

**PENGEMBANGAN *VIRTUAL LABORATORY* DENGAN  
MELIBATKAN *INTERFACE WET LABORATORY* UNTUK  
OPTIMALISASI KUALITAS PEMBELAJARAN BIOLOGI MOLEKULER**

**DISERTASI**

**Diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar  
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oleh

**Evi Suryanti  
NIM. 1502426**

**PROGRAM STUDI PENDIDIKAN ILMU PENGETAHUAN ALAM  
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***PENGEMBANGAN VIRTUAL LABORATORY DENGAN MELIBATKAN INTERFACE WET LABORATORY  
UNTUK OPTIMALISASI KUALITAS PEMBELAJARAN BIOLOGI MOLEKULER***

**Pengembangan *Virtual Laboratory* dengan Melibatkan  
*Interface Wet Laboratory* untuk Optimalisasi  
Kualitas Pembelajaran Biologi Molekuler**

Oleh  
**Evi Suryanti**

**S.Si. Biologi FMIPA Universitas Andalas, 1996  
M.Sc. Mikrobiologi FST Universiti Kebangsaan Malaysia, 2001**

**Sebuah Disertasi yang diajukan untuk memenuhi salah satu syarat memperoleh  
gelar Doktor Pendidikan (Dr.) dalam bidang Pendidikan IPA**

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**PENGEMBANGAN *VIRTUAL LABORATORY* DENGAN MELIBATKAN  
*INTERFACE WET LABORATORY* UNTUK OPTIMALISASI  
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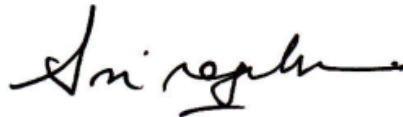
disetujui dan disahkan oleh panitia disertasi:

Promotor



**Dr. Any Fitriani, M.Si.**  
NIP. 196502021991032001

Kopromotor



**Prof. Dr. Sri Redjeki, M.Pd.**

Anggota



**Dr. Riandi, M.Si.**  
NIP. 196305011988031002

Mengetahui,  
Ketua Program Studi Pendidikan Ilmu Pengetahuan Alam



**Dr. Riandi, M.Si.**  
NIP. 196305011988031002

## **Pengembangan *Virtual Laboratory* dengan Melibatkan *Interface Wet Laboratory* untuk Optimalisasi Kualitas Pembelajaran Biologi Molekuler**

### **Abstrak**

Konten biologi molekuler memiliki sifat yang kompleks sehingga dukungan kegiatan praktikum sangat dibutuhkan untuk mencapai penguasaan konsep yang baik. Namun, keterbatasan fasilitas laboratorium menyebabkan praktikum biologi molekuler belum dapat dilaksanakan secara lengkap. Hal ini menjadi dasar dilakukannya penelitian pengembangan *virtual laboratory* yang melibatkan *interface wet laboratory* (VirLab-iWeL) untuk mengoptimalkan kualitas pembelajaran biologi molekuler. Metode penelitian yang digunakan adalah *Research and Development* (R & D) yang mengacu pada model ADDIE (*Analysis, Design, Development, Implementation, dan Evaluation*). Desain penelitian untuk ujicoba I dan II adalah *one-group pretest-posttest design*, sedangkan untuk tahap implementasi digunakan *quasi-experimental design*. Data penelitian dijarah dengan instrumen berupa lembar validasi VirLab-iWeL, lembar kerja inkuiri ilmiah mahasiswa (LKIM), lembar observasi aktivitas, soal kemampuan berinkuiri, soal penguasaan konsep, angket penilaian diri, angket tanggapan terhadap penggunaan VirLab-iWeL dan panduan wawancara. Kegiatan *wet laboratory* yang dilanjutkan dengan kegiatan *virtual laboratory* dengan memanfaatkan fasilitas laboratorium yang terbatas menjadi karakteristik utama dari VirLab-iWeL. Selain itu, karakteristik lainnya yang membedakan VirLab-iWeL dari *virtual laboratory* yang lain adalah ketersediaan fasilitas *interface* untuk memasukkan data hasil dari kegiatan *wet laboratory*, bersifat interaktif, dan ketersediaan informasi atau penjelasan yang terbatas untuk mendukung pembelajaran biologi molekuler dengan strategi *modified free inquiry*. VirLab-iWeL terbukti efektif dalam mengembangkan kemampuan berinkuiri dan meningkatkan penguasaan konsep biologi molekuler khususnya pada topik Isolasi DNA, Elektroforesis gel agarosa dan PCR. Sebagian besar mahasiswa menunjukkan antusiasme yang tinggi terhadap VirLab-iWeL ditinjau dari aspek inovasi, motivasi, efektivitas, dan penyajian praktikum. Disimpulkan bahwa VirLab-iWeL dapat mengoptimalkan kualitas pembelajaran biologi molekuler.

Kata kunci: kemampuan berinkuiri, kualitas pembelajaran biologi molekuler, penguasaan konsep, strategi *modified free inquiry*, VirLab-iWeL

## **The Development of Virtual Laboratory by Involving the Wet Laboratory Interface to Optimize the Quality of Molecular Biology Learning**

### **Abstract**

Molecular biology has complex content, so that the support of practical activities is needed to achieve a good mastery of concepts. However, the limitation of laboratory facilities have caused molecular biology labs can't be implemented completely. Based on the limitation, this research that develops virtual laboratories by involving a wet laboratory interface (VirLab-iWeL) was conducted to optimize the quality of learning molecular biology. The research method used is Research and Development (R&D) which proposes to the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The research design for first and second trials were a one-group pretest-posttest design, while for the implementation phase used a quasi-experimental design. The research data were collected by instruments in the form of VirLab-iWeL validation sheets, student scientific inquiry worksheets, activity observation sheets, inquiry ability test, concept mastery tests, self-assessment questionnaire, questionnaire responses to the use of VirLab-iWeL and interview guidance. The existence of wet laboratory activities before started virtual laboratory activities by utilizing limited laboratory facilities are the main characteristics of VirLab-iWeL. In addition, other characteristics that distinguish VirLab-iWeL from other virtual laboratories are the availability of interface facilities that input the results of data from wet laboratory activities, interactive, and the availability of limited information or explanations to support the learning of molecular biology with a modified free inquiry strategy. VirLab-iWeL proved effective in developing inquiry ability and enhancing mastery of molecular biology concepts, especially on the topic of DNA Isolation, agarose gel electrophoresis and PCR. Most students showed high enthusiasm for VirLab-iWeL in terms of the aspects of innovation, motivation, effectiveness, and display of practicum. It was concluded that VirLab-iWeL can optimize the quality of learning molecular biology.

Keywords: inquiry ability, quality of molecular biology learning, mastery of concepts, modified free inquiry strategy, VirLab-iWeL

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