



THE NEWSLETTER

INTEGRATIVE PATHWAYS

OF THE ASSOCIATION FOR INTERDISCIPLINARY STUDIES

Vol. 38, No. 2 (June 2016)

ISSN 1081 647X

James Welch IV, Editor

IN THIS ISSUE:

• **Julie Klein Wins Team Science Awards**

p. 2

• **Assessing Interdisciplinary Program Outcomes**

p. 3

• **Healthcare Report**

p. 6

• **Approaches to Knowledge: The Play**

p. 13



Integrative Pathways is published quarterly by The Association for Interdisciplinary Studies, Oakland University – Macomb, 44575 Garfield Road (Bldg. UC2, Suite 103), Clinton Township, MI 48038.
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Dissertation written in comics form

Sousanis Wins Awards for Graphic Novel

AIS Member Nick Sousanis's Graphic Novel *Unflattening* has won the 2016 American Publishers Awards for Professional and Scholarly Excellence and Lynd Ward Prize for Best Graphic Novel

Sousanis's doctoral dissertation, which he wrote and drew entirely in comics form at Teachers College, Columbia University, in 2014, was published as *Unflattening* by Harvard University in 2015.

The work has since gone on to receive widespread coverage in such places as the *New York Times Sunday Book Review*, *The Paris Review*, *Publishers Weekly*, and more, and made several Best of Year lists including *Forbes*, *The Independent* (UK), the *New York Observer*, and

Print Mag.

Unflattening was awarded the 2016 American Publishers Awards for Professional and Scholarly Excellence (PROSE Award) in Humanities as well as the sub-category, Media & Cultural Studies. Since 1976, the American Publishers Awards have annually recognized achievements in scholarly and professional publishing. This is the first time a work in comics form has won or even been considered for this award.



Unflattening also received the 2016 Lynd Ward Prize for Graphic Novel of the Year, organized by Penn State University Libraries and the Pennsylvania Center for the Book, an affiliate of the Center for the Book in the Library of Congress.

Continued on page 12

Editor Introduces Changes to Newsletter

Message from the editor:

I'd like to let our readers know about a few subtle changes to our newsletter. Starting with this issue, Integrative Pathways is moving to a regular quarterly publication schedule. The newsletter will come out in March, June, September and December of each year. As always, a pdf of the newsletter will be emailed to all members, followed later by the mailed print edition.

Last year, J. C. Casey, Professor of Communication at the University of Science and Arts of Oklahoma, took over as production editor. Together we have been expanding the content of Integrative Path-

ways to represent the broad scope and diversity of interdisciplinarity. This includes more graphic material, poetry, and fiction, along with content generated by the newly established AIS Sections.

Because the newsletter is also being distributed electronically, we are exploring the possibility of embedding audio and video content as well.

I invite all members to submit appropriate material to me at the email address below. Please put all graphic material into jpeg format.

Thanks!

James Welch IV

Editor, Integrative Pathways

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Klein's Achievements Like Baseball's 'Five Tools Player'

Julie Klein Wins Team Science Award

By Roslyn Abt Schindler
Wayne State University

The 2016 Science of Team Science (SciTS) conference, hosted by the Mayo Clinic in Phoenix, Arizona, featured a number of special sessions.

The overall theme of the conference was constructing an effective knowledge base for effective team science.

The conference built upon the momentum generated by the National Academies of Science report on Enhancing the Effectiveness of Team Science featured at the previous SciTS conference hosted in 2015 by the National Institutes of Health (<http://www.nap.edu/catalog/19007/enhancing-the-effectiveness-of-team-science>).

In a featured session on May 18, former AIS president and recipient of the Kenneth Boulding Award, Julie Thompson Klein, received the 2016 Science of Team Science Recognition Award.

This award honors her vision, dedication, and leadership in helping establish and continuing to advance the emerging field of Team Science.

A member of the SciTS planning committee, Klein also serves on planning boards of the international Network for Transdisciplinary Research, HASTAC (Humanities, Arts, Science, and Technology Alliance and Collaboratory), and the founding editorial board of the National Cancer Institute's Team Science Toolkit.

Klein is currently Professor of Humanities Emerita in the English Department and Faculty Fellow for



Julie Klein

Interdisciplinary Development in the Division of Research at Wayne State University.

In conferring the award, Dan Stokols, Professor Emeritus in the School of Social Ecology at the University of California-Irvine, recounted her qualifications for the Award. They include foundational contributions to conceptualization, study, teaching, and practice of team science.

Klein's scholarly and professional achievements [are likened] to qualities of a "Five Tools Player" in baseball.

In a delightful preface to Klein's keynote address following the presentation of the award, Stokols sketched the intersections of "team science," "interdisciplinarity" and "transdisciplinarity." Stokols, an avid baseball fan, likened Klein's scholarly and professional achievements to qualities of a "Five Tools Player" in baseball.

First, he said, she "Hits for Average," being a prolific contributor of high quality scholarship on interdis-

ciplinary and transdisciplinary team science over several decades.

Second, she "Hits for Power," documented by home runs in the form of high-impact journal articles, chapters, and books that have advanced understanding of interdisciplinarity, transdisciplinarity, team science, convergence science, and, most recently, digital humanities.

In addition, he noted that she has received numerous and distinguished posts abroad in Japan, Nepal, New Zealand, and Switzerland.

Third, in "Throwing Ability," she feeds the ball consistently to teammates while sharing ideas with others to enhance the scholarly efforts of colleagues, students, and partners in numerous professional organizations.

Fourth, she has "Fielding Ability," relaying the ball to other players by spanning boundaries and building bridges, thereby linking team science, interdisciplinary, and transdisciplinary scholars across the globe.

Fifth, she has "Running Speed and Endurance," personifying resilience and endurance.

Even after supposedly "retiring" from Wayne State in 2015, to concentrate on research and writing full time, Klein has not slowed down in productivity and achievement. Moreover, when life has thrown a nasty curveball or a tight inside fastball, she tries to get back up.

Stokols added a Sixth Tool: Julie Klein is a team member who makes fellow players better at what they do, and she is a utility player who can be put anywhere on the field and by her presence enhance team performance through collaboration.

Section on Interdisciplinary Assessment

Assessing Outcomes in Interdisciplinary Programs: A Place to Start

By Evan Widders, Ph.D.

Associate Professor and MDS Coordinator

Eberly College of Arts and Sciences • West Virginia University

As the demands for “outcome oriented education” grow more strident at the federal and state level, it is more important than ever for interdisciplinary studies programs to engage with programmatic assessment.

Providing stakeholders with qualitative and quantitative evidence of the value of an interdisciplinary curriculum is an important strategy for ensuring continued support for your programs. As a faculty member, it may at first seem distasteful to be called on to provide evidence of student attainment of learning outcomes and the post-graduation worth of your program.

Most of us were taught that learning is a higher purpose, worth pursuing for its own sake. But assessing learning outcome attainment and student achievement after graduation does not have to violate these ideals. Well considered assessment agendas contain an internal feedback loop engaging the programmatic and curricular priorities of students and faculty.

As a side benefit, you will also be amassing data to address the concerns of external stakeholders. Done properly, your assessment program will both please

We all know that interdisciplinary programs work, but it helps to be able to prove it.

stakeholders and improve the curriculum, capitalizing on programmatic strengths and diminishing programmatic weaknesses.

For many, the central question is, “where do I start?” Perhaps you feel that your faculty lack the time or resources to create a comprehensive assessment agenda for your program. While I would argue that detailed programmatic assessment is not as time consuming as many would think, particularly once good assessment protocols have been internalized, initiating the process may still seem a daunting prospect.

If you want to begin somewhere, but are concerned about the time and effort needed to cre-

Done properly, your assessment program will both please stakeholders and improve the curriculum, capitalizing on programmatic strengths and diminishing programmatic weaknesses.

ate a comprehensive assessment agenda for your program, a less intensive approach is to familiarize yourself with how large-scale, national, and institutional datasets engage external stakeholder concerns.

The Chronicle of Higher Education, National Center for Education Statistics (NCES) American Association of Colleges and Universities (AAC&U), and your institution’s Office of Institutional Research collect data in dozens of areas. Making use of this pre-collected and sorted data is often as easy as a Google search.

As a demonstration, we can use this approach to briefly explore a set of myths that are near, if not so dear, to our interdisciplinary hearts.

We have all heard the prophecies of the looming death of the liberal arts. Students, the narrative goes, no longer want to pursue majors in cultural studies, the humanities, religious studies and other varieties of interdisciplinary programs focused on the liberal arts. Parents argue that college is too expensive, and an interdisciplinary degree is too risky. STEM, business management, the health professions—

Continued on page 4

Assessing Outcomes for Interdisciplinary Programs

Continued from page 3

these are the fields of the future. Many politicians have shown themselves particularly receptive to calls for “practical” education. If such rhetoric is taken at face value at your institution, it may be used to undermine the liberal arts generally and multi/interdisciplinary studies specifically.

A skeptic of the claimed benefits of “practical” education might ask if the evidence supports the claims of the irrelevance of the interdisciplinary major in the university and in the workforce. Perhaps there is an alternative narrative? Can it be that the critical thinking and rhetorical skills acquired in an interdisciplinary curriculum are in fact more marketable in the workforce than we are being led to believe?

While there are a number of ways in which an interdisciplinary program can begin to collect data and assess the economic value of the degree after graduation, it may be easiest to rely on national statistics to examine the veracity of these claims.

Myth I: The liberal arts, and interdisciplinary studies particularly, no longer attract students.

According to NCES, in 2012-2013, 16.2% of all bachelor’s degrees granted were in the humanities (including multi/interdisciplinary studies) down from 17.1% in 1970-71.

Over the same forty-year period, the actual number of humanities degrees

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granted more than doubled from 143,549 to 297,337. For comparison purposes, the percentage of all bachelor’s degrees that are granted in education has fallen by over 15% since 1970-71, the social sciences, 7%.

In fact, the *Chronicle of Higher Education* reports that between 1991 and 2011, the number of undergraduate degrees granted in multi/interdisciplinary studies increased 137% to more than 42,000 a year. That’s more than the number of degrees granted in the physical sciences and agriculture combined.

Myth II: Multi/interdisciplinary studies majors don’t have the skills the modern workplace demands.

There are multiple reports

... there is broad agreement among employers that all students, regardless of their chosen field of study, should gain broad learning across areas including (1) problem solving with people who have differing views, (2) democratic institutions and values, (3) civic capacity, (4) liberal arts and sciences, and (5) intercultural skills.

documenting the preference of business for graduates who can do more than perform assigned tasks and are able to “think critically, communicate clearly, and solve complex problems.” A 2015 Hart Research Associates survey of 400 employers concluded:

“The majority of employers think that having both field-specific knowledge and skills and broad range of skills and knowledge that apply to a variety of fields is important for recent college graduates to achieve long-term career success at their company.”

Additionally, there is broad agreement among employers that all students, regardless of their chosen field of study, should gain broad learning across areas including (1) problem solving with people who have differing views, (2) democratic institutions and values, (3) civic capacity, (4) liberal arts and sciences, and (5) intercultural skills.

Interdisciplinary studies programs, with their focus on critical thinking and negotiating multiple academic disciplines, are ideally situated to provide students with the skills desired in the workforce.

Myth III: You can major in multi/interdisciplinary studies, but you won’t get a job.

According to a recent report from the Georgetown Center on Education and the Workforce, the lowest unemployment rates among very recent college graduates was 5.4% in education and health, the highest, 13.9% in ar-

Continued on page 5

Assessing Outcomes for Interdisciplinary Programs

Continued from page 4

chitecture. The humanities and liberal arts rated 9.4% as compared to say, 8.2% for computers and mathematics.

The unemployment rate for humanities and liberal arts majors is clearly too high, but it is not necessarily out of proportion to many other degrees. Once the liberal arts graduate has gained some workforce experience, the unemployment rate drops to 6.1%. Add a graduate degree, which many multi/interdisciplinary studies students do, and the unemployment rate falls to 3.9%.

Myth IV: Multi/interdisciplinary studies majors don't make any money.

Admittedly, starting salaries are low. For instance, a 2014 report by the AAC&U places starting salaries for liberal arts majors at \$26,271. But salaries in the sciences and mathematics, a degree encouraged by numerous government sponsored STEM initiatives, was even lower, at \$25,986.

Perhaps more significantly, despite the higher starting salaries of students with professional and

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The unemployment rate for humanities and liberal arts majors is clearly too high, but it is not necessarily out of proportion to many other degrees. Once the liberal arts graduate has gained some workforce experience, the unemployment rate drops to 6.1%. Add a graduate degree, which many multi/interdisciplinary studies students do, and the unemployment rate falls to 3.9%.

preprofessional degrees (\$31,183), by the time peak earning potential is reached at ages 56-60, the liberal arts majors were out earning the professional majors \$66,185 to \$64,149. Multi/interdisciplinary student also appear to outperform other humanities majors in starting salary.

A 2015 salary survey by NCES reported that general studies/ liberal arts degree holders (a category including multi/interdisciplinary studies) earned starting salaries significantly higher than any other category of liberal arts degree.

While national and institutional data doesn't necessarily validate the worth of your multi/interdisciplinary studies program specifically, these reports can be an important tool for demonstrating the value of interdisciplinary studies in fostering marketable skills and creating positive post-graduation outcomes.

Hopefully drawing on national and institutional statistics will provide a gateway to building your own assessment program.

Once you understand the wider trends in higher education, you can begin to measure your own program against the national numbers, collecting data from your

students to assess your program's strengths and weaknesses.

Perhaps you will begin by determining if your program's learning outcomes align with in-demand workplace skills in critical thinking or cultural awareness.

Or you may choose to query student satisfaction with the program and whether graduating students feel prepared to succeed in achieving their goals. You may even engage with post-graduation assessment, surveying graduated students to discover how your employment, graduate school attendance, and salary numbers compare to national averages.

No matter where you choose to start your assessment, you will be generating valuable data on where your interdisciplinary program stands and where it needs to go.

Join the AIS Assessment Section!

This is the first in a series of articles on assessing interdisciplinary programs authored by members of the AIS assessment group. If you are interested in learning more about the group, contributing an article to the series, or would like to be included in AIS-related assessment news and conversation, please consider joining the AIS assessment listserv. For more information email AIS board member Tami Carmichael (tami.carmichael@email.und.edu), the listserv curator, or Evan Widders (evwidders@mail.wvu.edu).

Section on Healthcare and Aging
**When Sciences Collide:
 Social, Statistical, and Health Sciences Research
 that Builds Voice While Informing Policy**

By

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When our research group was contracted by the U.S. Assistant Secretary for Preparedness and Response (ASPR) within the Department of Health and Human Services (DHHS) to develop a cross-population multi-stakeholder informed conceptual model for management of acute unscheduled care in the U.S., we were faced with several problems:

- *How do we utilize what we already know from medicine about emergency and acute care to inform the problem?*
- *What methods could ensure that any policy recommendations to ASPR were the result of evidence-based inclusion of key stakeholder populations that did not always have a voice in the national policy building discourse?*
- *How could we ensure that our research findings and subsequent recommendations could be easily and clearly communicated to a federal agency, under severe*

time constraints, that sought useful solutions to its problem of ensuring that a new and informed light on acute unscheduled care could be used in policy building?

We found that the only way to be successful in our task was to enter into our own interdisciplinary dialogue that would invite emergency care expertise, a social science worldview, and technology that could make visualizing the diversity of concepts and stakeholder perspectives accessible to a federal agency made up of its own diverse stakeholder ship.

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task our sciences collided and emerged as a new way to envision making policy recommendations while giving new voice to important and sometimes underrepresented stakeholders.

The Problem. The U.S. acute care medical system includes a variety of medical settings, including hospital-based emergency departments (ED), urgent care clinics, retail clinics, doctor's offices, freestanding EDs and telemedicine. There is variation in service by condition, service, and time of day for many conditions, including acute time-sensitive issues. This results in highly variable performance within and across stakeholder communities.

The problem precipitated the need for a multi-stakeholder approach for information gathering, combining several methods. During a two-year period (2014-2016) several

Continued on page 7

When Sciences Collide

Continued from page 6

stages of research were conducted with patients, payers, providers, and policy makers invested in acute unscheduled care.

The results were a report to ASPR (Pines, Lotrecchiano, Zocchi, & Lazar, 2015), a publication on recommendations for policy consideration (Pines et al., 2016, in press) and a paper outlining, in detail, the method and its importance to voice and policy building (Lotrecchiano et al., 2016, in preparation).

Stages included a comprehensive review of science and practice literature, online focus groups with different stakeholder perspectives, a concept mapping analysis, expert panel assessment, and comments from the acute care professional public to inform a newly constructed model. The project drew from

these investor sources to develop a conceptual model for the management of acute, unscheduled care that integrates the emergency care system into the broader healthcare delivery system.

What did we already know? A literature review on unscheduled acute care was organized according to the input-throughput-output conceptual model of ED crowding [developed by Asplin et al. (2003)].

The conceptual model of ED crowding is a model of acute care demand and supply and unscheduled acute care a combination of emergency care for the seriously ill/injured and acute exacerbations of chronic disease. Using this model to guide our scoping review (Arksey & O'Malley, 2005), we thoroughly explored the peer-reviewed and lay press material. After completion of the review, we summarized the results as applied

to the input-throughput-output model and identified areas where we thought a more contemporary model was called for. (See Figure 1 below.)

What methods ensured a diversity of voices in the discourse?

Using group concept mapping (GCM) (Kane & Goldman, 2014; Trochim, 1989) as a methodological tool for gathering and collating perceptions about critical concepts for the building of a more informed model, our study informed how acute care systems can be envisioned in the future that accommodated for the diversified demands from the four subsamples that made up our study population, delivered good value, and were resilient for disasters gathered from multiple disciplinary and stakeholder perspectives.

Continued on page 8

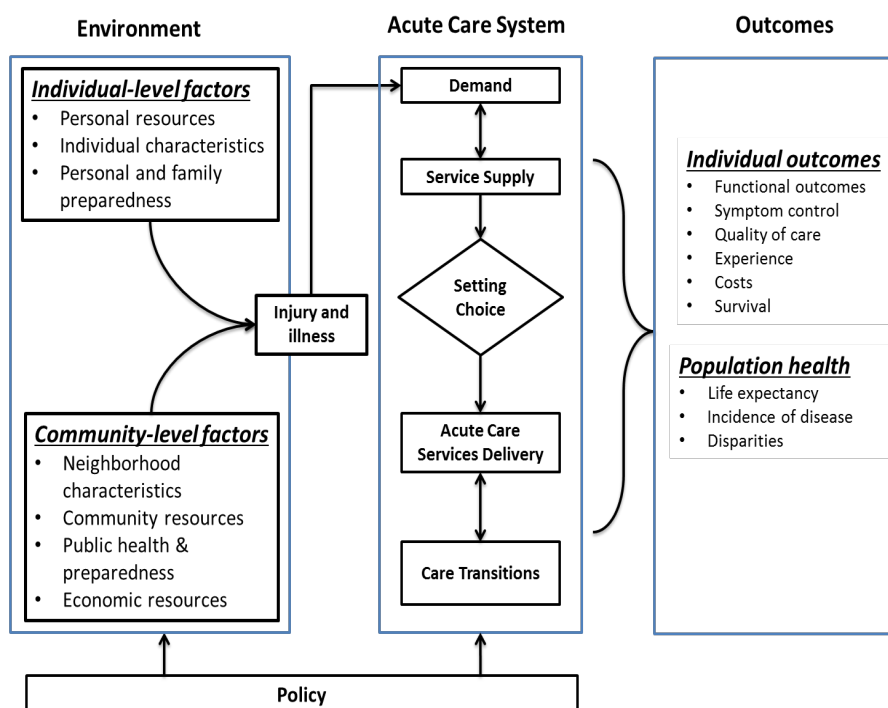


Figure 1

When Sciences Collide

Continued from page 7

In four online and in-person focus groups (one of each type per sub-sample), GCM sought feedback, identified relationships, and articulated priorities from participants. With a single universal focus prompt, “An additional issue that needs to be addressed in this model of acute care management is...,” participants contributed feedback to the prompt. Each participant was encouraged to answer as many times as they chose. Statements were aggregated and all participants were asked to sort and rate statements thereafter.

The process with each focus group was the same, utilizing the main steps of the concept mapping process:

- *Brainstorming* through anonymous answers to the prompt;
- Individual *sorting* of statements gathered from the brainstorming step into related “piles” of information, based on the individual sorts subjected to multidimensional scaling (MDS) to understand the relationship between individual concepts;
- *Rating*, on a scale of importance or centrality of the characteristics for the purpose at hand;

The investigators were able to infer from the cluster outputs major themes of concern by the stakeholder population and degrees of importance of these concerns by subgroup.

Ultimately, the project showed that recommendations to health policy could be grounded in multiple worldviews, serve as a means for developing voice amidst complexity, and be conducted in a systemic and scientific manner utilizing both naturalistic and experimental methods.

- *Analysis* follows that produces *Maps, Clusters, and Labels* of the knowledge entities providing visualization of relationships based on clustering of statements of greatest shared meaning shown in proximal spatial relationship.

CSGlobal Max™ software (www.conceptsystems.com) was used within each of these steps to organize the data. The investigators were able to infer from the cluster outputs major themes of concern by the stakeholder population and degrees of importance of these concerns by subgroup. These data ultimately informed a national participant technical expert panel (TEP) about the development of the finalized model. In Figure 2 (page 9), we outline the process utilized.

How did we ensure that our findings could be used in policy building? Visualization of findings was key to being able to communicate what otherwise could be considered a complicated maze of data to decision-makers who valued brevity and concision. This is where the visual characteristics of the method were particularly helpful. In Figure 3 (page 10), you will see how we were able to coalesce the thoughts and needs of different stakeholder with a wide variety of worldviews into an organized matrix of meaning. Each of the different domains captures the statistical relationship of ideas. Within each domain, a “constellation” of

ideas represented the outstanding needs of the various voices being consulted in a relational way.

From this visual vantage point, we could more specifically identify how the different stakeholder groups compared to each other in thought and need for the further development of a more advanced model that captured multiple viewpoints and stakeholder considerations. These “go-zones” gave us, the researchers, the needed evidence to suggest a newly improved conceptual model based on real data that our funders could understand while keeping true to the real social research that we were conducting.

The result was a useful visual representation of multiple voices, grounded in evidence, in a conceptually appealing manner for our funder. In addition, we were able to extrapolate a series of recommendations for policy building and culture change from these analyses that spoke specifically to the needs of all stakeholder involved (Pines et al., 2015).

Our final model (Figure 4, page 11), though seemingly more complex than the original version, yielded greater input by stakeholders with a greater variety of worldviews, captured not only conceptual thoughts and challenges in the system but definitions and alterations to the systems based on various specific concerns brought up

Continued on page 12

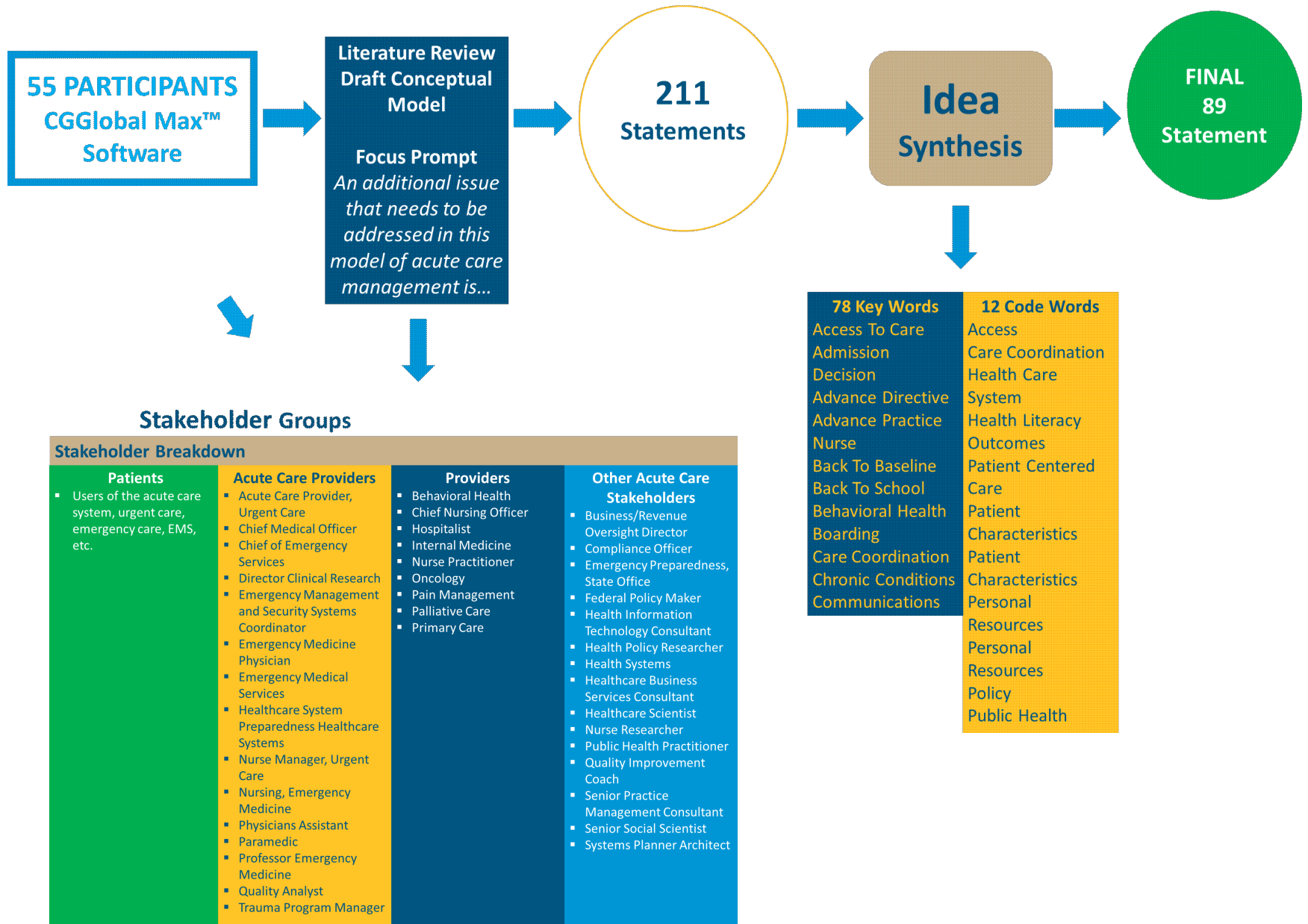


Figure 2

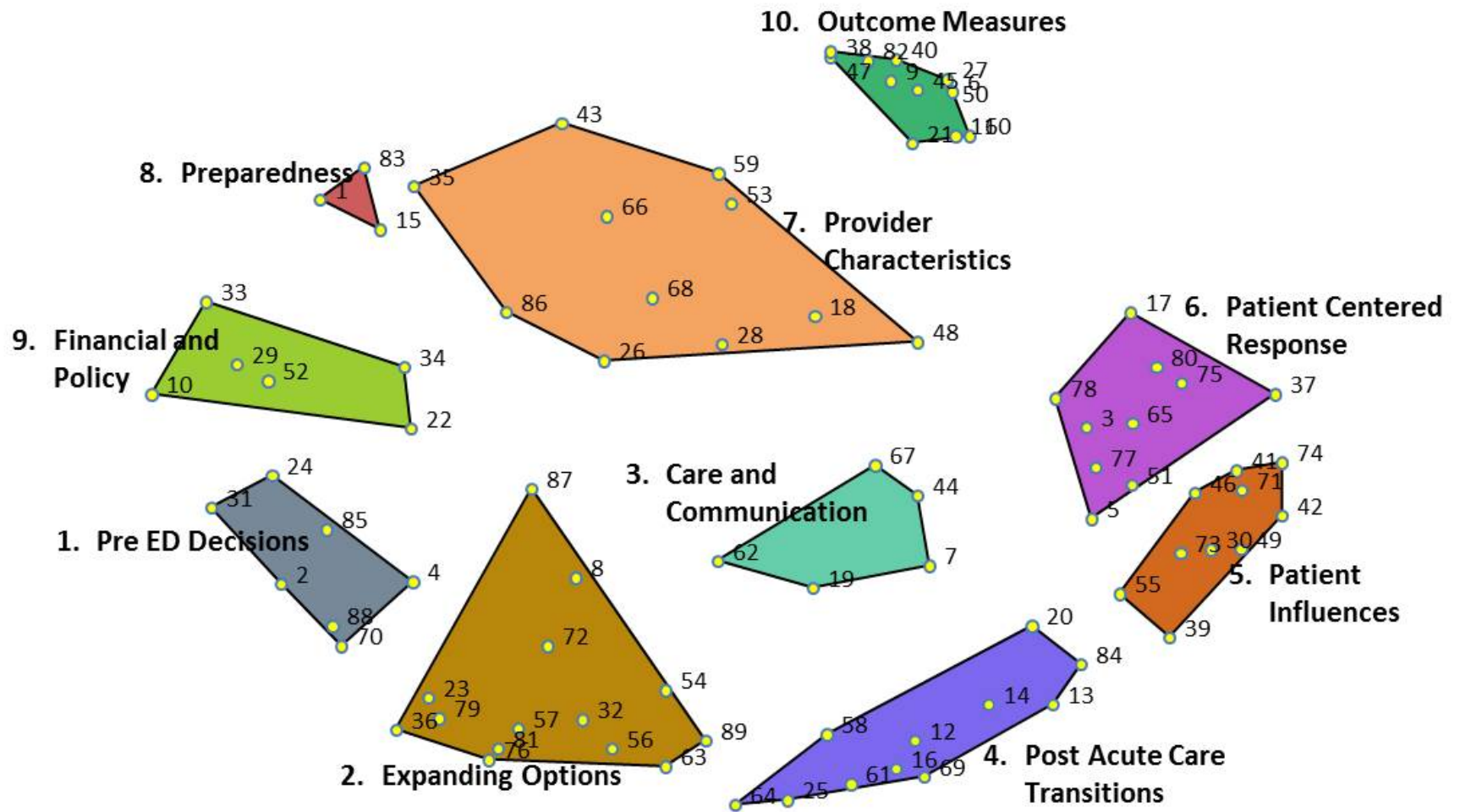
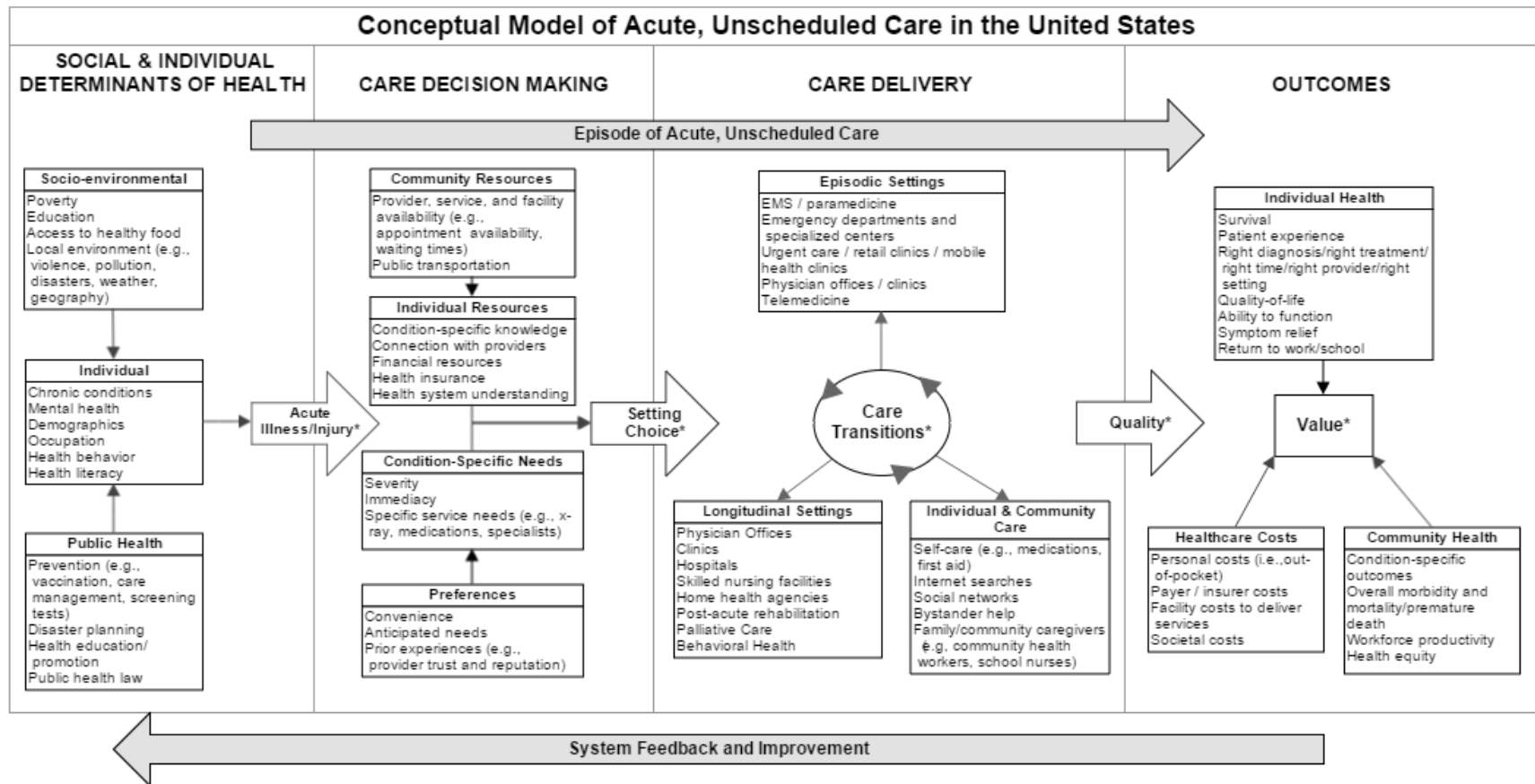


Figure 3



- * **Acute Illness/Injury** - The likelihood of a person experiencing an acute illness or injury is determined by social and individual health determinants, public health measures, and socio-environmental factors. Acute illness / injury includes debilitating medical illness (e.g. influenza, pneumonia, or myocardial infarction), acute injuries (e.g. hip fracture), exacerbations of chronic diseases (e.g. heart failure exacerbation), acute mental illnesses (e.g. severe depression or psychosis), and/or effects of substance abuse (e.g. intoxication).
- * **Setting Choice** - Setting choice is determined by both individual and community resources (e.g., provider and facility availability when patients are ill/injured), personal preferences (e.g., convenience of the setting), and the condition-specific needs (e.g., resources needed to diagnose and treat the patient). Setting choice can be determined by the individual experiencing the acute illness/injury, family, friends, and EMS.
- * **Care Transitions** - Care transitions refers to the movement of a patient's care and information between different health care settings (e.g. episodic to longitudinal) and home (e.g., self care and management). Also includes the provision of a care plan to patients, patients' understanding of the care plan, and mechanisms to communicate the care plan across settings.
- * **Quality** - Healthcare quality including the following Institute of Medicine domains: safety, effectiveness, patient-centeredness, timeliness, efficiency and equity. (IOM). Healthcare quality results from the care that was delivered and impacts healthcare outcomes.
- * **Value** - Value is defined as achieving the best possible individual and community outcomes per cost outcome (e.g., health dollar spent).

Figure 4

Sousanis Wins Awards

Continued from page 1

The jury recognized the work's interdisciplinary nature, calling *Unflattening* "an innovative, multi-layered graphic novel about comics, art and visual thinking. The book's 'integrated landscape' of image and text takes the reader on an Odyssean journey through multiple dimensions, inviting us to view the world from alternate visual vantage points. These perspectives are inspired by a broad range of ideas from astronomy, mathematics, optics, philosophy, ecology, art, literature, cultural studies and comics.

"The graphic styles and layouts in this work are engaging and impressive and succeed in making the headiest of ideas accessible.

"In short, 'Unflattening' takes

sequential art to the next level. It takes graphic narrative into the realm of theory, and it puts theory into practice with this artful presentation of how imaginative thinking can enrich our understanding of the world."

Named for the author of early twentieth century wordless woodcut novels which retroactively have been considered to be the first graphic novels, this award is presented annually to the best graphic novel, fiction or nonfiction, published by a U.S. or Canadian citizen or resident, and is accompanied by a \$2,500 prize and a two-volume set of Ward's six novels, which will be presented to Sousanis at a ceremony at Penn State University in the fall.

Finally, Sousanis is also nominated for an Eisner Award for Best Scholarly/Academic Work. These

awards, seen as the comics industry's equivalent to the Oscars, are named for comics legend Will Eisner and since 1988 have been presented for creative achievement in American comics. Winners will be announced at Comicon in San Diego in mid-July.

Pages from *Unflattening* have also been displayed in international solo exhibitions, including a solo show in Moscow and a show called "Educating Interdisciplinary" that began at Utrecht University in the Netherlands and traveled to the University of Amsterdam, overseen by AIS President Machiel Keestra.

Sousanis is currently an Eyes High postdoctoral fellow in Comics Studies at the University of Calgary. This fall, he will begin as an Assistant Professor in the School of Humanities and Liberal Studies at San Francisco State University.

When Sciences Collide

Continued from page 11

by the participants.

The final model is richer in diverse expressions and viewpoints. In addition, it satisfied the needs of the researchers and funders and communicated our findings in a way that decision-makers could understand and used evidence-based research to inform policy building.

Ultimately, the project showed that recommendations to health policy could be grounded in multiple worldviews, serve as a means for developing voice amidst complexity, and be conducted in a systemic and scientific manner utilizing both naturalistic and experimental methods. The collision of these sciences resulted in an in-

terdisciplinary approach to policy building true to humanistic and organizational needs.

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Section on Arts and Humanities

Approaches to Knowledge: The Play

By Carl Gombrich
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Publisher's Note:

Because of space limitations in the newsletter, this play will be published in two parts. Part I appears in this issue. Part II will appear in the September issue.

Author's Note

This play is intended as a pedagogical tool for 1st year undergraduates on a Liberal Arts and Sciences programme.

Because it is written for a course called "Approaches to Knowledge" on the Arts and Sciences BASc at University College London, part of its mission is to teach about exactly that: different approaches to knowledge. But this might be a rather vague phrase, so let me clarify.

There are at least three premises—or presuppositions—that the play aims to problematize:

- *That any particular discipline, or "approach to knowledge," is more foundational (and thus "important") than any other;*
- *That knowledge itself is best thought of in "disciplinary" terms;*
- *That approaching problems through single disciplinary lenses may be the most productive way to advance knowledge.*

Readers of the play may find other uses and other premises which are being problematized. For example, a discussion of "reductionism" may also be lurking not far below the surface...

In the play, each character (an academic) argues that, in some important way, their discipline is more "foundational" and therefore of more epistemological or societal importance than other disciplines. (These two rather different claims are conflated here and may be

teased apart later.)

The discussion is lightly mediated by a "Conference Organiser" who, throughout most of the piece, does not have a view on the matter but is open to being persuaded by any of the academics.

In the end, however, the Conference Organiser wonders if this claiming of priority is the most helpful way to approach a discussion about knowledge. He offers the possibility of a different, higher perspective in which all disciplines are valued, all can be problem-focused, and none can claim unproblematically to be foundational.

The "problem-focused-ness" of the Conference Organiser can, of course, be problematized, too, but I have found this an attractive way to introduce 1st year undergraduates to the potential value of interdisciplinary study and research.

Further issues and topics for discussion may arise. In a metaphysical light, one can discuss whether the play shows, indeed, that there is no such thing as "foundational knowledge."

Perhaps all knowledge is somehow interconnected and interdependent, but in a non-hierarchical way? Such a view can naturally give rise to problems associated with relativism—and this can be a spur for further discussion.

But this view may also reflect a modern sensibility about the best way to approach the world, driven

in part by the importance of democratically respecting different viewpoints and in part by the complex and multifarious nature of many of today's problems in science, politics, ethics and so on. Such a conversation is often in evidence when discussing problems of interdisciplinary working.

For wider pastoral purposes which overlap with some of the teaching aims of many liberal arts and sciences courses, the play may also give food for thought to students as to how best to approach their own studies, expand their abilities in perspective-taking and crossing academic boundaries, and for how they may work more effectively in multi- and inter-disciplinary teams.

To date, the play has been performed three times in a lecture theatre—once with professional actors situated among students in the audience, and twice with students taking the lead roles.

The students came up with many interesting and entertaining accents for the academics and the characterisation is deliberately left open to interpretation. Various small props were used to point the different disciplines: hard hat for engineer, skull for neuroscientist, etc.

The play can also be read as part of a seminar, which affords the advantage that the material can be analysed more closely.

Continued on page 14

Approaches to Knowledge: The Play

Continued from page 13

Characters

| | |
|----------------------|--------------------------|
| Conference Organiser | Dr. Politics |
| Prof. Neuroscience | Dr. Geography |
| Prof. Physics | Dr. Anthropology |
| Prof. Mathematics | Prof. English Literature |
| Prof. Linguistics | and the Arts |
| Dr. Philosophy | Dr. Medicine |
| Prof. Engineering | Prof. History |
| Dr. Economics | |

The Scene

The large lounge of a conference venue, somewhere in the world. Tables and chairs are arranged ballroom-style or lecture theatre style.

Conference Organiser: Welcome, ladies, gentlemen, student delegates. It's a pleasure to see you all here today at the beginning of our conference: "How to change the world: Which discipline is most important for the future of humanity and the planet?"

Now tomorrow is our first formal session in the main hall, but I thought, before you all give your formal presentations, we might use this opportunity to get some ideas going, something to sleep on before we start tomorrow. Professor Neuroscience, you look as though you would like to say something already...

Professor Neuroscience: You know everything we do, everything we perceive and, of course, everything we think about is mediated by the brain. That is, I know, a truism, but it needs repeating. People forget. As I sit here now and talk to you, the auditory messages impact on your ears, go through the nerves and up into your brain where they are interpreted by the higher centres of thought in the frontal cortex.

You are looking at me: what you see comes in through your eyes onto your retina, from where the messages are sent up to your brain and interpreted. You are thinking about what I say. These thoughts about my words and my appearance impact on you, they have meaning. Some might irritate you, others amuse you or even make you happy. All these sensations, thoughts and feelings happen in your brain. Even your deepest emotions and your values emerge from your brain.

Understanding our brains and thus gaining knowledge of how our minds work is the most important thing we, as humans, can now do; without this knowledge we cannot hope to progress as a species. Everything in the wider world on which our progress depends (climate change, economic reform, establishing the political structures for peace) rests ultimately on human behaviour and that, ultimately, depends on our brains. Understanding this pivotal part of who we are is the final frontier of human exploration and the most important area of human activity.

Professor Physics: You know, I hear these things you say, but you really miss the point. [*Stands and turns on .ppt slides of cosmos and sub-atomic particles*]. Because, at bottom, you can only analyse the brain in terms of chemical and biological things. Neurons in the brain are little pieces of matter which transmit electrical currents. And, as you know, chemicals are responsible for sending messages across the millions of synapses that occur in the brain where neurons connect. All that living tissue, the tissue of the brain, is biological stuff made of chemicals. And what are chemical and biological things? Well, ultimately, they are physical things – molecules and atoms - and can be explained in terms of physics.

Physics is the most fundamental science. In the material world—and, I take it, we do think the brain is part of the material world?—in the material world, all reduces to a knowledge of physical materials and processes. It is by probing the deepest levels of matter—fundamental particles, electrons, quarks, gluons—and the forces that work in the interactions of these things, that we come to have knowledge of the ultimate nature of reality, of which our brains are just a small part. It is by studying physics that we will understand our origins and the origins of the universe itself. There is nothing more important, nor, indeed, more noble than that.

Conference Organiser: My learned colleagues, I must thank you for kicking off this discussion with such interesting examples. (By the way, please don't be shy: if you need a drink do go to the bar—there'll be plenty of time to catch up with what's going on here. [*Goes to turn off .ppt slides*]. You have both

Continued on page 15

Approaches to Knowledge: The Play

Continued from page 14

made a good case for your discipline being of primary importance, but I would like to ensure that all our colleagues have a chance to speak; Professor Mathematics, you look a bit troubled by what you have just heard.

Professor Mathematics: Yes... You know I hear you, my physics friend, but you are forgetting something. You know, really, as well as I do, that physics is just applied mathematics. All work in physics is written in mathematical equations. As the great physicist Galileo said: the universe is written in the language of mathematics. But it actually goes further than this. The mathematician Eugene Wigner spoke of the “unreasonable effectiveness of mathematics in the Natural Sciences”—and by this he means this almost miraculous connection between the mathematics we do as an abstract study and the way we can use it to do our science and gain knowledge of the world. It seems that the deepest laws we know of can be formulated mathematically.

Why is this? Well, we don’t really know. It is a truly beautiful and wonderful mystery about which many have conjectured. But it seems clear that maths is in some ways the “king” of all subjects. It leads physics which in turn, as you have rightly said, leads other sciences. It is thus the rock of everything foundational in science.

It is now well established that many results in very pure mathematics turn out to have deep and valuable connections with the real world. It is true that sometimes it takes many decades for us to see how pure mathematics research can be applied to real world problems. But again and again it happens. Mathematics born of pure research comes to have startling and powerful applications in science and technology.

As I say, we don’t know why this is, but it points strongly to the fact that mathematics is the deepest and most important of all human activities. Mathematics leads all science, and science is not only our best description of the universe but leads all technological and economic progress. Gaining mathematical knowledge is thus the most important thing we can do.

Professor Linguistics: My mathematics colleague, you talk about forgetting things and you criticise our physicist friend for that, but you cannot see the wood for the trees you walk in—you have missed the truth under your nose!

Everything you have just said, every point you have made and have wanted to make has been transmitted through language. You cannot even approach your physics or your neuroscience without understanding language. Even—perhaps most obviously—mathematics is a language. Indeed, there are no mathematical equations that cannot, at least in principle, be written out in the ordinary language of speech. [*Goes to board, writes out “x squared equals four”*]

See?! Every mathematical equation can be written out just like ordinary language.

Continued on page 16

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INTEGRATIVE PATHWAYS

Approaches to Knowledge: The Play

Continued from page 15

The meaning of what you want to convey is inextricably bound up in the language you use—and that meaning itself depends on there being some order, some rules—what we might call “syntax” in that language. How this syntax relates to our sense of meaning, our “semantics,” remains a fascinating problem to be addressed by computer scientists, linguists and philosophers. But none of these camps would deny that language is central to our understanding.

Unless we are able to understand and elucidate the fundamental nature of language we will be stuck in “ways of describing” things; we will get no nearer understanding the ultimate nature of the brain nor physical reality nor even mathematics. A deep study of linguistics and a knowledge of language in its widest sense are therefore fundamental to understanding human thought and our interaction with the world.

To be continued in September Issue

About AIS

The Association for Interdisciplinary Studies is the U.S.-based international professional association devoted to interdisciplinary teaching (including service learning), research, program administration, and public policy. Interdisciplinarity integrates the insights of knowledge domains to produce a more comprehensive understanding of complex problems, issues, or questions. AIS serves as an organized professional voice and source of information on interdisciplinary approaches and the integration of insights from diverse communities to address complex problems in education and research. Founded in 1979, it is incorporated as a non-profit 501(c)3 educational association in the state of Ohio.

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