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<td>作者</td>
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JAIST
JAPAN ADVANCED INSTITUTE OF
SCIENCE AND TECHNOLOGY
A Summary Report of JAIST 20th Anniversary Symposium  
(October 27, 2010)

Yoshio Okamoto (Research Associate Professor, Center for Graduate Education Initiative)  
Mun’delanji C. Vestergaard (Research Associate Professor, Center for Graduate Education Initiative)

JAIST 創立 20 周年記念シンポジウム報告

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フェスターグード・キャサリン・ムンデランジ  
(大学院教育イニシアチブセンター特任准教授)

Japanese Abstract: 2010 年 10 月 27 日に開催された JAIST 創立 20 周年記念シンポジウムの概要を報告する。特に、セッション 2「JAIST の大学院教育の実践と挑戦」における、JAIST 大学院教育イニシアチブセンター客員教授 飯吉透氏による「21 世紀の大学院教育を展望する—高等教育のグローバル化、情報化、オープン化を巡って—」、および、JAIST 理事・副学長 日比野靖氏による「JAIST の教育理念とこれまでの実績」の内容を紹介する。

[Key Words: Globalization, Information Technology, Openness, Graduate Education]

JAIST 20th Anniversary Symposium took place on October 27, 2010 at National Center for Sciences, Hitotsubashi, Tokyo. The morning was devoted to sessions held in parallel in three rooms, one for each school. Also, some faculty members and students gave poster presentations on their own research. In the afternoon, two plenary sessions were organized. The first afternoon session consisted of three invited speeches. The first speaker was Tamotsu Tokunaga, Director-General of National Institute for Educational Policy Research. The second speaker was Terutaka Kuwahara, Director General of National Institute of Science and Technology Policy. The third speaker was Nobuyuki Ouchi, a professional 9-dan shogi player. They discussed the role of education and training for experts from various perspectives.

The second afternoon session concentrated on the future of education at graduate schools, especially in JAIST, which is the main focus of this report.

As the first speaker, Toru Iiyoshi, Visiting Professor of the Center for Graduate Education Initiative and Senior Strategist at Massachusetts Institute of Technology, USA, gave a lecture. The key themes of his lecture were (i) Globalization; (ii) Information; and (iii) Openness. He
discussed how globalization of higher education has made national borders less relevant, mobility of student and faculty has exploded, international collaborations are increasingly common, and international college rankings proliferate. Prof. Iiyoshi stated that with this globalization, researchers, students and educators alike, should be prepared to address research issues that are global in scope, and to participate in research activities that will continue to contribute to cross national and cultural boarders. Examples of collaborative efforts towards this end include joint and dual degree programs, and collaborations.

Prof. Iiyoshi stressed the important role played by the exponential growth of information technology in driving higher education system(s). Among the various ways in which the information technology era have positively contributed, driven and shaped growth in higher education are (i) overcoming the conventional constraints of space, time, and monopoly, (ii) democratization character of information technology, (iii) the growing relative importance of intellectual capital compared to physical or financial capital, (iv) and the ever evolving ways in which we now handle digital data, information and knowledge.

Information technology has also contributed towards openness in education. The three main components for open education (i) open technology; (ii) open content; and (iii) open knowledge were discussed. Prof. Iiyoshi provided a few examples of open education including iLab. iLab technology allows people to access laboratory equipment, and other materials from remote locations.

Prof. Iiyoshi concluded the stimulating lecture, by outlining ways for designing an effective doctoral program. He discussed the role of students, faculty and university administrators. He said students must be responsible, active, and intentional agents in their own education. They should be active and willing participants, and have ownership of their education. Faculty must become familiar with emerging principles and insights that can help guide students from experience to expertise. He said that educators should impart to students an inquisitive mindset, critical thinking, and evidence-based research. The university administrators must support the efforts by, among many activities, (i) providing the resources needed, (ii) joining national and international efforts, (iii) raising the profile of departmental improvement initiatives, and (iv) sending signals about the importance of the quality of doctoral education. The overall message being that real improvement in education must be a joint adventure in which faculty and students are genuine partners.

The second speaker, Yasushi Hibino, Vice-President of JAIST, presented the education system of JAIST and its outcome in the past twenty years. JAIST was founded in 1990. To implement the core concepts of its education, it selected three main fields, namely Information Science, Materials Science and Knowledge Science. It has been hiring faculty members of high-level standard from academia and industry. Modern and up-to-date research infrastructure has been installed, and the curriculum has been arranged in a way that a systematic education can be carried out with an emphasis on coursework. JAIST has also attempted to cultivate people who are to be useful in society. This is reflected to the admission processes in a way that it admits
people from various fields, not restricted to their previous major, and the entrance examination is conducted through interviews only. Prof. Hibino showed some numbers exhibiting this fact. For example, in School of Knowledge Science, the percentage of enrolled students who previously did not major in science and technology is 41.2 (in the master course), and 40.1 (in the doctoral course). Furthermore, looking at the geographic areas from which students came, he showed that the percentage of students from Hokuriku area in 1992 (for the first students of JAIST) was 25.2, but it dropped to 11.1% in 2010. On the other hand, the foreign students occupied only 1.8% in 1992, but it rose up to 11.5% in 2010. This shows a rapid globalization in the campus of JAIST.

Another data was shown to show the outcome of JAIST education. One of the tables showed that JAIST imposes a hard work to students for their qualification. The percentages of students who finally graduated from the master courses are 86.2 (in School of Information Science), 90.2 (in School of Materials Science), and 87.5 (in School of Knowledge Science). For the doctoral courses, the numbers are 74.4% (in School of Information Science), 78.5% (in School of Materials Science), and 72.9% (in School of Knowledge Science). This severe qualification made JAIST possible to send excellent graduates to society. For example, 161 graduates currently teach at universities.

In the latter half of his speech, Prof. Hibino talked about the future of JAIST education. He introduced “the second foundation of JAIST” by education reform. This aims at (1) training of ability that can cope with a rapidly changing society, (2) globalization, (3) quality assurance, and (4) the increase of foreign students. For training of ability that can cope with a rapidly changing society, he mentioned the foundation of “Institute of General Education” in 2011. There, education for liberal arts, global communication and career support will be organized. For globalization, he mentioned the need of people who can work in the international environment. This is based on observations about the change of industrial activities. For quality assurance, he mentioned the support for students to learn actively and autonomously. This also includes the reconstruction of curriculum and the submission of study plans by students with awareness of their future careers. For the increase of foreign students, he raised a goal that the percentage of foreign students in JAIST is to be 30. As shown above, the foreign students occupy 11.1% of JAIST student population in 2010. The following ideas can be part of the implementation toward this goal: dual degrees, scholarship, lecturing in English, supporting foreign students for getting jobs in Japan, mental care for foreign students.

Tetsuo Asano, Director of the Center for Graduate Education Initiative, took a role of the third speaker, and introduced the concepts and the mission of the center. To avoid repetition, please refer to pages 67-70 of this annual report.

The symposium had around 250 participants from inside and outside of JAIST. After the symposium, a reception was held, which activated more discussion among the participants.
Envisioning Graduate Education in the 21st Century: From Perspectives of Globalization, Information, and Openness

Toru Iyoshi, Ph.D. (iyoshi@mit.edu)
Visiting Professor, Center for Graduate Education Initiative
Japan Advanced Institute of Science and Technology

Key Themes
- Globalization
  - Increasing Global Competition in Higher Education
  - From “Brain Drain” to “Brain Circulation”
- Information
  - Strategic Use of Information Communication Technology
  - Visualizing Processes and Outcomes of Teaching and Learning
- Openness
  - Sharing Educational Technology, Content, and Knowledge
  - Promoting Collaboration, Educational Community Building, and Collective Pedagogical Improvement

Globalization of Higher Education

- National borders are less relevant
- Students and faculty mobility has exploded
- Cross-national research collaboration is more common than ever
- International college rankings proliferate

Into Global Brain Circulation

“Meanwhile, many universities in other countries have become more open to the world, thereby becoming cores of the global community. They are creating programs that attract students from around the world and address global challenges in areas such as health, energy, climate change, and the environment.

The international student-faculty-alumni network that these efforts forge is a powerful tool that is crucial for any nation’s future success.

In contrast, only a few universities in Japan are truly international.”

Percentage of International Students (2009)

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<th>MIT</th>
<th>Univ. of Tokyo</th>
<th>JAMST</th>
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<tr>
<td>Undergraduate</td>
<td>9.3%</td>
<td>1.7%</td>
<td>N/A</td>
</tr>
<tr>
<td>Students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate</td>
<td>38.2%</td>
<td>15.7%</td>
<td>19.7%</td>
</tr>
<tr>
<td>Students</td>
<td></td>
<td></td>
<td>24.3%</td>
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Can you make a cellphone change the world? nextlab I Designing Mobile Technologies for the Next Billion Users 6.976, MAS.965, SR716 http://nextlab.mit.edu

Needs for Effective International Collaborations

As future researchers, educators, and leaders, graduate students must be prepared to address research issues that are global in scope and to participate in research endeavors that will continue to develop across national and cultural borders.

International research and educational collaborations, such as joint and dual degree programs and formal and informal research collaborations and exchanges, are key to this preparation, enabling graduate students to directly experience the challenges and opportunities of international research and education.

Technology-Driven Change in Higher Education

1. The exponential place of the evolution of information technology.
2. The Ubiquitous/pervasive character of the Internet.
3. The relaxation of the conventional constraints of space, time, and monopoly.
4. The democratizing character of information technology (universal access to information, education, and research).
5. The changing ways that we handle digital data, information, and knowledge.
6. The growing importance of intellectual capital relative to physical or financial capital in the “new economy.”


Open Research & Open Science

3.96 : Biomaterials: Tissue Interact

Subject Evaluation Report Search Find and view institute- and department-run subject

< Back to Search Results
OPENING UP EDUCATION

The Collective Advancement of Education through Open Technology, Open Content, and Open Knowledge

A Collaborative Publication Project

- How can we advance teaching and learning by taking full advantage of open education?
- A hardcover book + free online distribution with Creative Commons
- 38 chapters by 38 prominent leaders and visionaries (Foreword by John Seely Brown)
- Lessons learned and visions of the future from Intel, AMS, ON, Zeal, Moodle, ETUDES, Campus, YUE, Mellon Foundation, OER, Emergent, OLI, MERLOT, OCLC, Microsoft, Creative Commons, LAMS, Hewlett Foundation, CASTL, VNP, ILMOSTL, Open University, Educause, Carnegie Foundation, and more

Building Common Platforms and Tools

Open Technology Can:

- Promote open innovations (both technical and pedagogical) taking advantage of open standards, open systems, and interoperability,
- Deepen our understanding of better technology-enhanced learning and teaching through the tool design-development-evaluation process, and
- Catalyze new ways of collaboration and interaction in education.

Towards Systemic Advancement of Education

By openly sharing educational tools, resources and practical knowledge of effective teaching and learning, we can anticipate three dramatic improvements over time:

1. Increased quality of tools and resources
2. More effective use of them
3. Greater individual and collective pedagogical knowledge
Dimensions of Teaching and Learning Knowledge

- Pedagogical Knowledge
- Content Knowledge
- Pedagogical Content Knowledge
- Tacit Knowledge ↔ Explicit Knowledge
- Local Knowledge ↔ Global Knowledge

Knowledge of T&L is COMPLEX

To examine, select and organize teaching and learning objects and transform them into visually appealing and intellectually engaging knowledge representation is a daunting task.

KEEP Toolkit Meets Japan: MOST for Collaborative FD

- Available to all universities in Japan
- Built on Open Technology (Java - KEEP Toolkit)
- https://keep.j养老 (.org hosted by Kyushu Univ.)

Towards Collaborative Knowledge Production: Opening Up the Universities

- Level 1: Course Content Exchange
- Level 2: Course Content Collaboration
- Level 3: Course Content Co-Innovation
- Level 4: Knowledge Co-Creation
- Level 5: Collaborative Learning Connection

Designing Effective Doctoral Program

1. Look ahead for the discipline.
2. Identify what a Ph.D. in the discipline must know and be able to do.
3. Construct the goals of the program.
4. Design the program.
5. Collaborative Learning Connection.

Principles for Graduate Student Scholar Formation

1. Faculty members have a responsibility to become familiar with emerging principles and insights that can guide student’s transition from experience to expertise. Moreover, they are responsible for bringing to their work with students the same habits of inquiry and evidence-gathering they bring to their research, asking hard questions about whether (and which) students are meeting program goals and how those goals might be more successfully pursued.
2. Students must be responsible, active, intentional agents in their own learning.
3. Real improvement must be a joint venture in which faculty and students are genuine partners.

Actions by Students
- Become involved in—and help lead—a process of self-study and deliberation about the doctoral program you are a part of: How it works, how well, and how it must change.
- Find occasions and intellectual communities in which you can engage the questions that should be fundamental for any scholar:
  - Why do you want to study this field?
  - What is it about the field that ignites your passion?
  - What do you need and want to learn?
- Seek out powerful learning opportunities.
- Cultivate multiple mentoring relationships and look for ways to make their benefits reciprocal.
- Become involved: Join a departmental committee, host a visiting speaker, or organize a seminar.

Actions by Faculty
- Turn scholarly lenses on the experience of students.
- Have the difficult conversations about purpose.
- Come together with colleagues to say what you seek for your students.
- Use evidence to identify strengths and weaknesses of the program.
- Share results widely.

Actions by University Administrators
- Send signals about the importance of the quality of doctoral education.
- Raise the profile of departmental improvement initiatives.
- Make good ideas from other settings available and visible.
- Look for ways to connect successful innovations in undergraduate programs to work at more advanced levels.
- Join national and international efforts.
- Bring resources and ask for results.
これに加えると、大学院前期課程における教育では、様々な視点の理解は必要で、応用の観点に立つ視点が教育を行う必要がある。応用は、現実の問題を分析しモデル化して理論との違いを解明し、その違いを乗り越えるために必要な能力である。

博士後期課程で求められる国際発表能力を育成できるのは研究室内教育だけではなく、今後の学生を対象としたコース別科目において国際発表能力を育成することは可能だろう。

問題発見能力を涵養するために何にすべきか？
学生の「議論」をどのように支えられるか？
「未解決課題ワークショップ」のような講座を活用する試みの実施

国際的通用性を備えた大学院教育の質保証と修了基準の確立

本論、修士の修了基準は国際共通であるべき。
しかし、全ての大学が同じ修了基準を持つべきか？
各大学がそれぞれ見解の異なる修了基準を持つべきか？
これが大学の個性となる。
問題は、社会が大学の修了基準を受容するか？
重要なのは修了基準を社会に対して明示すること。

dot、修了基準をどのように公表すべきか？
様々な学生が修了基準を満たすかどうかの評価・判断が必要
ポートフォリオの重要性

大学[大学院]の個性

学習目標[Learning Goals]による特徴づけ、
「どんな学生を育てようとしているか？」

学生の学習目標達成に対する組織的なサポートが重要

大学として、どのように学生を指導・助言を行おうか？
そのための組織として何を用意すべきか？
大学として、個々の学生をどのように見守るか？
学生の学習目標達成度をどのように評価・判定するか？

ポートフォリオの重要性

単なる成績管理ではなく、研究室内部指導が含めた形での助言、
助言の効果を確認しフィードバックすることも重要

日本学術会議令22年
「大学教育の分野別質保証の在り方について」

以下を踏まえて、具体的な分野別の質保証の枠組みとして、以下を
主要な内容とする「分野別の教育課程編成上の参考基準」につい
ての考え方を取りまとめた。
① 各学問分野に固有の特性
② 各学問分野に筆差しの特性
③ 各学問分野に多様性の特性

大学院教育においても同様の枠組みが考えられる。
特に、②に対する多様性の特性に関して、大学院では何が求め
られるのかを明らかにすることが重要である（現在では、専門知
識の獲得が基礎）また、大学院では、研究指導に関して
その効果の評価方法を考えることも必要になる。

従来の大学院教育（情報系の場合）

• どの学生がどの大学院で専門性がある。
• 情報学出身の学生、社会人出身学生は少数。
• 教員は学生の知識レベルを考慮している。
• 学科の学習研究の本格として、既に研究に取り組んでいる。
• 自分の研究に関心があるかどうかで講義内容を決める。

学生の関心には関係なく、講義内容を単位取扱うこと

自分の熱意形成の観点に重要。

カリキュラムは、教員が大学院生として必要だと考える知識
単位によって定義、これを講義単位に分かわ

修了に必要な単位数などの事項は学部生が決定されているが、

結果として学生が示されることはない。

• 様々な視点から学ぶために必要な能力が何かの知識が

新たな大学院教育（情報系の場合）

• 多くの学生が学部と大学院で専門性がある。
• 多くの学生が専門性がある。
• 教員は学生の知識レベルを考慮している。
• 学生の関心は講義が講義の内容であること

自分の熱意形成の観点に重要。

カリキュラムは、教員が大学院生として必要だと考える知識
単位によって定義、これを講義単位に分かわ

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• 様々な視点から学ぶために必要な能力が何かの知識が
テーマ：国際化時代の大学院教育の質保証

- 統合大学院教育の実態を知ることが肝要。
- そのためにある課題が発生する。

大学院教育における質保証を検討する方法をどう考えられるか？

大学院教育における質保証の検討に関する課題。

(試験) 問題データベース

<table>
<thead>
<tr>
<th>分野</th>
<th>世界中の試験の問題を収集。</th>
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<tbody>
<tr>
<td>1.</td>
<td>試験問題の難易度を評価することは可能か？</td>
</tr>
<tr>
<td>2.</td>
<td>試験問題の難易度を管理することは可能か？</td>
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</table>

理想的試験問題とは何か？

- 理想的には、同じ程度の難易度の問題を毎年作成することが可能であること。
- そのためには、専門用語の出題を行う。

(試験) 問題データベースの

- 必要性：
- (1) 試験問題作成は大学院教員にとって非常に重要な仕事であるが、良い作成に関して専門的なトレーニングを受けていない。
- (2) 言語に関しても同様であるが、「上手な」教員に関しては様々なFOD活動が実施されている。
- (3) 学生の学習目標達成度の評価において試験は重要であり、それが作成した試験に基づいて実施を行うのは不可能。
- (4) 学生目標達成度の評価という意味で効果的で、しかも難易度が主観的ではない、客観的で一定の基準を満たしているような試験問題の作成が求められている。

理想的な試験問題作成に向けてのアプローチ

教員個人の力だけは限界がある。

- 同様な科目を担当する教員間での協力が重要。

大学院教育イニシアティブセンターの

- 大学院教育における質保証の検討に関する課題。
- 質保証を支える試験問題の評価・改善

(試験) 問題データベースの

- 必要性：

新たな講義支援システム

大学院レベルの講義と大学院レベルの講義の何が違うか？

大学院レベルの講義

- 典型的に、指定の教科書の範囲内で講義が行われる。
- 学生が主に指導者を求めるようになる。

(試験) 問題データベースの

- 必要性：

試験問題は、講義内容の理解度チェックになることが多い。

大学院レベルの講義

- 定期的な更新が必要。
- 学生の教育と意図の変化に適応するものである。

(試験) 問題データベースの

- 必要性：

新たな講義支援システム

web miningの手法に基づいた新たな講義支援
講義に要請する可能性のある本をスキャンで読むことにより、テキストベースに変換することから始める。
講義はアルゴリズムの分野に限定して述べる。
50冊程度のアルゴリズム関連図書をスキャンで入力。
OCRを利用してスキャナに入力した文字を読取る。
テキストはページごとに管理。
講義は戦略単語の出現頻度を求める。
それぞれの単語の出現頻度により、用語の難しいを評価。
講義資料(pdfスライド)のページごとに、その内容と見良くマッチするテキストのページを探すと参考書とする。

キーワード抽出の具体的な手順
1. 教科書をスキャンし、pdfファイルに変換
2. テキストデータから単語を抽出
3. 毎月単語、2単語、3単語を求め、それぞれの単語の出現頻度を計算
4. 要約データベースにおける用語検索
5. 更に教科書の索引に現れる単語は残す

新たな形式の講義設計の流れ
1. 合格学生が有すべき能力を規定
2. そのように学生を教育するのに効果的な教育内容を設定
3. 講義の工夫
4. 理解を深めるための別者の見方を常に示すこと
5. 学びの重要性
6. 質問の重要性
7. テキストレポートの重要性