

# ***A Model for the Implementation and Engagement of Independent Research by Community College Students***

by  
Richard S. Groover  
rgroover@reynolds.edu

## **Executive Summary**

The primary mission of the Virginia Community College System (VCCS) is to teach, not to conduct research. However, across the United States community colleges are beginning to realize the benefits of independent research opportunities for their students. Numerous studies and articles have recognized that student research benefits the students by improving their knowledge in the chosen discipline, their writing and verbal skills, and self-confidence; and they enhance their problem-solving abilities and critical thinking skills.

Implementation of undergraduate research programs at Virginia's community colleges will stimulate curriculum improvements. Students transferring to four-year colleges and universities will have transcripts showing their enrollment in more rigorous courses and their involvement in research-related classes and activities, which advances their knowledge and experience. Relationships the student have with colleges they transfer to can be established during community college student research activities.

Development and implementation of undergraduate research will also lead to better utilization of the college's infrastructure (e.g., labs and libraries) as students engaged in research will spend more time using these facilities.

Independent research can open opportunities for outside funding. It also opens new doors for community connections and support of the College.

Faculty involved in student research are more engaged in the college. Faculty indicated they would participate in research conducted by students if they were encouraged to do so by the administration. Every discipline can be considered for undergraduate student research experiences. The faculty will be more likely to engage in independent student research projects if they have a Model to follow.

This ***Model for the Implementation and Engagement of Independent Research by Community College Students*** can help to achieve the VCCS and the College's goals. This Model provides the suggestions and processes for faculty and administrators to follow for successful implementation of such independent student research.

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## **Introduction – Virginia Community College Mission & Goals**

The primary mission of the Virginia Community College System (VCCS) is to teach, not to conduct research. However, there are benefits provided in undergraduate student research that may not be apparent. Exposure to research can enhance a student's knowledge and skills gained during the college experience. Undergraduate student research can improve faculty involvement at the College. Undergraduate student research can open funding opportunities for community colleges. From this premise, this Model presents how independent student research can help attendees of the community colleges, the faculty, and the College. This Model also charts the steps administrators and faculty can follow to have a successful student research initiative.

In November 2009, the VCCS revised its formal mission to state, “We give everyone the opportunity to learn and **develop the right skills** so lives and communities are strengthened” (Virginia Community College System 2010). “The right skills” is important in the context of this document. Many community college students transfer to four-year institutions, and thus are expected to be as prepared and as competent as the students that attended those colleges and universities during their freshman and sophomore years. Undergraduate research for community college transfer students can give those students the “right skills” for success.

Dateline 2009 directed the Virginia Community College System (VCCS) to:

- Rank in the top 10 percent of the nation's community college systems in rates of student graduation, retention, and job placement.
- Triple the number of graduates who successfully transfer to four-year institutions.

It is assumed that these goals are still important although a new set of goals for 2015 has been established. Student engagement in independent research will increase students' motivations to remain enrolled at the community college where they will have access to research experiences beyond what might be available to them as freshmen or sophomores at a four-year university. As students engaged in independent research remain at their community colleges until graduation, VCCS retention and graduation rates will increase. If VCCS graduates have had research experiences at the community colleges they attended, then they will be in a better position to compete for coveted transfer slots at four-year colleges and universities.

Some recognize that one of the greatest challenges for community college is the need to prepare our future workforce. The new VCCS initiative, Achieve 2015, states a student success goal:

- Increase the number of students graduating, transferring or completing a workforce credential by 50 percent, including increasing the success of students from underserved populations by 75 percent.

Independent student research improves a student's motivation to graduate and to transfer successfully to a four-year institution. It can improve the abilities of the future workforce. This ***Model for the Implementation and Engagement of Independent Research by Community College Students*** can help to achieve the VCCS goals. This Model provides the nuts and bolts for faculty and administrators to follow for successful implementation of such independent research.

J. Sargeant Reynolds Community College's mission is to provide "access to education that develops individuals for employment and career advancement, **prepares students for successful transfer to colleges and universities**, builds a skilled workforce that contributes to regional economic development, and promotes personal enrichment and lifelong learning" (J. Sargeant Reynolds Community College 2010). Preparing students for successful transfer might include knowledge and skills in the research conducted in their major. The Reynolds mission statement also states it "will **create a dynamic learning environment** that will expand students' opportunities and enrich our community." Furthermore, it states, "We **provide diverse learning experiences** for our students, employees, and the community in support of learning, scholarship, and personal growth." Dynamic learning environments and diverse learning experiences could also include involvement in the processes of undergraduate research.

## **Studies Support the Benefits of Undergraduate Research**

The benefits of undergraduate research may not be obvious to everyone. There are numerous examples of undergraduate student research at other institutions across the United States. Most are occurring at four-year colleges and universities. Many institutions, including community colleges, are encouraging their faculty to engage in and mentor students doing undergraduate research. Millsbaugh and Millenbah (2004), noted the benefits for students and faculty in such relationships. Students learn better problem solving and better communication skills. Recruitment and retention of good students is increased as a result of undergraduates having research opportunities. Faculty have assistance with research they are pursuing. These authors also state that undergraduate research experiences (URE) help overcome some of the shortcomings of undergraduate education, especially the missing career skills that students need when they get out of college. URE provides key career skills and allow students to acquire relevant working-world experience they need. Brakke et al. (2009) report that top companies are using experience in undergraduate research as a screening and hiring criteria .

A defense of having independent undergraduate student research is important to consider in more detail because such may be new to community colleges. The benefits to the students, benefits to the faculty and benefits to the college can be acknowledged.

Student engagement is a goal that many educators seek. Research indicates that students who are involved in independent research become engaged in their education to a greater degree (Lanza 1988). Students doing independent research become better at analysis, better at problem solving, better at writing and better at managing time.

During the research experience, the occasional unexpected problems that arise force the students to troubleshoot for solutions, which “catapult students in undergraduate research past cookbook-style class experiments with step-by-step instructions and outcomes” (Guterman 2007). Students learn to handle uncertainty and problem solving more adroitly.

By involving students in faculty research projects, small colleges, in particular, may derive the additional benefit of better maintaining undergraduate science student enrollment and retention (Stannitski et al. 1986).

Benefits for community college students have been noted. Two-year college students indicated that research experience early in their college experience strengthened their writing and verbal skills, improved their self-confidence, and enhanced their problem-solving abilities and their critical thinking skills (Emerson 2007). All students can benefit, despite varying abilities when they work on their own (Cohen 1962). Undergraduate students who are successful in their research experience are often led to seek even greater challenges, and thus elevate their education experience to higher levels (Lanza 1988).

Students may be hesitant to undertake independent research because of unknowns. This Model provides strategies to follow that can alleviate some of the students’ concerns. Once fears are overcome, the benefits for the students can be recognized. The University of Missouri (2008), although not a two-year school, has presented some points regarding benefits undergraduate research can provide their students. Community college students would benefit in the same ways:

*Develop a one-on-one successful research relationship with a faculty member that can earn the student a great recommendation letter — a necessity for acceptance into the transfer to a four-year college or university,*

*Help clarify the student’s academic and career interests and goals,*

*Acquire knowledge in the student’s academic field that transcends classroom study,*

*Enhance critical skills in communication, independent thinking, creativity and problem-solving,*

*Enhance professional and academic credentials to support applications for scholarships, awards, career employment and entry into future graduate and professional schools,*

*Engage in the creation of new knowledge on the cutting edge of an academic discipline and apply that knowledge to real-world problems,*

*Participate directly in the College's central mission of scientific discovery, scholarly activity and artistic creation,*

*Provide the student possible academic credit and may allow them to be eligible for departmental honors.*

As highlighted in the University of Missouri list, students engaged in independent research will be better qualified for transfer, have stronger transcripts in their competitions for admission and be better prepared for success at their transfer school. The community college students can be exposed to experiences that typically only college juniors and seniors get to experience. This Model directs faculty for improving advanced skills in learning not usually covered in detail at community college level courses, such as literature searches, scholarly writing and statistical analysis.

Undergraduate research implementation will provide improvements in curricula / transcripts for transfer students, thus elevating the stature of our community colleges. The development and implementation of undergraduate research provides better utilization of the college's infrastructure (labs, libraries, etc.) as engaged students spend more time in these facilities.

Student research initiatives will result in marketing opportunities for the colleges, especially if they offer or maybe result in public-private partnerships to support the student research. Community organizations outside the colleges often like "riding on our wagons of success" as these make their stature in the community greater. A plan to provide a springboard for corporate and philanthropy donations could result.

Community college faculty may not typically be associated with research. Traditional teaching of the students is the norm. Performance evaluations for faculty could include research as professional development, but they often are not. For the sciences, college faculty do not have assigned lab space for research. Other barriers are perceived; some may think that faculty will only do research if they are paid additional funds, which may be true for some but is not for many others. Conversations with numerous faculty, in several disciplines, have indicated that they would do some student-center research if encouraged to do so by the administration. They will be more likely to engage in independent student research projects if they have a Model to follow. This Model can help faculty succeed in such, and it will help them become a more committed part of the VCCS. Details are provided later in this document.

Although many think that science is the best curriculum for research, any curriculum could support independent undergraduate research. Psychology could study behavior of a unique group, computer science could study consumer use of certain technologies,

English could study influences of a particular author, history could research a significant event not yet researched, anthropology could study a unique past culture, health could study new advances in holistic diets, and mathematics could investigate special uses of differential equations in various models. The research topics are almost unlimited. Students in every curriculum can benefit from independent student research.

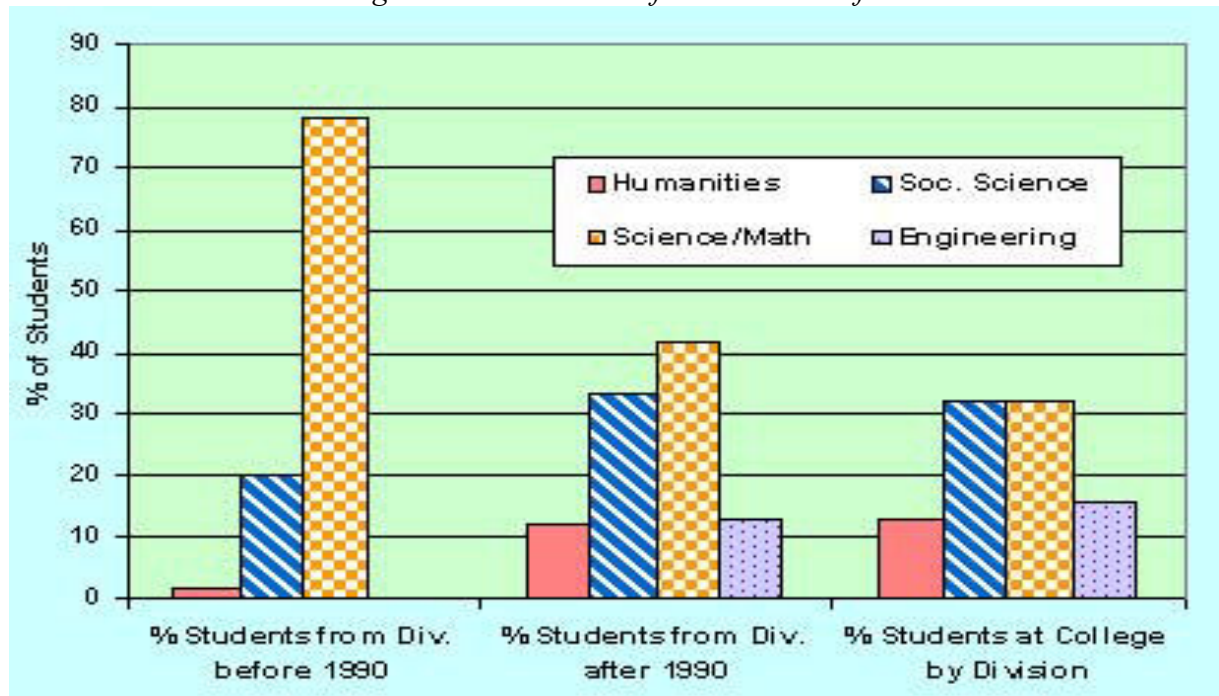
Wellesley College student projects from 1993 – 2003, increased by discipline because their administration and their faculty realized the benefits of undergraduate research for their students in those disciplines. Table 1 reflects the data from Wellesley College (Joyce 2008).

*Table 1: Distribution of Wellesley College Student Projects by Discipline from 1993 - 2003*

<i>Discipline</i>	<i>Percentage of Projects</i>
<i>Anthropology</i>	<i>8%</i>
<i>Economics</i>	<i>21%</i>
<i>Political Science</i>	<i>14%</i>
<i>Psychology</i>	<i>24%</i>
<i>Sociology</i>	<i>19%</i>
<i>Other</i>	<i>13%</i>

At Union College, New York, students in various disciplines were encouraged to become involved in undergraduate research. Students from sociology, psychology and history, all non-science majors became involved in undergraduate research. Table 2 reflects the data from Union College (Werner et al. 2008) .

*Table 2: Union College, NY Students Attending National Conference on Undergraduate Research before 1980 and after 1990*



Administrators may be dubious about independent student research, as such may appear as an additional drain on their resources. Independent research can open opportunities for outside funding sources. It can create opportunities for public-private partnerships. Other funding doors may open as a result of initiating research with their undergraduates. Student research can establish favorable relationships with the outside community, that might increase donor support for the College. The National Science Foundation considered student independent research so important that they initiated the program “Research Experience for Undergraduates,” with a current annual budget of \$5.9 billion.

## **What is Feasible for Virginia Community Colleges**

Independent research by community college students is not new to our System, or at community colleges. In fact, nationwide college administrators are realizing that this is important for their growth and improvements. Often the research efforts in the VCCS have been small research or an assignment embedded in the typical courses 100 or 200 level courses. As faculty have only occasionally provided independent research opportunities for the students, the procedures for such have sometimes lacked structure and could be more beneficial if better designed and implemented with more detailed research activity. However, time limits affect what can be accomplished when such research is embedded in typical courses.

Successes such as Professor Doug Carmichael’s, at Virginia Highlands Community College, who published an article “BioProjects: Independent Research in Bio 101” (2001) have been noted. Implementation instructions for the faculty are not presented in that article nor are they present in Professor Carmichael’s internal publication *BioProject Guide* (2003). Dr. Carmichael has been involved in the development of this Model as we attempt to provide direction for implementation. At the VCCS Science Peer Conference “Making an Internship or Independent Study Work” was presented (Groover 2005), but the implementation details for the administration and the faculty guiding a student independent research were not presented at that time.

Considering more advanced courses in the VCCS, many faculty have initiated student research via the 190’s or 290’s course offerings to students. This Model presents a process that can be successful for use with several other courses. These might include:

Course Number 190	Coordinated internship
Course Number 199	Supervised Study
Course Number 290	Coordinated Internship
Course Number 293	Studies In _____
Course Number 295	Topics In _____
Course Number 296	On-site Training
Course Number 298	Seminar and Project
Course Number 299	Supervised Project

## The Model

The *Model for the Implementation and Engagement of Independent Research by Community College Students* has a number of components to guide faculty and administrators through a successful effort for independent, but faculty supervised, research by community college students. This is meant to be a recommendation for the process, not a mandatory requirement.

The Model suggests steps and procedures for the faculty to use as they undertake such projects. Included is a checklist for initial planning, suggested marketing strategies organization steps as the project is being formulated and getting necessary approvals. See Addendum A for this checklist. The checklist suggests the inclusion of a timetable so that best planning may be accomplished.

### ***PROJECT / PROPOSAL APPROVAL***

A **Proposal Approval Form** (see Addendum B) for the requesting instructor to complete and submit to her/his dean for approval is recommended. It provides a series of guidelines and questions to answer so that the administration fully understands what the faculty member intends to do and what facilities will be included, before the independent student research project has begun. This helps the administration evaluate whether such research should be undertaken. The Proposal Form recommends objectives and assessments to be stated to achieve for a successful program.

If course credit is sought for the students, many community colleges have internal approval forms that are addressed by various entities. At J. Sargeant Reynolds Community College this includes:

Form 05-0002	Course Content Summary
Form 05-0004	Request to Add, Reactivate, or Revise Course
Form 50-0001	Request to Do Research
Form 20-0014	Memo of Understanding for Establishing New Funds

Not all of these forms may be necessary, but the supervising professor should review and consider what is necessary.

The Model recommends actions the College/Department might undertake to secure “outside the System” in-kind or financial support of independent research by students. In-kind could include internships or special locations for research to occur (like a state park, hospital or a business location). Approvals should be sought if outside locations are used, and they might be a part of the student’s final grade or evaluation. Outside sources may also be feasible for funding support of research. National Science Foundation, Virginia Foundation for the Humanities, corporations, civic organizations and trade associations might be approached for such support. At J. Sargeant Reynolds Community College a “Handbook for Grant Proposal Development” has been prepared and should be



reviewed for proper internal approval procedures. Outside relationships can be very rewarding; one community college in the Mid-west collaborated with an animal feed company, developed a new brand of animal feed, and the revenue from that product is now shared by that college and the company, which is a sizable amount of income.

### ***MEMORANDUM OF AGREEMENT***

Every independent student research project needs guidance by a faculty member. Perhaps the most important component of this Model is a document which provides structure for the students to follow so that the independent study will have identifiable directions, known requirements, and identified objectives and goals to be met. These are clearly identified in the supporting document identified as the **Memorandum of Agreement** prepared by the guiding faculty member. The expectations on the student must be clearly defined. A standard prototype “contract” format has been developed and can be edited with specific information. See Addendum C. It defines what the student should expect from the faculty member and what the supervising faculty should expect from the student. It makes recommendations regarding how faculty should evaluate the student projects. It covers conduct off-campus if such will be occurring. It also covers liability for the student, as well as laws the student must follow.

### ***CONNECTION FOR THE STUDENT BEYOND THE RESEARCH***

An important suggestion in this Model is the recommendation to set up a **connection and involvement with a faculty member at the four year institution** where the student plans to attend. For example, if the student plans to attend James Madison University (JMU) when they transfer, and their research at the community college is in the field of anthropology, this Model suggests that the supervising faculty at the community college secure a brief commitment from a JMU sociology/anthropology department faculty member to:

- 1). Read the student’s research methods summary as the research begins, and provide brief comments, and
- 2). Read the student’s final report and provide some brief comments.

This component of the Model provides several positive things, if the student work is good. One, it establishes for the student a faculty member connection at the transfer college/university before the student arrives. Such might be helpful to the student in their remaining two years at that institution. It may also give the transfer institution faculty a known student for assistance with their research. Second, it establishes a possible professional connection between the community college faculty member and the four-year school faculty member, possible for future collaborative work. Such may result in increasing respect for community college faculty.

Thirteen Midwestern colleges and universities have demonstrated the benefit of community college students initiating undergraduate research at the community college and then transitioning to four-year institutions (Brothers & Higgins 2008). Their programs after three years continued to provide better education opportunities for the involved students.

### ***ESTABLISHING GOALS & OBJECTIVES***

As the research project progresses in its development stage, Thornton et al. (2008) have suggested some **goals and measurable outcomes** in undergraduate research that have been adopted in this Model. The measurable outcomes may include:

- Attitudes Change ... improving student interest in material or topic
- Intentions ... recognition for increased use of material in future
- Knowledge Increase ... learn what was not previously known
- Skills Improvements ... demonstration of information collecting, analysis, and problem solving

Every project should have objectives especially to measure success of that effort. This Model recommends that every independent student research initiative include five things as **learning objectives**. The sooner in their education that students are exposed to these, the better their education will be enhanced:

1. *Hypothesis identification and planning to test it.* Being able to identify what is the question (s) the researcher is seeking to answer helps skill building for improved research activities in the future.
2. *Experience in literature searching.* Every graduate program and many undergraduate programs expose students to search engines and citation capture software.
3. *Analysis and problem solving are essential skills for researchers.*
4. *Additional experience in writing and communications.* This might be in the forms of a submission for journal publication and presentation at conference.
5. *Mathematics calculations and statistical analysis,* even for non-science projects, will provide the researcher with improved means of presenting their results and conclusions. Nonparametric analysis could be used.

Some authors recommend that students submit a research proposal to the managing faculty member (Millspaugh and Millenbah 2004). This might work for graduate students or upper undergraduate students, but this author's experience suggests that first or second year students, either from a four year college or a community college, are not yet experienced enough to produce a document that has much value. This Model recommends a few meetings between the faculty member and the student to sort out what research questions might be sought, and then develop a jointly drafted plan of research to investigate the student's hypothesis. A summary research proposal from this effort will

be beneficial in charting the initial direction for the student. The development of a timetable for the project is also critical (Carmichael 2009).

### ***STUDENT SELECTION & MARKETING***

Student selection is very important. As community colleges have open enrollment, not every student will be good fit for some projects. The faculty member will need to evaluate the student and aspects of working with the faculty member. Some faculty may advertise to students and then select their researcher. Some faculty may prefer to wait and see if any students express unsolicited interest. Nevertheless, a concerted evaluation of the student and their ability to work with the supervising professor is necessary.

The professor might choose to market their research project to students, to increase the selection pool. Marketing helps bring attention to the work in many ways. If an outside agency is involved they may greatly appreciate the public notice of their support. The College's Public Relations Office might assist with promotions of the project. After the research is underway, numerous publicity opportunities may arise.

### ***LITERATURE SEARCH, A FIRST STEP IN RESEARCH IMPLEMENTATION***

Research should not be undertaken without extensive literature searches. The literature search will reveal what is known about the topic and may recommend possible additional research questions to pursue. This search will build the student's knowledge of the researched topic, a critical piece of the research effort. The College library staff is a great resource for the student to use to help with topic queries, especially searching for relevant journal articles. This search should not be rushed; an extensive amount of time (several weeks) might be necessary. Once articles are located and read for relevance, citation information should be captured for future use. Several citation capture software are available to assist in this undertaking. Endnote <sup>TM</sup> is considered the industry leader.

### ***STUDENT SUPPORT & MANAGEMENT***

As the research begins, faculty evaluation of student learning abilities may be important to consider. Grow (2007) said that self-directed student research needs guidance. He states that each student may not be at the same level of self-direction. Grow recommends that the faculty member directing the research should evaluate the student's ability and help them accordingly. Stage 1 Learners of Low Self-Direction will need more "hand-holding" than Stage 4 Learners of High Self-Direction. Grow provides some criteria for identifying these, see in Table 3.

***Table 3 The Staged Self-Directed Learning Model***

	Student	Teacher	Examples
<b>Stage 1</b>	Dependent	Authority, Coach	Coaching with immediate feedback. Drill. Informational lecture. Overcoming deficiencies and resistance.
<b>Stage 2</b>	Interested	Motivator, guide	Inspiring lecture plus guided discussion. Goal-setting and learning strategies.
<b>Stage 3</b>	Involved	Facilitator	Discussion facilitated by teacher who participates as equal. Seminar. Group projects.
<b>Stage 4</b>	Self-directed	Consultant, delegator	Internship, dissertation, individual work or self-directed study-group.

Constant communication between the student and the mentoring professor is critical. If the work is on-site at the college, the faculty member should visit the student's work-site and check progress, providing advice, and answering questions. If the student is working off-site, weekly telephone briefings, at the minimum, are recommended. If a sponsor exists off-site, occasional contact between the faculty member and the sponsor are recommended.

### ***ETHICS IN RESEARCH***

Regrettably, unprincipled researchers occasionally publish unsupported and probably fallacious results. Engaging students in discussions and giving them examples of unethical work may help to establish a level of understanding and honesty that will benefit students as they continue in their careers.

In the sciences, when animal research is involved, it might be necessary to establish an Institutional Animal Use and Care Committee. The purpose of the Committee would be to review the student's research proposal and to consider applicable laws, ethical treatment of animals, and other matters that might have an impact of the home institution and its reputation. In essence the Committee becomes part of the approval process for the student to proceed with their research. Research with microorganisms might also warrant such a review committee. The U.S. Department of Health and Human Services has website information that might help with this (U. S. Department of Health & Human Services 2009). A possible make-up of the committee would be the dean of unit the student is involved with, a faculty biologist not severing as the research advisor to the

student, a veterinarian, and a representative from the local Human Society. Additional information regarding Institutional Review Boards is provided in Addendum D.

### ***RESEARCH FOR ALL DISCIPLES***

It is important to emphasize that this Model is intended for implementation of undergraduate research in conceivably any discipline/curriculum offered at the community colleges. Although this Model may focus on science research, it is believed that any curriculum could support independent undergraduate research. Psychology, computer science, English, history, anthropology, sociology, health, and even mathematics could help student engage in undergraduate research. The topics are really unlimited. Students in every curriculum can benefit from independent student research experience.

The terminal degree for hiring for most community college disciplines is a master's degree. Many who have completed a master's degree did not do independent research when they were graduate students. This Model is offered and especially useful to assist those faculty if they may be unfamiliar with research methods and processes.

### **Resources Available for You**

The Council on Undergraduate Research (CUR), headquartered in Washington, D.C. is the best single source of information on setting-up, management, conducting, and assessment of undergraduate research indicatives. CUR publishes a journal, the *Quarterly*, which presents a variety of topics germane to undergraduate research experiences. They have also published the following helpful pamphlets:

“How to Develop and Administer Institutional Undergraduate Research Programs” by T. M. Hakim. 2000.

“How to Get Started in Research” by T. Godwin, B. Holmes, and K.E. Hoagland. (publication date unknown).

“Undergraduate Research at Community Colleges” edited by B.D. Cejda and N. Hansel. 2009.

Many state academies and foundations may be of great help and should be contacted. In Virginia, The Virginia Academy of Science is such an organization. They also provide Small Grant Funds for small student projects.

## **Challenges for the Administration**

If the College supports that the implementation of undergraduate research is beneficial, that it is feasible, and that it should be pursued, this Model offers some suggestions for consideration to help independent student research occur:

1. Make this document available to interested faculty,
2. Encourage faculty involvement and the sponsorship of undergraduate research with a limited number of students,
3. Provide in-kind support to the faculty for this research where feasible,
4. Make student research mentorship and direction a valued element in annual faculty evaluations,
5. Distribute positive communications to students to consider these opportunities,
6. Support 190 – 299 course offerings

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## Addendum A

### Checklist for Initial Planning of Student Research

- ☐ Draft Research Project Topic & Principle Questions/Topics to Address Documented
- ☐ Tentative Agreement with Administration for Initiate Planning. Does the Faculty Member Have the Time to Do This?
- ☐ Organization Steps & Estimated Timetable
- ☐ Outside Sponsor Agreement Reached if a Part of the Project (especially for internships)
- ☐ Suggested Marketing & Student Selection Strategies Developed
- ☐ Draft Memorandum of Agreement with Student(s) Completed
- ☐ Administration Approval Completed Using the Proposal Approval Form (Addendum B)
- ☐ Course Selection and Course Syllabus Completed
- ☐ Form 05-0002 and 05-0004 Submitted the JSRCC Curriculum Committee if student course credit is sought; approval required before proceeding if course credit is sought. Other colleges may have different forms
- ☐ Selection of Student(s) Completed
- ☐ Memorandum of Agreement Signed by All Parties

## Proposal for Independent Student Research

Instructor: \_\_\_\_\_

Semester the Research Project is to be Undertaken:

Describe the Research Project to be Undertaken:

Describe the Research Objectives, Evaluation & Assessments to be Used:

College Facilities and Equipment Needed for this Project:

Does this research require approval by an Institutional Animal Care & Use Committee? Explain why.

Costs to the College (itemize if necessary):

Timetable/Duration of the Project and Impact of Faculty Time Required:

Number of Students Involved & Their Expected Time Commitment:  
(please attach the draft Memorandum of Agreement to be used with the students and outside sponsor locations)

Course Prefix, Number, Title & Credit Hours: \_\_\_\_\_

Manner of Selecting Students:

NO additional compensation will be awarded to the Instructor for this project. Publishing agreements and distribution of findings will be established in a separate document and are to be approved by the Dean.

APPROVED

NOT APPROVED

DEAN: \_\_\_\_\_

Date:

Supervised Study < SAMPLE > Memorandum of Agreement Page 1 of 2

Research Advisor: R. S. Teacher

J. Sargeant Reynolds Community College (JSRCC)

This independent study research is designed to give the student additional knowledge in \_\_\_\_ < *the subject of interest* > \_\_\_\_, with emphasis on \_\_\_\_ < *fill this in as appropriate* > \_\_\_\_ . The student will be required to learn selected material covered in readings and lecture on \_\_\_\_ < *subject* > \_\_\_\_, master assignments in literature search relative to this project, complete field research activities as assigned, complete a final report on his/her research by August 30, 20 --, and complete all other expected outcomes. The student will work independently with guidance from the research advisor and is expected to complete all assignments by assigned due dates.

The following outlines are expected outcomes from the student:

**PART 1 .....** Complete a Research Proposal / Summary with stated hypothesis and expected methods for this research; such is due one week after the research initiative begins on May 26, 20--. The Research Advisor must approve this document before the actual research begins.

**PART 2 .....** Conduct a complete literature search of published articles and books relative to this research undertaken. The student will submit a “Literature Cited List” to the advisor by the end of the second week after the research initiative begins.

**PART 3 .....** Field data collection of the students project will be conducted in a timely manner, with weekly updates provided to the advisor. All field work and data collecting will be completed by the last week in July, 20--.

**PART 4 .....** Students taking BIO 299 will take two graded tests: one on June 30 & one on July 20, 20--. Content will be explained in a separate document. With the advisor’s evaluation of the student’s progress by July 30, these will form the basis for the student’s course grade.

**PART 5 .....** Student’s final report must be completed and submitted to the advisor by August 30, 20--. This report shall be drafted in a manner similar to published journal articles.

Initials: \_\_\_\_\_

**Student agrees to abide by all state and federal laws involving collection of plant and animal species. Permission to private property, collecting permits on government land, or any other approvals that are necessary must be adhered to.**

**Student agrees to abide by all rules that may exist on field sites.**

**Student may at times be working in the field without advisor at field locations. The student must adhere to good safety practices at all times. This includes, but is not limited to avoidance of dangerous plants and animals, being properly dressed for field work, carrying appropriate supplies such as water, and notifying responsible persons as to your locations and expected return times. Because JSRCC faculty advisor will not always be present in the field, the student must agree to hold J. Sargeant Reynolds Community College and the advisor harmless of any liability resulting from the activities and events in connection with this study.**

**Student must agree to telephone and speak (in person) to the advisor or meet with the advisor every Monday at 4pm for an update and discussion of progress.**

**Student understands and has signed the Learning Objectives (a separate document).**

**It is understood that the student will submit and make a presentation of her/his research at the May 20-- , Virginia \_\_\_\_\_ Conference. The College will pay for the student's travel and registration expenses.**

**If any portion of the student's research is published or becomes a part of a published document by the advisor, the student understands and accepts that the advisor will be the principal author and the student will be acknowledged in an appropriate way.**

**Failure to perform requested assignments, met due dates, or maintain weekly contact during the summer, with the advisor may constitute the student's breach of this agreement, which may cause the student to be terminated from the supervised study initiative and/or affect the student's final grade.**

**The above represents all matters of understand and agreement relative to this research project.**

**Student: \_\_\_\_\_**  
**Printed name: \_\_\_\_\_**  
**Date: \_\_\_\_\_**

**Advisor: \_\_\_\_\_**  
**\_\_\_\_\_**  
**Date: \_\_\_\_\_**

## **Addendum D**

### **Institutional Review Board**

An Institutional Review Board (IRB) functions within an agency or organization as a committee to review research proposals that involve the use of human subjects. Federal regulations require that any research involving human subjects, which is supported by grants or other funds from the federal government, must be approved by a properly constituted IRB. Additionally, various professional and scholarly organizations that are stakeholders in human research have adopted ethical codes affirming the need for research involving human subjects to be overseen by an IRB. Fortunately, procedures for community colleges to follow in forming and maintaining an IRB have been put forth by the American Psychology Association Committee of Psychology Teachers at Community Colleges. A summary of the committee's formal report is available at the APA website (<http://www.apa.org/ed/precollege/undergrad/ptacc/institutional-review-board.aspx>), along with a link to the full report, which includes samples of appropriate IRB forms.

Although establishment of an IRB is generally recommended, not all community colleges will want or need to proceed with this process. Much of the research conducted at community colleges is exempt from the requirement for IRB approval. The protections provided to human subjects by IRBs generally take the form of (a) protecting subjects from exposure to harmful or potentially harmful situations, conditions, or events, and (b) safeguarding the personal information obtained from subjects during the course of the research. When the proposed research project does not infringe upon either of these areas, then IRB review of the research proposal may be unnecessary. A list of exemptions is available within the APA report mentioned above.

Provided by D. Drinkard, August 2010

## Supplement

### **An Example Using this Model & The Final Report for the Chancellor's Professorship**

#### **Introduction**

From 2008 - 2010, I served as the Chancellor's Commonwealth Professor. This award required a project to be completed, and thus the *Model for the Implementation and Engagement of Independent Research by Community College Students* was begun. An opportunity to use undergraduates in my doctoral research, the intent to develop small independent research projects for those students, interconnecting with the student's work with my doctoral research, provided an opportunity to test this Model. My doctoral research is the "Temporal and Spatial Aspects of the Colonization and Re-colonization of Dragonflies in Lentic Habitats." Student involvement in the development and testing of the Model occurred in two ways: 1). Field collection of lotic species of dragonflies, 2). Vivarium construction and operations.

Two students were selected and became involved in their own independent research of dragonflies in lotic habitats (streams) by collecting dragonfly adults for official speciation records. The second project involved the construction of a dragonfly vivarium and its operation to rear larvae into adults. I sought an engineering student (thus making this initiative a co-curricula undertaking) to supervise and facilitate the successful construction and operation of a vivarium. However, no engineering student expressed interest; two biology majors were selected for the vivarium project.

After their research projects were completed, two students prepared and presented their results at the Spring 2010 Annual Meeting of the Virginia Academy of Science, and are published for such. All components of this Model were utilized in the students' independent research. The implementation and outcomes of their research became a field testing of the Model before it is finalized. This testing also serves as an additional evaluation of the Model.

Even though my project was directed by a faculty member at J. Sargeant Reynolds Community College (JSRCC), it has transferable to all VCCS colleges. Even though I am a biology professor, this Model is crafted for more than just the science curriculum, as independent student research might be undertaken in numerous other curricula.

#### **Step # 1 Approvals & Student Selection**

The Approval Form addressed in the Model had not been developed when this project began. Approvals from my dean and other appropriate administrators were achieved, but less formally. Learning Objectives were documented for the research, see Addendum V, to support the approval request. A considerable amount of time was taken for selection of the students. A mailing to 700 science majors at JSRCC was undertaken, advertising the

project. Fifty students came to the briefing, ten students applied, and four were selected. An application form is provided as Addendum W. As noted on the application, students had to list the biology and math completed by the time the research would begin, and I required a completion of BIO 102 and MTH 166. They, of course, had to be in the Associates of Science Program at JSRCC. Each applicant had to complete an essay as part of the application process, so I could assess their ability in writing, an important component in all research. A committee of four adjunct instructors was used to rank the applicants. As the primary investigator, I made the final a selection.

## **Step # 2 Student Agreements & Course Credit**

Perhaps the most important instrument in the Model is the Memorandum of Agreement (MoA) used with each student. A boiler plant agreement is included as Addendum X. A confirmation letter with the MoA became a part of the official records. Each student got to select which team they wished to be on. As it worked out, two were assigned to each team. The MoA mentions course credit options. Three students wanted course credit. Approvals had been obtained for the course to be listed in the College's offering, BIO 299 Intermediate for two credits and BIO 299 Advanced for four credits, see Addendum Y and Z. The College had specific procedures required to achieve approval for these, which I handled prior to the research commencement. Registration was restricted so that I could control such and only the three approved students could register for it.

## **Step # 3 Learning Objectives, Lectures, Literature research & Writing Practice**

The JSRCC Form 05-0002, which establishes the course credit and defined Course Objectives was completed and approved, as noted above. This helped identify what content to cover in the lectures. Only two lecture sessions were provided. Students did have considerable reading assignments to help prepare them for field work.

The four students were required to increase their knowledge of stream and pond ecology. A two hour lecture on each occurred. For the stream lecture they had to read Chapters 1, 3 and 6 in Allan (1995), *Stream ecology, structure and function of running waters*. In addition they had to memorize the terms provided. They were tested on the material. The pond ecology lecture included readings from Chapters 1 and 2 in Bronmark and Hansson (2005), *The Biology of Lakes and Ponds, 2<sup>nd</sup> Edition*. They also had lotic environment terms to memorize. A test was given on this material.

The Literature Search was a very important preparation for their field work and for skills needed in research. Special training by the college librarian was provided, helping the students learn best practices for queries.

Each student was required to complete a writing component. Writing for journal publication is different than other forms of writing. Brevity and clarity of writing were targeted in practice writing assignments. Each student was given an article to read and

then summarize. I selected Knight et al. (2005) article “Trophic cascades across ecosystems,” which is an outstanding aquatic habitat study. This assignment allowed analysis of the article’s data and an understanding of the major points in the article.

#### **Step # 4 Fieldwork & Results**

Prior to going into the field, for which the Lotic Team would be in moving streams, I conducted a detailed safety training for all students. This included water safety, avoidance of poisonous plants, and avoidance of poisonous animals. Other safety tips on sun exposure and dehydration were covered.

The Vivarium Team completed the installation of animal chambers and water circulation in the vivarium. They tested 10 dragonflies in the enclosure, keeping them alive for the test period. Lotic Team surveyed two rivers and two streams and compiled a list of lotic species yet recorded in Hanover County, VA. Both groups efforts will be published in future articles within science journals.

Every research team was assigned a math component to complete. Math is an essential skill all college students need to accomplish whether they like it or not. The Lotic team was asked to calculate the percent of species caught verses the number of species expected to be found. The Vivarium Team was asked to calculate the percent of survivorship during their trial run and the daily food requirement of the dragonfly larvae.

Data analysis became an important next step. The students needed to look at the data and determine what it revealed. The preceding math assignments aided in this. Data analysis allowed them to take the research to the next step in determining the outcomes for the research.

#### **Step # 5 Assessments of the Professorship & the Student Research**

Assessment of the Professorship was considered in two ways. One, the Model was completed and can be used by others in the VCCS system. Second, the independent student research was conducted, but with limited success. The Vivarium Team was less enthusiastic but did complete their assignment. The construction of the vivarium was probably viewed as cheap labor. After the vivarium was up and running they did not show interest in its operation. I perhaps failed to inspire them, and both students did not rise to the challenges and had to be prodded. Selection of the two students was perhaps a mistake, thus demonstrating the importance of using good procedures for selection of the students. The procedures were good, but I made two bad choices. In addition, they did not show interest in presenting their results at either presentation events.

The Lotic Team, on the other hand, was very enthusiastic and did take every opportunity to get in the field for data collection and took every opportunity to present their results. Their attitudes change about field ecology demonstrated by their improved interest in the



topic. Intentions were increased, both students indicate they will stay involved in such research in the future. They definitely increased their knowledge of stream ecology and dragonflies. Skills Improvements were accomplished information collecting, analysis, and problem solving.

### **Step # 6 Deliverables for the Professorship**

The Professorship required some presentation of this project to various public audiences. In April 2009, I presented a summary of the Model at the American Society for Biochemistry and Molecular Biology Annual Conference, which was held in New Orleans (Bell 2009). In April 2010, I made a similar presentation at New Horizons in Roanoke, VA (Virginia Community College System 2010). I will be making a presentation at the Science Peer Conference in Richmond in the Fall 2010. In October 2010, I will be serving on a discussion panel on undergraduate research at the College of William & Mary to discuss undergraduate science research. The theme of the conference is “Creating a culture of research on campus.”

After their research projects were completed, two students prepared and presented their results at two events. These included the Virginia Academy of Science Fall 2009 Undergraduate Research Meeting and the Spring 2010 Annual Meeting of the Virginia Academy of Science, and will be published for such.

### **Literature Cited - Supplement**

Bell, E. 2009. What is going on in New Orleans. ASBMB Today, March. pp 24 – 25.

Knight, T.M., M. W. McCoy, J.M. Chase, K.A. McCoy, R. D. Holt. 2005. Trophic cascades across the ecosystem. Nature. Letters. 437: 880 - 883

Virginia Community College System. New Horizon 2010, Discover What’s Next. pp 36.

Learning Objectives for Biology 299 Supervised Study  
Details of Student Assignments to be Completed

- 1). Students will learn advanced literature search skills and about a software for capturing citations. Students will conduct detailed literature searches relevant to their selected research. Students will engage in group discussions about several articles.
- 2). Students will learn basic ecology terms and concepts, particularly for an aquatic habitat.
- 3). Students will learn identification and life history details for 10 dragonfly species found in Central Virginia. Four species will be lotic and 6 will be lentic.
- 4). Students will draft a hypothesis for their research and a proposal including the draft of a methodology for testing this hypothesis.
- 5). After approval of their Methods document, students will conduct field research and collect the data.
- 6). Students will analyze their data and develop mathematical/statistical analysis of the data.
- 7). Students will prepare a final report on their research. The form of the report will be similar to standard journal publication style.

Student Acknowledgement: \_\_\_\_\_

Date: \_\_\_\_\_

**Undergraduate Research Initiative Application  
J. Sargeant Reynolds Community College**

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

TELEPHONE # \_\_\_\_\_ SIS # \_\_\_\_\_

LIST THE SCIENCE & MATH COURSES YOU WILL HAVE COMPLETED BY  
MAY 15, 2009. ALSO, INDICATE THE GRADE YOU EARNED

DO YOU HAVE PERSONAL TRANSPORTATION FOR TRAVEL TO  
RESEARCH SITES (about 20 miles away)

\_\_\_\_\_ yes \_\_\_\_\_ no

DESCRIBE ALL TIME OBLIGATIONS YOU WILL HAVE THIS SUMMER (jobs,  
courses, family, etc.)

WRITE & ATTACH AN ESSAY THAT WILL INDICATE YOUR:

- Characteristics as a self-starter, self-motivation and an independent worker
- Interest in ecology and outdoor research

LIST FACULTY REFERENCES WHO KNOW YOU WELL: (include contact  
information)

- 1).
- 2).
- 3).

INCLUDE ANY OTHER STATEMENTS AND INFORMATION YOU WISH TO  
ADD

SIGNED: \_\_\_\_\_

DATE: \_\_\_\_\_

Send this document to:  
BY MARCH 13, 2009

Richard Groover  
Biology Department, PRC, P.O. Box 85622,  
Richmond, VA 23285

Supervised Study in Field Ecology Memorandum of Agreement Page 1 of 2

Research Advisor: Richard S. Groover  
J. Sargeant Reynolds Community College

This independent study research is designed to give the student additional knowledge in Field Ecology, with emphasis on aquatic habitats in the Hanover County, Virginia. The student will be required to learn selected material covered in readings and lecture on ecology, conduct assignments in literature search relative to this project, complete field research activities as assigned, complete a final report on his/her research by August 30, 2009, and complete all other expected outcomes. The student will work independently with guidance from the research advisor and is expected to complete all assignments by assigned due dates.

The following outlines are expected outcomes from the student:

**PART 1 ..... Complete a Research Proposal / Summary with stated hypothesis and expected methods for this research; such is due one week after the research initiative begins on May 26, 2009.**

**PART 2 ..... Conduct a complete literature search of published articles and books relative to this research undertaken. The student will submit a "Literature Cited List" to the advisor by the end of the second week after the research initiative begins.**

**PART 3 ..... Field data collection of the students project will be conducted in a timely manner, with weekly updates provided to the advisor. All field work and data collecting will be completed by the last week in July, 2009.**

**PART 4 ..... Students taking BIO 299 will take two graded tests: one on June 30 & one on July 20, 2009. Content will be explained in a separate document. With the advisor's evaluation of the student's progress by July 30, these will form the basis for the student's course grade.**

**PART 5 ..... Student's final report must be completed and submitted to the advisor by August 30, 2009. This report shall be drafted in a manner similar to published journal articles.**

**Initials:** \_\_\_\_\_

**Student agrees to abide by all state and federal laws involving collection of plant and animal species. Permission to private property, collecting permits on government land, or any other approvals that are necessary must be adhered to.**

**Student may at times be working in the field without advisor at field locations. The student must adhere to good safety practices at all times. This includes, but is not limited to avoidance of dangerous plants and animals, being properly dressed for field work, carrying appropriate supplies such as water, and notifying responsible persons as to your locations and expected return times. Because JSRCC faculty advisor will not always be present in the field, the student must agree to hold J. Sargeant Reynolds Community College and the advisor harmless of any liability resulting from the activities and events in connection with this study.**

**Student must agree to telephone and speak (in person) to the advisor or meet with the advisor every Monday at 4pm for an update and discussion of progress.**

**It is understood that the student will submit and make a presentation of her/his research at the May 2010 Virginia Academy of Science Conference at James Madison University. The Advisor will pay for the student's travel and registration expenses.**

**If any portion of the student's research is published or becomes a part of a published document by the advisor, the student understands and accepts that the advisor will be the principal author and the student will be acknowledged in an appropriate way.**

**Failure to perform requested assignments, met due dates, or maintain weekly contact during the summer, with the advisor may constitute the student's breach of this agreement, which may cause the student to be terminated from the supervised study initiative and/or affect the student's final grade.**

**The above represents all matters of understand and agreement relative to this research project.**

**Student: \_\_\_\_\_**  
**Printed name: \_\_\_\_\_**  
**Date: \_\_\_\_\_**

**Advisor: \_\_\_\_\_**  
**\_\_\_\_\_**  
**Date: \_\_\_\_\_**

**J. Sargeant Reynolds Community College  
Course Content Summary**

**Course Prefix and Number: Bio 299**

**Credits: 2**

**Course Title:** Supervised Study in Ecology - Intermediate

**Course Description (including lecture hours, lab hours, total contacts)**

Supervised Study in Ecology assigns problems for independent study by the student incorporating previous instruction and supervised by the instructor. The student will research scientific literature on their selected topic, design a field study to be conducted, assemble and analysis observed field data, and complete a final report on this research. Approximately 10 % of the course will be lecture, with the balance being field studies. Total contacts will be 480 minutes per week for 10 weeks.

**General Course Purpose**

The purpose of this course is to introduce the student to the process of scientific research, conducted in a systemic fashion utilizing the scientific method and concluding with the presentation of a scholarly journal article.

**Course Prerequisites/Corequisites** (*Entry-level competencies **required** for enrollment*)

Students must have completed one year of college biology, that would include Bio 102. Students must have completed College Algebra (MTH 163 or MTH 166), or have faculty approval.

**Course Objectives** (Each item should complete the following sentence.)

Upon completing the course, the student will be able to:

- Understand and implement the scientific method to study biological problems.
- Complete a thorough scientific literature search.
- Utilize experimental design to develop research protocols.
- Collect, analyze and statistically evaluate data.
- Explain data and trends and correlate the data to what is currently known in the field.
- Present the research by writing a journal-level article for possible publication as well as presenting the data at a formal scientific meeting.

**Major Topics to be Included**

- General Ecology concepts
- Natural History of researched organisms
- Animal behavior topics
- Aquatic biology concepts

**Effective Date of Course Content Summary (Month, Date Year):** May 26, 2009

**J. Sargeant Reynolds Community College  
Course Content Summary**

**Course Prefix and Number: Bio 299**

**Credits: 4**

**Course Title:** Supervised Study in Ecology - Advanced

**Course Description (including lecture hours, lab hours, total contacts)**

Supervised Study in Ecology assigns problems for independent study by the student incorporating previous instruction and supervised by the instructor. The student will research scientific literature on their selected topic, design a field study to be conducted, assemble and analysis observed field data, and complete a final report on this research. Approximately 10 % of the course will be lecture, with the balance being field studies. Total contacts will be 960 minutes per week for 10 weeks.

**General Course Purpose**

The purpose of this course is to introduce the student to the process of scientific research, conducted in a systemic fashion utilizing the scientific method and concluding with the presentation of a scholarly journal article. Student will conduct a detailed and complex research project.

**Course Prerequisites/Corequisites** (*Entry-level competencies **required** for enrollment*)

Students must have completed one year of college biology, that would include Bio 102. Students must have completed College Algebra (MTH 163 or MTH 166), or have faculty approval.

**Course Objectives** (Each item should complete the following sentence.)

Upon completing the course, the student will be able to:

Understand and implement the scientific method to study biological problems.

Complete a thorough scientific literature search.

Utilize experimental design to develop research protocols.

Collect, analyze and statistically evaluate data.

Explain data and trends and correlate the data to what is currently known in the field.

Present the research by writing a journal-level article for possible publication as well as presenting the data at a formal scientific meeting.

**Major Topics to be Included**

General Ecology concepts

Natural History of researched organisms

Animal behavior topics

Aquatic biology concepts

Population ecology concepts

**Effective Date of Course Content Summary (Month, Date Year):** May 26, 2009