2:45 PM - 5:00 PM	English
2:45 PM - 5:00 PM	PE
5:00 PM - 6:30 PM	Building
5:00 PM - 6:30 PM	Computers
5:00 PM - 6:30 PM	Robots
6:30 PM - 7:00 PM	Dinner
7:30 PM - 8:30 PM	RAs and Mentors

Date: 6/27/95

7:30 AM - 8:00 AM	Breakfast
8:00 AM - 10:00 AM	Preparation for Busch Gardens
10:00 AM - 6:00 PM	Busch Gardens
6:00 PM - 6:30 PM	Dinner
7:00 PM - 8:00 PM	More Food and Chemistry

Date: 6/28/95

Time		Activity
7:30 AM	8:30 AM	Breakfast
8:30 AM	10:00 AM	Building
8:30 AM	10:00 AM	Robots
8:30 AM	10:00 AM	Computers: Bioquest
10:00 AM	10:15 AM	Break
10:15 AM	11:45 AM	Measuring Greenhouse Gases
11:45 AM	12:45 PM	Lunch
12:45 PM	2:45 PM	NNS
2:45 PM	5:00 PM	Art
2:45 PM	5:00 PM	English
2:45 PM	5:00 PM	PE
5:00 PM	6:00 PM	Self-Esteem
6:00 PM	6:30 PM	Dinner
7:30 PM	9:00 PM	Designing Buildings

Date: 6/29/95

7:30 AM	8:30 AM	Breakfast
8:30 AM	10:00 AM	Computers
8:30 AM	10:00 AM	Building
8:30 AM	10:00 AM	Robots
10:00 AM	10:15 AM	Break
10:15 AM	11:45 AM	The Fragile Environment
11:45 AM	12:45 PM	Lunch

Time	Activity
12:45 PM - 5:00 PM	Site Visit NASA and Cebaf
5:00 PM - 6:00 PM	Patterns in Nature
6:00 PM - 6:30 PM	Dinner
7:30 PM - 9:00 PM	VIMS; Marine Science

Date: 6/30/95

7:30 AM - 8:30 AM	Breakfast
8:30 AM - 10:00 AM	Computers
8:30 AM - 10:00 AM	Robots
8:30 AM - 10:00 AM	Building
10:00 AM - 12:15 PM	Art
10:00 AM - 12:15 PM	PE
10:00 AM - 12:15 PM	English
12:15 PM - 1:15 AM	Lunch
1:15 PM - 2:45 PM	So what can I be?
2:45 PM - 3:00 PM	Break
3:00 PM - 4:30 PM	Sunscreens

Date: 7/3/95

8:30 AM - 9:00 AM	Welcome Back
9:00 AM - 10:30 AM	Computers
9:00 AM - 10:30 AM	Robots
9:00 AM - 10:30 AM	Building
10:30 AM - 10:45 AM	Break

Time	Activity
10:45 AM - 12:15 PM	Post-tests
12:15 PM - 1:15 PM	Lunch
1:15 PM - 2:45 PM	Dinosaurs
2:45 PM - 5:00 PM	PE
2:45 PM - 5:00 PM	Art
2:45 PM - 5:00 PM	English
5:00 PM - 6:30 PM	Robots
5:00 PM - 6:30 PM	Computers
5:00 PM - 6:30 PM	Building
6:30 PM - 7:00 PM	Dinner
7:15 PM - 8:45 PM	Williamsburg Preparation

Date: 7/4/95

7:30 AM - 8:30 AM	Breakfast
8:30 AM - 5:30 PM	Williamsburg
5:30 PM - 6:30 PM	Dinner
6:30 PM - 8:00 PM	The Science of Fireworks
8:00 PM - 10:00 PM	Newport News Fireworks Display

Date: 7/5/95

8:00 AM - 9:00 AM	Breakfast
9:00 AM - 10:30 AM	Building
9:00 AM - 10:30 AM	Computers: Bioquest
9:00 AM - 10:30 AM	Robots

Time	Activity
10:30 AM - 10:45 AM	Break
10:45 AM - 12:15 PM	Calculating Area
12:15 PM - 1:00 PM	Lunch
1:00 PM - 2:45 PM	NASA Careers
2:45 PM - 5:00 PM	English
2:45 PM - 5:00 PM	PE
2:45 PM - 5:00 PM	Art
5:00 PM - 6:00 PM	Self-Esteem
6:00 PM - 6:30 PM	Dinner
7:30 PM - 10:00 PM	Mentors

Date: 7/6/95

7:30 AM - 8:30 AM	Breakfast
8:30 AM - 10:00 AM	Computers
8:30 AM - 10:00 AM	Robots
8:30 AM - 10:00 AM	Building
10:00 AM - 10:15 AM	Break
10:15 AM - 11:45 AM	The Mall Project
11:45 AM - 12:45 PM	Lunch
12:45 PM - 5:00 PM	Virginia Living Museum
5:00 PM - 6:00 PM	Computers and Privacy
6:00 PM - 6:30 PM	Dinner
7:30 PM - 9:00 PM	Ice Cream Party

Time		Activity
Date:	7/7/95	
7:30 AM	8:30 AM	Breakfast
8:30 AM	10:00 AM	Computers
8:30 AM	10:00 AM	Robots
8:30 AM	10:00 AM	Building
10:00 AM	12:15 PM	PE
10:00 AM	12:15 PM	English
10:00 AM	12:15 PM	Art
12:15 PM	1:15 PM	Lunch
1:15 PM	2:45 PM	Careers
2:45 PM	3:00 PM	Break
3:00 PM	4:00 PM	More Mall Stuff
4:00 PM	5:00 PM	Good-Bye

DESCRIPTION OF PROJECT ACTIVITIES

1. Technology Sessions

   A. Computers and the Internet
      -basic computer skills, email (Virginia Pen), Gopher, Netscape, SimLife

   B. Building projects and design contests
      -lamp, solar car, Spindly structures contest, paper bridge contest

   C. LEGO/dacta robots
      -computer-controlled LEGO dacta robot, basic computer programming, free time to design, built working robotic arm

2. Participatory Science Sessions

   A. Greenhouse Gases - Methane measurements and greenhouse tour
   B. Chemistry and food - Baking powder and ice cream creation
   C. Dinosaurs and speed - Stride length, leg length, and speed
   D. Computer and Ethics - Medicine, privacy, artificial intelligence, and the future
   E. Environment and Ethics - Landfills and environmental responsibilities
   F. Statistics and Ethics - Descriptive statistics and their misuses
   G. Area - Area of circle from squares; length vs. area vs. volume
   H. Binary numbers - Conversion from decimal to binary using manipulative
   I. Solar home construction - Energy efficiency and temperature maintenance
   J. Digital Signals - Electronic circuits and logic testing
   K. House wiring - Basic theory and safety

3. Science Field Trips

   A. Colonial Williamsburg: 18th Century Medicine/Cooking
      half day preparation - 18th century ideas
   B. Richmond Math and Science Center: NASA Challenger Center
      half day preparation - communications
   C. Busch Gardens: Amusement Park Physics
      half day preparation - physics
   D. Virginia Institute of Marine Science
   E. Newport News Shipbuilding
   F. Virginia Living Museum
   G. CEBAF (now Jefferson Labs) and NASA

4. Science Across the Curriculum Sessions

   A. English - Linguistics, articles about women scientists, descriptions of their lives in 2025.
   B. Physical Education - Effects of exercise, exercise physiology - heart rate

measurements, Ballistics and flying objects - Frisbee golf

C. Art - Mathematical manipulation of self-portraits
D. Career Development Sessions - Career Resource Center, Library Resources for Careers, Writing assignments and presentation, degree requirements for matching careers
E. Esteem-building sessions - self-acceptance, acceptance of others, knowing myself, and conflict resolution

5. Interactive Sessions with Local Female Scientists

A. Nuclear physicist (Jefferson National Accelerator Facility); Visit and experiments
B. Veterinarian - Instruments and animal health; 24 stations for girls to investigate
C. Microbiologist - Bacteria cultures and characteristic appearances under a microscope
D. Mechanical engineers (SWE) - Density and buoyancy theory and experiment
E. Aerospace engineers (NASA Langley) - NASA visit, wind tunnel video, discussion
F. Polymer chemist - Experiments using or creating food/household products -making slime was a hit!
G. Architect - Mall information and preliminary mall design

6. The Great Mall Project

A. Goal: design and locate a mall
B. Issues: location, space utilization, store selection, parking, transportation, access, security, plants, lighting, distribution, name, etc.
C. Tasks: written report of questions to ask mall manager, written report of answers from mall manager, presentation of paper model of mall, presentation of foam board model of mall.
D. Award: mall gift certificates

4. Ethics

A. Computer Ethics – privacy, copying software
B. How to Lie with Statistics – mean, median, mode
C. Environmental Ethics

8. Careers

A. Pre-Test/Post-Tests for Evaluation
B. SIGI – CNU's
C. Library search for careers related to girls' interests
D. Test – name??
E. Discussing appropriate high school and college courses to prepare girls for their chosen careers

9. Self-Esteem

A. Informally structured discussions of the participants' feelings resolving conflicts within themselves and with others.

Appendix C

Information for Teachers who wish to participate in the Summer portion of the Science of Living Spaces Program

1 What is it?

As a result of suggestions from teachers from your school system, we are asking three teachers from Isle of Wight and Charles City counties to come join us at Christopher Newport University for the Science of Living Spaces intensive summer session.

Teachers who take part in the summer program will come stay with the girls from 8:00AM-4:30PM every day from June 19-July 6. One-third of the girls will be assigned to each teacher, who will participate in all of the programs that the girls experience, and serve as their guide throughout the program. Teachers who participate may choose to stay in the Residence Hall with the girls at night, or they may return home each night.

2 How to Apply

If you would like to participate, please write a letter by April 28, 1995 telling us why you would like to participate. Send the letter to:
Prof. Lynn Lambert
Physics and Computer Science
Christopher Newport University
Newport News, VA 23606

We would like to have at least one teacher from each middle school from which we have students. You will be notified by May 5, 1995 of your acceptance into the program.

3 Responsibilities

You will have the following responsibilities:

- Be at Christopher Newport every day from 8:00AM-4:30PM Monday-Friday June 19, 1995-July 7, 1995 (including July 4).
- Supervise and encourage your group of girls. You will be given one-third of the girls as your responsibility. You will attend all sessions that your girls attend; go on field trips; and each lunch with them. It will be your responsibility to make sure that your group gets to each session on time.
- Attend the training session on Friday, June 16, 1994 from 9:00AM-4:00PM (note that this is a longer session than you would take part in if you were just participating in the academic year program).

4 Rewards for participating

In addition to learning more about the girls you teach and your fellow teachers, upon successful completion of the orientation program and after fulfilling your responsibilities from June 19-July 7, you will receive $2050, $650 each week, plus $100 for attending the orientation. You will also receive 45 recertification points.

Information for Teachers who wish to participate in the Academic Year portion of the Science of Living Spaces Program

1 How to Apply

We hope that you will participate in the Science of Living Spaces program. We think that it will be a rewarding and exciting experience. If you would like to participate, please write a letter by April 28, 1995 telling us why you would like to participate. Send the letter to:
Prof. Lynn Lambert
Physics and Computer Science
Christopher Newport University
Newport News, VA 23606

We would like to have at least one teacher from each middle school from which we have students. You will be notified by May 5, 1995 of your acceptance into the program.

2 Responsibilities

Your responsibilities will include the following:

- Advertise the program; aid students in filling out applications; and write recommendation for students who request them.
- Attend one day orientation session June 16, 1995 from 9:00AM-2:00PM (lunch will be provided).
- Attend Fall and Spring sessions, November 11, 1995 and March 16, 1995.
- Support and encourage students throughout the year, and record their progress on a form which we will provide. Write a brief report once a semester evaluating the females' overall achievement and assessing their class participation and attitudes towards science and math

3 Rewards for participating

In addition to learning more about the girls you teach and your fellow teachers, upon successful completion of the orientation program and after fulfilling your responsibilities for the Fall and Spring programs, you will be awarded 25 recertification points and an honorarium of $100 for attending the Orientation, and an additional $150 for successfully completing the year project.

The Science of Living Spaces Program
Department of Physics and Computer Science
Christopher Newport University
Newport News, VA 23606

voice: (804) 594-7826/7065
fax: (804) 594-7919
email: lambert@pcs.cnu.edu

June 16, 1995

Dear Teachers,

Welcome to the Science of living spaces program. We are thrilled that you are here.

As we go through the program, we want to be flexible to meet the demands of the students, so if you have any comments, please feel free to share them with me, with Dr. Bampton, or with Dr. Greenlee. We are all part of making this program happen, and I am interested in your input.

In order to be paid, please make sure that you have completed a drug form, an I-9 (with accompanying IDs), a VA-4, and a W-4.

Because the schedule is different every day, your hours will be slightly different each day. The total number of hours is less than the original 8:30-4:30 M-F schedule. Here is your schedule. If you cannot meet these hours, please tell me today.

Mon, June 19	8:30-3:45	Mon, June 26	8:30-3:45	Mon, July 3	8:30-2:45
Tues, June 20	8:30-6:00	Tues,June 27	8:30-6:00	Tues, July 4	8:30-5:30
Wed, June 21	8:30-2:45	Wed, June 28	8:30-2:45	Wed, July 5	8:30-2:45
Thurs, June 22	8:30-2:45	Thurs, June 29	8:30-5:00	Thurs, July 6	8:30-5:00
Fri, June 23	8:30-4:30	Fri, June 30	8:30-4:30	Fri, July 7	8:30-5:00

I have allowed ample time for transportation, but because Tuesdays and Thursdays are our field trip days, we may be late or early depending on traffic conditions.

Thank you for participating. I look forward to an exciting summer with you.

Sincerely,

Lynn Lambert

The Science of Living Spaces Program:
Women in the Environment of the 21st Century
College of Science and Technology
Christopher Newport University
Newport News, VA 23606

Contract for Teachers

The details of the summer and academic year responsibilities and payment are outlined in Information for Teachers who wish to participate in theAcademic Year portion of the Science of Living Spaces Program and Information for Teachers who wish to participate in theSummer portion of the Science of Living Spaces Program. Please refer to that for any details about the program or call Lynn Lambert at Christopher Newport University, (804) 594-7826/7045.

I understand and agree to the information in those documents.
_____ yes
_____ no because _____.

I also agree to the following:

Attending a one day orientation session June 16, 1995 from 9:00AM-2:00PM.
_____ yes
_____ no because _____.

Attending the Fall and Spring sessions, November 11, 1995 and March 16, 1996.
_____ yes
_____ no because _____.

Filling out a form once a semester which evaluates my school's participants overall achievement and assessing their class participation and attitudes towards science and math.
_____ yes
_____ no because _____.

(for summer participants only):
Attending CNU Monday-Friday 8:30-4:30 from June 19-July 7 and participating with a group of students from my school in all of their activities (NOTE: I will ask each of you to be flexible with the schedule because we may not return home by 4:30 every Tuesday, our field trip day. If we do not, then the additional hours that you spend on Tuesday will be subtracted from other days. Please indicate if this is not possible given your schedule).
_____ yes
_____ no because _____.

I understand that I will receive a total of $250 for participating in the academic year program, and $650 for each week that I participate in the summer. I further understand that I will receive 25 recertification points for participating in the academic year program and 45 for participating in the summer program.

_____ _____
signed date

Appendix D

THE SCIENCE OF LIVING SPACES
Program Evaluation Form
(March 25, 1995)

RESULTS

QUESTION 1: Given your experience and general knowledge of the program's objectives, how would you rate the following activities for 7th and 8th grade girls. (Please check the response that most closely approximates your opinion.)

N = 9

	Excellent %		Good %
A. Movement and Dinosaurs	66.6	(11.1)	22.2
B. Careers in Science	100.0		
C. Robots	77.7	(11.1)	11.1

QUESTION 2:What would you change or add to the program to make The Science of Living Spaces Program better?

A. Make sure content of components does not duplicate units taught in schools. Suggest you do not exceed $50 deposit, even though refundable will be hardship for some.
B. I think that it is super. You will learn from your mistakes.
C. N/A
D. One teacher from each system should accompany their students and participate throughout the summer program.
E. More specific directions (already addressed), close supervision of girls, leave time for the girls to do discovery and for them to have lecture and learn.
F. You may need to add just a couple more "free time" breaks to the schedule.

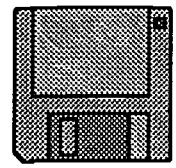
QUESTION 3: Based on today's presentation, what did you like about The Science of Living Spaces program?

A. I found the Robots presentation very interesting. The Careers in Science presentation is much needed in the school system.
B. Caliber of instructors and facilitators.
C. The activities were very well planned.
D. The program shows a definite interest in the development of young girls. It is a good time to reach them.
E. Hands on Activities.
F. All hands on projects - make them concrete.

QUESTION 4: Considering all things, how would you rate your satisfaction with The Science of Living Spaces program?

(LOW) 1 2 3 4 5 (HIGH)

Average = 4.77 ; 77.7% gave a rating of 5 and 22.3 % gave a rating of 4



THE SCIENCE OF LIVING SPACES
TRAINING PROGRAM FOR PARENTS

EVALUATION FORM

Please help us plan future training seminars by providing an evaluation of today's session. Please do not include your name, so that your evaluation will be anonymous.

1. To what extent did the following information contribute to you understanding the importance of the "Science of Living Spaces" program?

	GREAT	GOOD	FAIR	POOR	NO
A. Purpose of Program	5	4	3	2	1
B. Research on girls in the sciences	5	4	3	2	1
C. Earnings for women	5	4	3	2	1
D. Goals for girls	5	4	3	2	1
E. Inhibitors and Enhancers in reaching goals	5	4	3	2	1

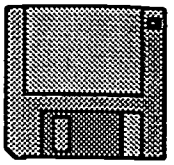
2. Did the information presented in this seminar raise your awareness of the factors impacting your daughter's selection of careers in science, engineering, and mathematics.

_____Yes _____No

If no, what other information would have been helpful to you?

3. Overall, how would you rate your satisfaction with this seminar?

(LOW) 1 2 3 4 5 (HIGH)



THE SCIENCE OF LIVING SPACES
TRAINING PROGRAM

EVALUATION FORM

Please help us plan future training seminars by providing an evaluation of today's session. Please do not include your name, so that your evaluation will be anonymous.

1. Please check the space below which best represents your role in the program.

_____ **I am a Student Mentor.**
_____ **I am a Supporting (Middle School) Teacher.**
_____ **I am a Project Supervisor.**

2. To what extent did the following information contribute to you understanding the importance of the "Science of Living Spaces" program?

	GREAT	GOOD	FAIR	POOR	NO
A. Research on Girls in Classroom	5	4	3	2	1
B. Activity on appropriate behavior for girls	5	4	3	2	1
C. Adolescence and Adolescent girls	5	4	3	2	1
D. Locus of Control	5	4	3	2	1
E. Instructional strategies for enhancing motivation	5	4	3	2	1

3. Did the information presented in this seminar raise your awareness of the factors impacting girl's selection of careers in science, engineering, and mathematics.

_____Yes _____No

If no, what other information would have been helpful to you?

4. Overall, how would you rate your satisfaction with this seminar?

(LOW) 1 2 3 4 5 (HIGH)

Appendix E

THE SCIENCE OF LIVING SPACES PROGRAM: WOMEN IN THE ENVIRONMENT OF THE 21st CENTURY

CHRISTOPHER NEWPORT UNIVERSITY
College of Science and Technology

Dear Student and Parent,

This packet includes a description of this exciting residential program for three weeks this summer at CNU and materials for you to use if you decide to apply.

If you and your parent think you'd like to take part in our program, please complete the enclosed forms. This application is a lot like the ones students use to apply to college, so think about this as a chance to practice! For our application, you have three items to submit:

1) an application form, including and essay and a statement about what interests you have;
2) a statement of parental support; and
3) a grade release form.

We also need a recommendation from one of your teachers. Your teacher's recommendation will be sent separately from your application directly to the University, and will be kept confidential.

Your application with its three parts and your teacher's recommendation should be sent by Friday April 28th, 1995 to:

Prof. Lynn Lambert
Physics and Computer Science
College of Science and Technology
Christopher Newport University
Newport News, VA 23606

If you have any questions about the program or about the application, please call Lynn Lambert at 594-7826 or 594-7065. If you just leave a message, Dr. Lambert will call you right back so you don't have to pay for a long distance call.

We look forward to hearing from you--we're excited about this program, and we think you will be too!

For the Science of Living Spaces Program,

THE SCIENCE OF LIVING SPACES:
WOMEN IN THE ENVIRONMENT OF THE 21ST CENTURY
January 1995-June 1996

Designed for 7th and 8th grade girls from rural areas in Isle of Wight and Charles City County this year-long program will introduce girls to the science and technology that will shape the world they will live in as adults. The heart of the program is **a three week session during the summer,** in which the 25 girls who are chosen to take part will live at Christopher Newport University in its new, air-conditioned and comfortable Residence Hall.

While the girls are in the summer residence session, they will learn how sciences like computer science, biology, chemistry and physics and engineering affect the living spaces of today and of the 21st century. These projects will be almost entirely hands-on. There will be very few times when the girls will learn from lectures.

Among the living spaces we will study will be the home, where the girls will learn about electricity and to build circuits. For the study of living spaces in the community, we will work on the environment and we will measure "greenhouse gases." We will even explore the possibilities of living space, with help from the Richmond Math and Science Center where the girls will work on experiments in simulated space. Through simulation, the girls will also explore the space environment in which astronauts will live and work.

In addition to doing science, the girls will learn about their own talents and abilities and about the ways in which women are now working in science, with computers, and in engineering. Women scientists and engineers will conduct the program and will come in as visitors. The girls will also go on well-supervised off-site visits to places where interesting work in science and engineering is in process. There will also be social activities planned for the girls.

While the summer session is the heart of this program, there will be two follow-up meetings on November 4, 1995 and on March 16, 1996, at Christopher Newport University. The girls will work throughout the year at their home schools on a project focusing on living spaces. They will present their project at the March, 1995 meeting. The girls will also be assigned mentors who will keep in touch with them over the year by e-mail which will come into the girls' schools.

Parents will come to a half-day orientation at the beginning of the program, and will attend both follow-up sessions. Parent support for girls in science is very important, and we look forward to seeing parental interest in their daughters' development as we move into a new century with new ways of living, working, and playing.

STUDENT APPLICATION FORM

(PLEASE PRINT OR TYPE)

THE SCIENCE OF LIVING SPACES PROJECT

I. General Information:

Applicant's Name _____
(LAST) (FIRST) (MIDDLE)

Address _____
(STREET)

_____
(CITY) (STATE) (ZIP CODE)

Social Security Number _____ Telephone Number ( ) _____

Date of Birth _____ Sex _____
(Month/ Day/ Year) (Male or Female)

Are you:

_____ White (not of Hispanic origin)
_____ African-American (not of Hispanic origin)
_____ Hispanic
_____ American Indian or Alaskan Native
_____ Asian
_____ Pacific Islander
_____ Other

What is the name of the school that you are presently attending?

_____
(PLEASE PRINT FULL NAME OF SCHOOL)

Indicate the grade you are enrolled in at this school (as of September, 1994).

GRADE _____6 _____7 _____8

What is the name of the teacher who is writing a recommendation for you, and in what grade did this teacher have you as a student?

_____

II. Parent or Guardian Information

Parent or Guardian's Name _____
(LAST) (FIRST) (M.I.)

Address _____
(STREET)

_____
(CITY) (STATE)
(ZIP CODE)

Telephone Number (Home) _____ (Work) _____

What is the highest level of schooling completed by your parent or guardian?

ANSWER BOTH A AND B BELOW IF APPLICABLE. CHECK ONLY ONE IN EACH COLUMN.

A (Father)	B (Mother)	
___	___	Did not finish high school
___	___	Graduated from high school or equivalent (GED)
___	___	After graduating from high school, attended a vocational school, a junior college, a community college, or another type of two-year school
___	___	After graduating from high school, went to college but did not complete a four year degree.
___	___	Bachelor's degree
___	___	Master's degree or equivalent
___	___	Ph.D., M.D., or other advanced professional degree
___	___	Don't know

Please indicate your parents' occupation.

Father _____

Mother _____

III. Science and Mathematics Interest Information

Rank in terms of who or what you think had the most influence on whether you took (or will take) science or math course. (1 = most influence; 5 = least influence)

_____ I did	_____Parent/Guardian	____Counselors	____Teacher
_____Friends	_____Brother/Sister	_____T.V./Media	_____Books

How interested are you in taking more science and mathematics courses at school?

___Extremely interested ___Very interested ___Somewhat interested __Not very interested

How likely is it that you will become a scientist, engineer, or mathematician in the future?

_____Better than 75% chance	_____Better than 50% chance	_____50% chance
_____Less than 50% chance	_____Less than 25% chance	_____No chance

What are your favorite school subjects? _____

_____

IV. General Interest Information

Do you plan to go to college? _____Yes _____No

If you plan to go to college, what do you think you'd like to be? List your top three choices.

1. _____

2. _____

3. _____

List several activities or hobbies you enjoy.

_____

_____

Name two accomplishments/awards you are proud of over the last two years.

_____

_____

V. APPLICATION ESSAY

In your own words, please write a brief essay indicating why you are interested in this program. To be considered for this program, this section must be completed.
(If needed, one additional sheet may be used.)

STUDENT STATEMENT OF COMMITMENT: If accepted as a participant for The Science in Living Spaces program, I will adhere to established rules and regulations, participate in scheduled activities, and respond to future data inquiries as required for the tracking of participants.

Signature of Applicant _____ **Date** _____

PARENT STATEMENT OF COMMITMENT: I am the parent and/or guardian of the minor above and acknowledge that I have reviewed the application. I acknowledge that I have been informed of the nature of the program and activities (described in the overview). If my child is accepted, I agree to participate in the activities specifically designed to include parents or guardians.

Signature of Parent/Guardian _____ **Date** _____

Parent Statement of Support

THE SCIENCE OF LIVING SPACES PROJECT

As a parent of _____, I agree to attend the orientation on
(name of student)
Wednesday, June 14 from 6:30-9:00PM at Christopher Newport University.

_____ YES

_____ I cannot attend that day, but I would be willing to work out another time when I could attend and receive the information.

I agree to attend both follow-up sessions on Saturday, November 25, 1995 and Saturday, March 16, 1996, and I will bring my daughter to both of those sessions.

_____ YES

_____ I have a prior commitment on _____.
(write in which date you are unavailable)

I understand and am willing to pay a $75 deposit for my daughter to attend the Living Spaces program. I understand that this money will be refunded based on my daughter's participation in the program (partial participation will result in a pro-rated refund).

_____ YES

I will support my daughter's participation in this program by:
1) encouraging her in the program,
2) listening to her practice any presentations that she will give, and
3) spending one hour a week reviewing science and math subjects with her

_____ YES

Signature of Parent/Guardian _____ **Date** _____

Signature of Parent/Guardian _____ **Date** _____
(all parent/guardians must sign this form).

GRADE Release Form

THE SCIENCE OF LIVING SPACES PROJECT

I, _____ permit _____ to release the grades of _____
(name of parent) (name of school) (name of student)
from the 1994-95 school year to Christopher Newport University for the purpose of reviewing my daughter's application and participation in the Science of Living Spaces project. I understand that these grades will remain confidential, will be used only for the purpose of reviewing her application, and will be destroyed by Christopher Newport upon completion of the application process.

Signature of Parent/Guardian _____ Date _____

Teacher Recommendation Form

THE SCIENCE OF LIVING SPACES PROJECT

I agree to waive my right to see this form .

___ YES ___ NO

Signature of Student _____ **Date** _____
Signature of Parent/Guardian _____ **Date** _____

Teacher: Please rank the student on the following:

1. **Student's maturity level and behavior:**

Excellent	Good	Fair	Poor
_____	_____	_____	_____

2. **Student's study skills:**

Excellent	Good	Fair	Poor
_____	_____	_____	_____

3. **Student's ability to think independently:**

Excellent	Good	Fair	Poor
_____	_____	_____	_____

4. **Student's problem-solving skills:**

Excellent	Good	Fair	Poor
_____	_____	_____	_____

5. **Student's excitement about learning:**

Excellent	Good	Fair	Poor
_____	_____	_____	_____

Please write a paragraph describing why you think that this student is a good candidate for the Science of Living Spaces Program.

Signature of Teacher _____ **Date** _____

Appendix F

REFERENCE INFORMATION FOR PROJECT MEASURES

STANDARDIZED INSTRUMENTS

1. CAIMI

Gottfried, A. E. (1986). Children's Academic Intrinsic Motivation Inventory. Psychological Assessment Resources, P. O. Box 998, Odessa, FL. 33556/ Toll Free # -- 1-800-331-TEST.

2. SDS Career Explorer

Holland, J. L. and Powell, A. B. (1994). Self-Directed Search Career Explorer. Psychological Assessment Resources, P. O. Box 998, Odessa, FL. 33556. Toll Free # -- 1-800-331-TEST.

3. TSCS

Roid, G. H. and Fitts, W. H. (1994). Tennessee Self-Concept Scale. Western Psychological Services Publishers and Distributors, 12031 Wilshire Boulevard, Los Angeles, California 90025-1251. Toll Free # -- 1-800-648-8857

PROJECT

SPECIFIC

MEASURES

THE SCIENCE OF LIVING SPACES

GENERAL ASSESSMENT

DIRECTIONS: This test is designed to assess your general knowledge of science, engineering, and mathematics. Place your answers on the scantron sheet provided. If you have questions, please raise your hand and I will come to you.

Multiple Choice

A. COMPUTER SCIENCE

1. What is email?
   A. a way of sending messages to other people over computer lines.
   B. a very fast mail service provided by the Post Office.
   C. a programming language.
   D. an extinct mammal.

2. What is the Internet?
   A. a large catalog from which robot parts may be ordered.
   B. a large number of computer networks that have agreed to communicate using the same "protocol" (or set of rules).
   C. a communication satellite.
   D. a pattern that appears in nature.

3. What is software?
   A. the programs that determine what the computer does.
   B. a kind of clothes.
   C. a type of protective case for computers.
   D. a type of greenhouse gas.

4. What is the World Wide Web?
   A. a giant spider web.
   B. a telephone network.
   C. a soft drink.
   D. one way of viewing some resources on the Internet.

5. What is a MAC?
   A. a kind of computer.
   B. a kind of sandwich.
   C. a branch of science.
   D. a pattern that appears in nature.

MATHEMATICS

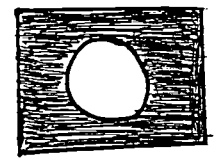
6. A box-and-whisker plot is used in statistics to:
   A. organize information
   B. gather information
   C. find z-scores

7. The median of a group of scores is:
   A. the score that occurs most often.
   B. the middle score
   C. found by adding all the scores and dividing by the number of scores.

8. The range of a group of scores is:
   A. the highest score.
   B. the lowest score
   C. the difference between the highest and lowest score.

9. An example of a correct expression of area is:
   A. 3 feet
   B. 3 square feet
   C. 3 cubic feet

10. Assume you know the area of the square and the area of the circle. To find the area of the shaded area, you would have to:
   A. subtract
   B. add
   C. divide



11. Write the decimal number 18 as a binary number.
   A. 18_2
   B. 10010_2
   C. 11_2
   D. 81

12. The binary number 100_2 is equivalent to the decimal number:
   A. 100
   B. 2
   C. 8
   D. 3

13. The growth pattern of plants such as pine cones, pineapples, sunflower heads, artichokes, asparagus tips reflect the:
    A. prime numbers
    B. odd numbers
    C. square numbers
    D. Fibonacci numbers

14. The next number in the Fibonacci sequence (1, 1, 2, 3, 5, _____) is:
    A. 7
    B. 4
    C. 8
    D. 10

LEGO ROBOT

15. You are building a robot and discover that you made a small mistake 3 steps back. What is the best way to handle the mistake?
    A. Take the whole robot apart and start over.
    B. Automatically take apart the last 3 steps.
    C. Ignore the error because it is small.
    D. Determine the importance of the error and find an efficient way to correct it.

16. When a lamp fails to work, which is NOT a reason?
    A. The cable connection to the lamp is incomplete.
    B. The cable is plugged into computer interface box upside down.
    C. The computer interface box is not plugged into electrical outlet.
    D. The computer interface box is not plugged into computer.
    E. The lamp is plugged into wrong port on computer interface box.

17. You want to turn on a sound alarm when the temperature sensor reading goes above 90 degrees. Which command should you use to monitor the sensor reading?
    A. on
    B. onfor
    C. if
    D. waituntil
    E. wait

18. What do you need to use a motor to control straight motion?
    A. the axle, gears, and a gear rack.
    B. the axle and gears.
    C. the axle alone
    D. nothing because it cannot be done.

19. Which is NOT needed to build a robot?
    A. computer engineer
    B. mechanical engineer
    C. interior decorator
    D. human interface designer
    E. computer programmer

LAMP BUILDING

20. In an electrical circuit, the two kinds of wires are:
    A. Hot and Cold
    B. Red and Blue
    C. Hot and Return
    D. Red and Green

21. When connecting a lamp cord to the lamp holder, which wire goes to the gold screw on the lamp holder?
    A. Red
    B. Hot
    C. Return
    D. Green
    E. Blue

22. When connecting a lamp cord to the lamp holder, which wire goes to the silver screw on the lamp holder?
    A. Red
    B. Hot
    C. Return
    D. Green
    E. Blue

23. When connecting a plug to an electrical cord, which wire does the skinny prong go with?
    A. Hot
    B. Red
    C. Green
    D. Return
    E. Blue

24. When connecting a plug to an electrical cord, which wire does the wide prong go with?
    A. Hot
    B. Red
    C. Green
    D. Return
    E. Blue

ENVIRONMENTAL GASES

25. The radiator of a car contains water. Why do we also add antifreeze to a car's radiator?
    A. It lowers the boiling point of water.
    B. It raises the freezing point of water.
    C. It makes the car get better gas mileage.
    D. It raises the boiling point of water.

26. Which of the following greenhouse gases is the best absorber of thermal radiation from the earth's surface?
    A. carbon dioxide
    B. methane
    C. ozone
    D. chlorofluorocarbons

27. Two types of well known polymers are "high density polyethylene (HDPE)" and "low density polyethylene (LDPE)." Density refers to how tight the molecule packs together and therefore, affects the flexibility. Which of these two polymers is found in bottles with the recycling labeled "2"?
    A. HDPE
    B. LDPE

28. As the temperature of a stream increases, the amount of oxygen in the water:
    A. increases
    B. decreases

29. There have been several cases recently of scientists reporting data that they had falsified. This has created a general outcry from the public. Is the falsification of scientific data different than any other form of cheating?
    A. Yes. Scientist should be held to a higher set of standards.
    B. Yes. It will have a greater impact on society than cheating on something like taxes.
    C. No. It is OK to cheat.
    D. No. Cheating is cheating.

SIM LIFE

30. Sim Life is:
    A. a way of creating real organisms.
    B. a computer program that allows one to alter aspects of organisms and their environments and to see what will happen to the system.

31. Biological evolution is:
    A. change in organisms over time.
    B. a myth
    C. true in the past but not happening in the world today.

32. An organism's DNA influences:
    A. the physical characteristics of the organism.
    B. the moral attributes of the organism.

33. The Sim Life "dashboard" shows:
    A. the change in the ecosystem.
    B. plant and animal icons.
    C. how fast time is passing.
    D. climate icons.

34. The animals in an overpopulated ecosystem can die mainly because
    A. they do not have enough to eat.
    B. they travel to other places and get hurt.
    C. they do not wish to live.

DINOSAUR FOOTPRINTS

35. Dinosaurs left footprints originally in
    A. rock.
    B. soft sediment.
    C. gravel.

36. The stride length is
    A. the length of one step (left to right).
    B. the leg length.
    C. the length of two steps (left to right to left).

37. The stride length is longer when
    A. running
    B. walking

38. The footprints are farther apart in larger animals because
    A. they can move their legs faster.
    B. their legs are longer.

39. We can determine the speed of the dinosaurs from their footprints because
    A. we can relate leg length and stride length to speed in other animals.
    B. we can measure their speed directly.
    C. the footprints are deeper if the speed was fast.

ENERGY

40. Which direction would you prefer your house facing from the point of view of energy efficiency?
    A. North
    B. South
    C. East
    D. West

41. In a very cold winter which coat would you prefer to wear to keep you warm longer?
    A. black
    B. gray
    C. white

42. Which form of energy is the cleanest to the environment?
    A. coal
    B. oil
    C. natural gas
    D. direct solar energy

43. As far as energy efficiency is concerned, compare an all brick house and a wood/vinyl house. Which is more efficient?
    A. same
    B. brick
    C. wood/vinyl

44. If you are going to build a house, and you only have limited amount of bricks. From an energy efficiency point of view, would you like the brick built:
    A. inside
    B. doesn't matter
    C. outside

MALL SECTION

45. A major factor when people decide where to build a mall is
    A. having flat land.
    B. having rich people around.
    C. having a lot of people around.

46. The focal point in a mall
    A. helps make the mall pretty.
    B. makes people want to buy things.
    C. helps people know where they are.

47. Making sure people feel safe in a mall is:
    A. very important.
    B. important.
    C. not very important.

48. When you decide where to put a mall, having nearby sewerage and water sources is
    A. very important
    B. important
    C. not very important because you can build them yourself.

18TH CENTURY MEDICINE

49. In Colonial times, people who had mental illnesses were usually:
    A. treated for their sickness by doctors.
    B. put in hospitals like prisons and sometimes kept in chains.
    C. given special drugs.

50. Before Colonial times, people thought there was
    A. a connection between sanitary conditions and disease.
    B. very little connection between sanitary conditions and disease.

51. One of the main causes of death of death of children was in Colonial times was
    A. diseases like measles and smallpox.
    B. accidents.
    C. bad food.

52. Most of the care given to sick people in the 18th century was done by
    A. doctors.
    B. nurses.
    C. women in a family.

WOMEN SCIENTISTS

53. Who was Marie Curie?
    A. an American doctor who cured polio.
    B. a Polish physicist and chemist who helped discover radium.
    C. a Mexican biologist who found a new species of frog.
    D. a Japanese botanist who explored the rain forests.

54. How many women scientists have won the Nobel Prize?
    A. 200
    B. 100
    C. 10
    D. 2

55. What did Maria Goeppert-Mayer work on?
    A. the development of the atomic bomb.
    B. the designing of the space shuttle.
    C. the genetic codes of ladybugs.
    D. the mapping of new galaxies.

56. Barbara McClintock studied the genetics of which plants?
    A. tomatoes
    B. beans
    C. potatoes
    D. corn

57. What did Rita Levi-Montalcini study?
    A. gorillas
    B. nerves
    C. nuclear energy
    D. the speed of light

THE SCIENCE OF LIVING SPACES

WEEKLY ACTIVITIES EVALUATION FORM

We hope your first week in this project has been exciting. Now, we need you to help us plan future projects for girls your age. Tell us how you feel by responding to the questions below. Remember there are no right or wrong answers.

1. Which of the following sessions did you participate in this week?
   A. Robots
   B. Computers
   C. Building

   On a scale of 1 (low) to 5 (high), rate your enjoyment of this activity.

LOW				HIGH
1	2	3	4	5

2. Which of the following sessions did you participate in this week?
   A. English
   B. PE
   C. Art

   On a scale of 1 (low) to 5 (high), rate your enjoyment of this activity.

LOW				HIGH
1	2	3	4	5

3. Below is a list of the activities you participated in this week. Rate your level of enjoyment of each activity.

	HIGH		AVERAGE		LOW
. Binary Numbers	5	4	3	2	1
B. Chemistry and Food	5	4	3	2	1
C. Wiring your house	5	4	3	2	1
D. How to lie with numbers	5	4	3	2	1
E. Digital Signals	5	4	3	2	1
F. The Medical Profession	5	4	3	2	1
G. Careers	5	4	3	2	1
H. CEBAF Participatory	5	4	3	2	1
I. Self Esteem Building	5	4	3	2	1

4. This week you went to Richmond Math and Science. On a scale of 1 (low) to 5 (high), rate your enjoyment of this activity.

LOW				HIGH
1	2	3	4	5

If you have any comments about the activities of the week, please use space below and on the back of this sheet.

THE SCIENCE OF LIVING SPACES

WEEKLY ACTIVITIES EVALUATION FORM

We hope your second week in this project was exciting. Now, we need you to help us plan future projects for girls your age. Tell us how you feel by responding to the questions below. Remember there are no right or wrong answers.

1. Which of the following sessions did you participate in last week?

A. Robots
B. Computers
C. Building

On a scale of 1 (low) to 5 (high), rate your enjoyment of this activity.

LOW				HIGH
1	2	3	4	5

2. Which of the following sessions did you participate in last week?

A. English
B. PE
C. Art

On a scale of 1 (low) to 5 (high), rate your enjoyment of this activity.

LOW				HIGH
1	2	3	4	5

3. Below is a list of the activities you participated in last week. Rate your level of enjoyment of each activity.

	HIGH		AVERAGE		LOW
Building a Solar	5	4	3	2	1
B. Chemistry and Food	5	4	3	2	1
C. Designing Buildings	5	4	3	2	1
D. Measuring Greenhouse Gases	5	4	3	2	1
E. The Fragile Environment	5	4	3	2	1
F. Patterns in Nature	5	4	3	2	1
G. Careers	5	4	3	2	1
H. Sunscreens	5	4	3	2	1
I. Self Esteem Building	5	4	3	2	1

4. Last week you went on several trips. On a scale of 1 (low) to 5 (high), rate your enjoyment of these activities.

A. Busch Gardens	5	4	3	2	1
B. Newport News Shipbuilding	5	4	3	2	1
NASA	5	4	3	2	1
D. CEBAF	5	4	3	2	1
IMS	5	4	3	2	1

(OVER)

5. On a scale of 1 (low) to 5 (high), how much interest in science related careers did last week's activities generate.

Low				HIGH
1	2	3	4	5

6. Please use the space below for additional comments about the activities of last week.

THE SCIENCE OF LIVING SPACES

WEEKLY ACTIVITIES EVALUATION FORM

We hope your final week in this project was exciting. Now, we need you to help us plan future projects for girls your age. Tell us how you feel by responding to the questions below. Remember there are no right or wrong answers.

1. Which of the following sessions did you participate in this week?
   A. Robots
   B. Computers
   C. Building

   On a scale of 1 (low) to 5 (high), rate your enjoyment of this activity.

LOW				HIGH
1	2	3	4	5

2. Which of the following sessions did you participate in this week?
   A. English
   B. PE
   C. Art

   On a scale of 1 (low) to 5 (high), rate your enjoyment of this activity.

LOW				HIGH
1	2	3	4	5

3. Below is a list of the activities you participated in this week. Rate your level of enjoyment of each activity.

	HIGH		AVERAGE		LOW
A. So what can I be? (Careers)	5	4	3	2	1
B. Dinosaurs	5	4	3	2	1
C. Calculating Area	5	4	3	2	1
D. NASA Careers	5	4	3	2	1
E. The Mall Project	5	4	3	2	1
F. Self Esteem Building	5	4	3	2	1

4. This week you went on several trips. On a scale of 1 (low) to 5 (high), rate your enjoyment of these activities.

A. Williamsburg	5	4	3	2	1
B. Newport News Fireworks	5	4	3	2	1
C. Virginia Living Museum	5	4	3	2	1

5. On a scale of 1 (low) to 5 (high), how much interest in science related careers did this week's activities generate.

Low				HIGH
1	2	3	4	5

Appendix G

THE SCIENCE OF LIVING SPACES

PARENTAL ASSESSMENT FORM

Please help us assess the impact of the "Science of Living Spaces" program by providing an assessment of your daughter's behavior, feelings, and attitudes towards science since participating in this program.

1. **Child's Name** _____

2. **Using the scale below, how would you rate your daughter's:**

	Excellent	Good	Fair	Poor
A. Maturity level and behavior	4	3	2	1
B. Ability to think independently	4	3	2	1
C. Problem-solving skills	4	3	2	1
D. Self-esteem	4	3	2	1
E. Study Skills	4	3	2	1
F. Excitement about learning	4	3	2	1

3. **On a scale of 1 (low) to 5 (high), rate your daughter's:**

	High				Low
A. Interest in science	5	4	3	2	1
B. Interest in Mathematics	5	4	3	2	1
C. Interest in Engineering	5	4	3	2	1
C. Scientific Ability	5	4	3	2	1
D. Mathematical Ability	5	4	3	2	1

4. **Overall, how would you rate your daughter's attitude towards and interest in pursuing a career in science, engineering, and mathematics.**

(LOW) 1 2 3 4 5 (HIGH)

THE SCIENCE OF LIVING SPACES

PARTICIPANT ASSESSMENT FORM

Please help us assess the impact of the "Science of Living Spaces" program by providing an assessment of your feelings and attitudes towards science since participating in this program.

Name _____

1. As a result of this program, how interested are you in taking more science and mathematics courses at school?

___Extremely Interested ___Somewhat interested
___Very Interested ___Not very interested

2. How likely is it that you will become a scientist, engineer, or mathematician in the future?

___Better than 75% chance ___Less than 50% chance
___Better than 50% chance ___Less than 25% chance
___50% chance ___No chance

3. Do you plan to go to college? ___Yes ___No

4. If you plan to go to college, what do you think you'd like to be? List your top three choices.

A. _____

B. _____

C. _____

5. Overall, how would you rate your satisfaction with the Science of Living Spaces Program?

(Low) 1 2 3 4 5 (High)

6. Do you think you would like to participate in similar type programs in the future? ___ Yes
___No

7. In your own words, please write a brief statement indicating the impact you feel this program has had on your behavior?

Mentor's Interim Report
(Due: January 5, 1996)

PLEASE PRINT OR TYPE

1. Name of Mentee _____

2. Number of emails with mentee _____

3. Other types of contact with mentee (List types and number_____

_____

_____

4. Conversation with mentee _____

_____

_____

_____

5. Changes in mentee (interest in science, kinds or types of questions asked in emails, etc.)

_____

_____

_____

6. On a scale of 1 (low) to 5 (high), rate your mentee in the following areas:

	High				Low
Mentee's excitement about SEM	5	4	3	2	1
Mentee's interest in SEM careers	5	4	3	2	1
Mentee's problem solving skills	5	4	3	2	1
Mentee's understanding of final project	5	4	3	2	1

6. During this program, you have had an opportunity to see and interact with women scientists. Has this had an impact on your selection of a career in science, engineering, and/or math? ____YES ____NO Explain your answer.

_____

_____

_____

_____

7. On a scale of 1 (low) to 5 (high), how much of an impact has this program had on your interest in science?

Low				High
1	2	3	4	5

8. As a result of this program, do you feel you like science more now?

_____YES _____NO

Why? _____

_____

_____

9. Several aspects of the program have been designed for the coming school year. On a scale of 1 (low) to 5 (high), how comfortable do you feel with:

	High				Low
A. Your mentor	5	4	3	2	1
B. Email	5	4	3	2	1
C. The mall project	5	4	3	2	1

10. Please use the space below for additional comments about the activities in this program.

_____

_____

_____

_____

_____

Appendix H

DISSEMINATION

1. Lynn Lambert. The Science of Living Spaces. (December 13-15, 1995) Women and Science Conference, Poster Session, Washington, D. C.

2. Joanne Trimber and Lynn Lambert. Engineering and Technology in a Summer Science Camp. (May 23, 1996). Virginia Academy of Science Conference. Richmond, Va.

3. Kathleen Brunke, Shelia Greenlee, and Lynn Lambert. Chemistry and other Hands-on Engineering and Science in a Summer Camp for Girls. (May 23, 1996). Virginia Academy of Science Conference. Richmond, Va.

4. Anna Bampton, Shelia Greenlee, and Lynn Lambert. Science of Living Spaces-Encouraging Girls in Science, Engineering, and Math. (June 23, 1996) American Society of Engineering Education - Women in Engineering Session. Washington, D.C.

5. Shelia Greenlee and Doris Archer. Girls and Science Careers: Self-Concept and Academic Intrinsic Motivation. (April, 1996). Southeastern Psychological Association Conference. Norfolk, Va.

6. Science of Living Spaces: Women in the Environment of the 21st Century Web page at http://eagle.pcs.cnu.edu/www/sls/sls.html

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