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## Revisiting an Integrated Health Informatics and Technology Curriculum Model

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**Abstract:** The shortage of health information technology workforce is quite significant in the health industry. The traditional education approach may not be effective enough to train college students to be an HIT workforce that requires both academic knowledge and extensive hands-on experiences in both healthcare and information technology. This paper presents an Integrated Health Informatics and Technology Curriculum Model to collapse the campus boundaries between regional Intermediate School Districts, Community Colleges, and a Four-Year health informatics and information management program to support expedited education with sufficient hands-on experiences in health informatics and technology. This model has been pilot tested by the Health Informatics and Information management Program at Western Michigan University. Early findings are very positive. More study and promotion of this curriculum model shall be continued.

### 1.0 INTRODUCTION

The lack of qualified health information technology (HIT) workers, whether perceived or real, is an urgent and legitimate concern for many healthcare stakeholders (e.g., hospitals, EMR/EHR consulting firms). A recent survey conducted by *HIMSS Analytics* shows the demand for qualified HIT workers is as high as it has ever been, and is projected to continue in the foreseeable future (HIMSS Analytics, 2014). Unlike other industries, healthcare is quite unique and service-driven. Most importantly, healthcare services spread across multiple disciplines and are delivered by professionally trained clinicians and technicians with a variety of knowledge and skills in HIT that is far beyond those normally required for any single discipline (e.g., nursing, marketing, etc.) in higher education (Fenton *et al.*, 2013). Moreover, similar to many health science disciplines, employers in healthcare expect the entry-level HIT workforce to have a certain degree of field experiences (e.g., clinical hours or practice) in, and understanding of, the healthcare environment before they join the organization and begin working with clinical professionals. Therefore, a blended knowledge and skills in *health informatics* and *information technology* are not only essential, but require solid academic preparation for a college HIT graduate to be qualified for employment, whether earning an associate or a bachelor degree. This finding has been echoed by many studies for more than a decade, e.g., Buensed (2010), Jackson (2013), and Burrows (2014).

Due to the unique nature of the healthcare industry, having hands-on experiences, via field trips or real-world internships, becomes an integral part of the learning process for students with a career interest in health informatics and information technology. With the emergence of HIT programs and the increasing demand for entry-level HIT workforce, there is an influx of students entering these programs who do not have any clinical backgrounds or sound training of information technology, then “*how shall these individuals be prepared to succeed with proper training and experiences before they enter the real world?*”

¶This, which in fact, is the research question of this paper. Given the more than tripling of college tuition over the past 25 years (Lorin, 2014) and, the need for more hands-on experiences, field internships will not be possible for everyone, yet will very likely delay the completion of defined coursework and ultimately, the graduation. Thus, it will not be economically feasible, or timely possible for us to employ a traditional curriculum model (i.e., a four years high school and a four-year collegiate curriculum – whether online or in-place) to tackle the problem highlighted by our research question. Any resolution proposed (to be detailed hereinafter) must assure that students will acquire hands-on and field experiences as soon as students identified their career interests or, at the very least, in parallel with

their study throughout the learning process, which may occur continuously from the beginning (when career interests identified) to the end (when college degrees conferred). Most of all, the whole learning process will ensure the newest generations become highly employable to join the health industry at affordable costs.

In this paper, an Integrated Health Informatics and Technology (IHIT) Curriculum Model is presented to demonstrate how education resources can be virtually combined and coordinated across campuses, from regional intermediate school districts to community colleges to a four-year university, to expedite the preparation of the HIT workforce for the unmet market demand in the healthcare industry. While this model mimics early educational proposals recommended by the National Center for Public Policy and Higher Education (Policy Alert, 2004) and by the National High School Center (Bangser 2008), our curriculum model reflects the conceptual framework that can be fulfilled through actual teaming with resources that are already available in the community (Carroll *et al.*, 2010).

The paper is organized in the following manner. The next section, section Two provides a background of our IHIT curriculum model – its major stakeholders and how it can be accomplished through teaming with teaching and learning of juniors and seniors in regional high schools to graduates from regional community colleges, and, if academically desirable for better career preparation, to the completion of a bachelor degree from a four-year higher education institute that offers a comprehensive IHIT undergraduate program. Section Three presents the infrastructure of the IHIT curriculum model with some highlights on how teaching of courses and learning of IHIT subjects can be started in junior/senior years at a regional intermediate school district with some dual enrollment of courses that can be credited toward high school graduation, the earning of an associate degree, and finally, a bachelor degree from a four-year university. Section Four gives a quick revisit of our developed IHIT curriculum at Western Michigan University. In specific, it highlights the growth of this majors at WMU along with anecdotal data and career placements of our early graduates from this new undergraduate major. Section Five summarizes lessons learned with additional discussion on challenging issues, and the final section concludes our findings from pilot testing of the proposed IHIT curriculum model.

## 2.0 BACKGROUND

As maintained by the findings from Carroll *et al.* (2010), “education is frequently fragmented and disconnected: professional development is not aligned with student and teacher needs, curriculum is not aligned with assessment, and standards are not aligned with curriculum.” This fragmentation prevents any substantial education reform from taking place because change in one area do not affect another. Collaborative teaching could bridge these gaps, but the reality is that today’s teachers work alone.” This finding is not new and, in fact, was well recognized in higher education (Evans & Malina, 2014) due to the specialization of disciplines and subsequently the formation of educational silos that prevent coordination and sharing of teaching resources.

Despite governmental initiatives such as the American Graduation Initiatives, *No Child Left Behind* and *Race To The Top*, far too many failed and we are left with a post-secondary population unprepared for the workforce or successful transition to postsecondary education (e.g., associate or bachelor degrees) and entry into an ever more competitive and technological employment (Bangser 2008; Barnett, *et al.* 2012; Johnson 2015). In addition, the skyrocketing increase in higher education (Lorin 2014) has further created financial difficulties for high school students to access to advanced education opportunities to complete their college education, let alone their readiness toward the future workplace. Hence, it is time that a new curriculum model shall be employed such that it will achieve the following goals:

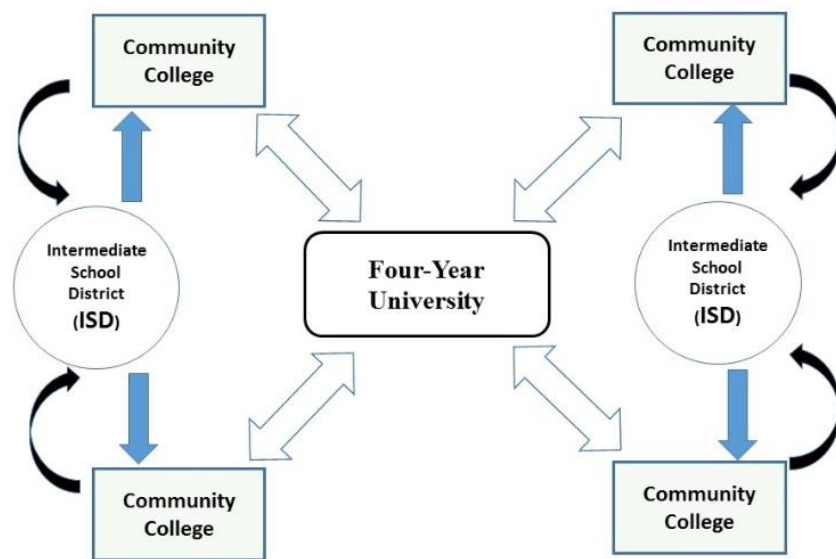
- Eliminate discipline silos to prepare students with blended knowledge and skills
- Offer an integrated curriculum plan that will promote effective teaching and learning necessary knowledge and skills to get students ready for the future workplace
- Permit “virtual” sharing of teaching resources that will establish an education pipeline, i.e., support students’ learning of required knowledge and skills - whether to join the workforce in time or to advance their education to seek higher degrees for better career achievement.

The above three goals are generally applicable to all careers, but are even more true and critical to the new workforce to join the healthcare industry, which is currently faced with a shortage of employees with HIT training. As addressed earlier, the healthcare industry is quite different from others. It is service-driven and services are delivered by

professionals that are multi-disciplinary with a variety of specialties and licensures. Any employee plans to join the healthcare industry will need to have the following knowledge, skills, and experiences (Falan & Han, 2011):

1. Understanding of healthcare (e.g., medical environment, culture, terminologies, etc.)
2. Basic sciences (e.g., statistics, biology, anatomy, etc.)
3. Medical applications (e.g., EMR/EHR, etc.)
4. Computing and technology (e.g., system modeling, database, data analysis, etc.)
5. Healthcare administration (e.g., finance management, resource planning, etc.)
6. Hands-on experiences (e.g., field trips, hospital volunteers, internships, etc.)

Of these, the first five are related to the coursework that may be taken by students once they have shown interests in joining the healthcare industry. Nevertheless, knowledge and skills learned from the coursework are only essential, but not sufficient, for students to be ready for their career placement. The last component (i.e., hands-on experiences) is relatively crucial and could become the deciding factor, especially in healthcare, if a student is able to obtain an internship or a full-time position from a healthcare organization. This, in fact, was recognized by our experiences (to be detailed later). How can all these knowledge, skills, and experiences be acquired by a student who would like to consider HIT as his/her academic major in order to become the new workforce for the healthcare industry. Compared to other disciplines, the HIT major, by nature, is cross-disciplinary and will need to be covered by a very organized and integrated curriculum plan, which may be completed if a student is not clear about his/her major when he/she enters the college. In fact, if a student does not have any prior hands-on exposures (e.g., served as a volunteer in hospitals) to the healthcare, it may turn out to be a handicap for him/her to be successful in getting an internship during the school years. To overcome these potential constraints and to ensure a smooth learning process, an IHIT curriculum model can be used by joining (sharing) the teaching and learning processes (resources) from a regional Intermediate School District (ISD) with nearby community colleges and, furthermore, with a four-year hosting university. Figure 1 highlights the teaching and learning environment of an IHIT curriculum model:



**Figure 1.** Teaching and Learning Environment of IHIT Curriculum Model

The reality is that the prevalent model of schooling today supports neither continuous job-embedded learning for teachers nor collaborative learning among teachers. Education is frequently fragmented and disconnected (Evans & Malina, 2014): professional development is not aligned with student and teacher needs, curriculum is not aligned with assessment, and, furthermore, standards are not aligned with curriculum.

The crisis in healthcare industry has been well recognized in mid 1980s. With more than 20 years of verbal services, no action was taken until February 17, 2009, the date that ARRA was signed into law. The urgency of healthcare needs, raised by a call from the community of healthcare professionals, prompted the faculty of Haworth College of Business to work with the faculty of College of Health and Human Services at Western Michigan University (WMU) to jointly developed a cross-disciplinary undergraduate major, Health Informatics and Information Management (HiiM), that has been approved by the Presidential Academic Council of the State of Michigan in Spring 2011 and officially put in place in Fall 2012. Details about this new academic major and its design philosophy are reported in Falan and Han (2011). While this new program (i.e., HiiM) collapses the academic silos in higher education, its success cannot be reached without collapsing the campus boundaries between education partners, i.e., an Intermediate School District (ISD), nearby community colleges, and the new program hosting university – WMU. In fact, over the past three years, the HiiM program has closely partnered with the ISD at Van Buren County, Michigan and two community colleges (i.e., Lake Michigan College at Benton Harbor and Kalamazoo Valley Community College at Kalamazoo) at southwest Michigan to pilot test the IHIT Curriculum Model, which allows sharing of teaching resources in order to pipeline student learning and incentivize ISD students to choose HIT (e.g., HiiM) as their future career when they are still a junior or a senior in high school. The details about course sharing across educational units are summarized in Table 1.

**Table 1.** Course Sharing between ISDs, Community Colleges, and the HiiM Program at WMU

ISD	Community College	Western Michigan University
Health Occupations	Intro to Health Care Career	Intro to Health and Human Services (HSV1040)
Medical Terminology (Reading)	Medical Terminology	Medical Terminology (MDSC 2010)
Biological Sciences (Biology)	Introductory Biology	Principles of Biology (BIOS 1120)
	Computers in Business	Introduction to Business Computing (CIS 1020)
	Anatomy and Physiology	Human Anatomy (BIOS 2110)
	Physiology	Human Physiology (BIOS 2400)
	Probability & Statistics	Introduction to Statistics (STAT 3660)
	Ethics (Philosophy)	Introduction to Ethics (PHIL 2010)

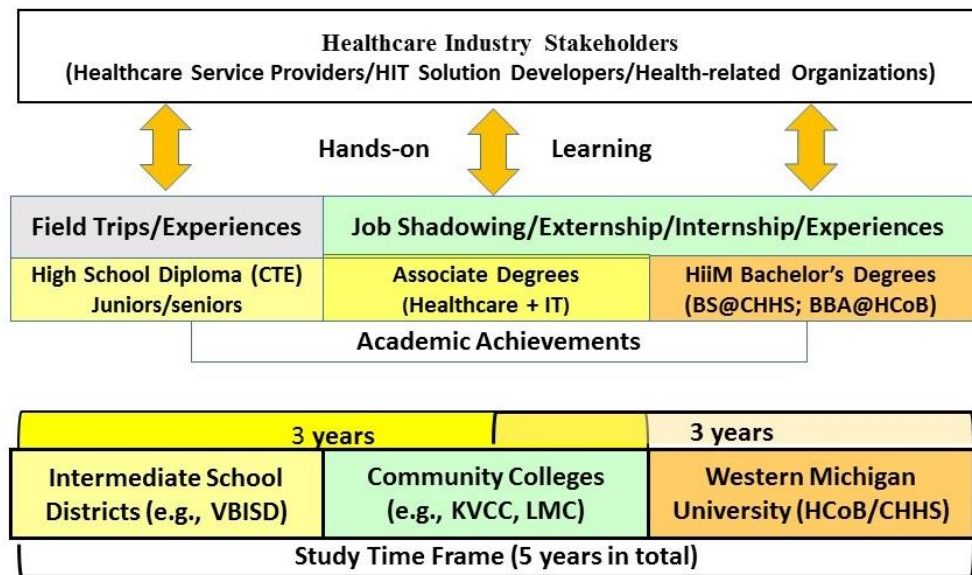
As seen in Table 1, eight courses required by the HiiM program at WMU can be learned by students by taking courses from either ISDs or any nearby community colleges. These courses are primarily the basic science or service course that meant to be taken by college students when they are either a fresh or a sophomore. Due to the increasing education costs (e.g., credit hour charge, lab charge, etc.), it is most desirable for incoming WMU students, especially those high school juniors or seniors who have identifies their career interest in health and information technology, to take these courses at a local ISD or nearby community colleges.

Note that the above course sharing is the results of many dialogues and course “content validation” by faculty coordinators at each partner. After a careful administrative approval process conducted by WMU, this above course credential agreement lays the foundation and serves as the blueprint for all education partners to implement the IHIT curriculum model. In fact, it is the beginning of our task that was started in Fall 2013. How can the above agreement be effectively implemented in order to ensure students are well prepared to be the new HIT workforce? The infrastructure and the implementation details of IHIT are presented in the next section.

### 3.0 AN INTEGRATED HEALTH INFORMATICS AND TECHNOLOGY MODEL

As pointed out in the previous section, due to the unexpected high demand for HIT workforce, it is imperative for educators in the health area to expedite the training of students who have potential and interest in learning health informatics and information technology. To fulfill this education process, we do need a new education (curriculum) model that will not only collapse the academic silos within a university campus (Falan & Han, 2011), but also pull together teaching resources across multiple campuses from regional ISDs to community colleges to a four-year university that hosts the health informatics and information management program (e.g., the HiiM program at WMU). However, to ensure quality training and preparation of new HIT workforce, the HiiM program at WMU was designed according to the standards defined by the CAHiiM curriculum standards (CAHiiM, 2014). In brief, a student who

chooses to have a HiiM as his/her academic major will be required to take, in total, at least 51 credit hours course load in the basic science, health informatics, and information technology and management area. With the course credential agreement (see Table 1), the demanding requirements for HiiM could be alleviated since students from a local high school will be able to complete anywhere between 8 and 22 credit hours of coursework before they enter WMU. Note that these credit hours transferable to the HiiM program do not include other credit hours that may be taken from a nearby community college and transferable toward a bachelor degree to be earned from WMU. Obviously, the above “mutual recognition agreement” in coursework makes teaching resources sharable among the education partners in the community. Nevertheless, the true merit of the IHIT curriculum model (see Figure 2) is to provide students with ample opportunities in gaining hands-on experiences at the early stage when students are still in a high school. Their early exposures to (or experiences in) the health industry grant them competitive advantages in securing an externships or internships in a healthcare organization when they continue to pursue an *associate degree* from a community college or a *bachelor degree* from a four-year university.



**Figure 2.** An Integrated Healthcare and Information Technology (IHIT) Curriculum Model

As shown in Figure 2, the middle part of the diagram indicates students hands-on experiences could be obtained when high school students attend a program offered by an ISD, which may be carried on and converted into job shadowing, externships, and internships when they attend a community college and further complete a HiiM major at WMU. If students are guided well by advisors from ISDs to community colleges and to WMU, then a student with an early career identification could finish a college bachelor degree in five years. In a traditional curriculum model, a junior in a high school will normally take eight years (i.e., two plus two plus four) to complete his/her college education. Using the proposed IHIT model, if all go well, it will save a high school junior at least three years to get a bachelor degree – a great time saving in education. Apart from huge savings in education costs, the college graduates under this IHIT curriculum model will have a much higher probability in finding a job. The expected benefits from cooperative education have been reported in an existing study (Jiang *et al.*, 2015).

The IHIT curriculum model has been applied to the HiiM Program at WMU. How does it impact the education of the HiiM majors and how has it influenced our graduates in terms of their job placement? The next section summarizes what we have experienced over the past three years.

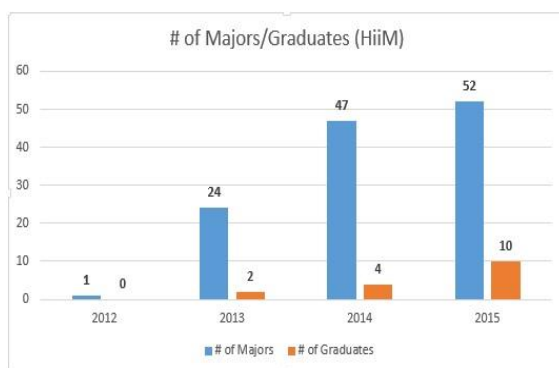


#### 4.0 THE IHIT EDUCATION AT WMU - EXPERIENCES OF EARLY SUCCESS

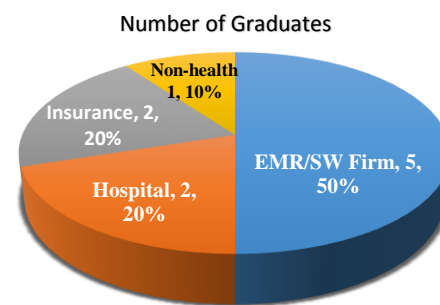
The IHIT curriculum model was started immediately after the HiiM Program put in place in Fall 2012. The education concept was raised in a special gathering about how HIT education can be expedited through collaboration between education partners in the Greater Kalamazoo Area in ICHITA-2011, held at the Fetzer Center at WMU. One of the attendees, as well as the co-author, Kenneth Bobo, introduced this model to the Curriculum Director of a rural Michigan secondary school system, the Van Buren Intermediate Schools District's Early College Health Alliance (VBECHA). At that moment, VBECHA was seeking to accelerate and augment post-secondary matriculation of students interested in health care fields, and later served a springboard in launching high school students onto an accelerated path and provided a pathway to the implementation of a Middle College program (Johnson, 2015), a component of the IHIT curriculum model. To some degree, the IHIT model provides learning experience that has been offered by the Kettering University, which was founded by Charles Kettering, the head of research at General Motors Corporation in 1919. More details about the learning model can be found in references (Adelman, 1999; Allen & Dadgar, 2012)

In brief, the early findings at VBECHA show that combination of rigorous high school coursework (e.g., advanced placement), demanding courses (e.g., physics and calculus) and dual-enrollment have a demonstrated a direct correlation to collegiate success (Adelman, 1999), and there is a strong correlation that participation in dual enrollment is positively related to GPA, persistence to second year, and ultimately, first-degree attainment (Allen & Dadgar 2012; Karp *et al.*, 2007; Swanson 2008). Moreover, rigorous coursework in high school leads to higher persistence and success rates in college (Struhl & Vargas, 2012). Indeed, in two years of operation at VBECHA, the 18 students enrolled in the program earned a combined 576 college credits; nine of the students earned more than 40 credits, each. The students earned an average collegiate coursework GPA of 3.5 and upon high school graduation, earned in excess of \$300,000.00 in scholarships to baccalaureate institutions.

As for the HiiM Program at WMU, Figure 3 shows the number of HiiM majors and graduates from 2012 to 2015. The number of students has grown from one student in 2012 to 52 students in 2015, and the number of graduates, from 2 in 2013 to 10 in 2015. The growth rates of both are much higher than what we expected, though they may not grow like this in the coming years. With the current resources, our program goal is to have 80 to 100 students by the year of 2017 and it is remained to be seen. With respect to the job placement, Figure 4 highlights the number of graduates in each organization types in the healthcare industry. Note that the results are based on a small sample of all graduates, 16, and data only indicate ten graduates who have been contacted with their current placement.



**Figure 3.** The number of Majors/Graduates of HiiM at WMU



**Figure 4.** The Job Placement of HiiM Graduates at WMU

The placement results indicate that 50% of HiiM graduates have joined the Electronic Medical Record (EMR) software firm, and the remaining recruited by health insurance firm and healthcare providers. Only one graduate joined a non-health organization. While these results may not be statistically proven, with these early signs we can make the following comments:

- The health market is relatively strong and job placement is very good
- The HiiM Program has a fast growth and expects to grow in the coming years.
- There is no guarantee that all HiiM graduates will be able to find a job in health-related industries.

What we have learned and challenges to healthcare informatics and information technology education are presented in the next section.

## 5.0 LESSONS LEARNED AND CHALLENGES

It has been a great journey for the faculty at WMU to develop a cross-disciplinary undergraduate program – Health Informatics and Information Management (HiiM) by eliminating the academic silos within the MMU campus (Falan & Han 2011). It is more like an exploratory voyage for us to cross the campus boundary to pilot test the IHIT curriculum model in the community by combining resources from ISDs to community colleges with the HiiM Program at WMU. The lessons we have learned include the following:

- It is possible to integrate teaching talents by partnering all education units (i.e., ISDs, community colleges, and a four-year university) to expedite education process and better prepare students to be the HIT workforce for the healthcare industry.
- It requires the commitment from both faculty and the administrator (i.e., deans of colleges, program director) in order to implement the IHIT curriculum model across multiple campuses.
- Extra support (e.g., a program staff for student monitoring and advising) will be needed to track student progress from campus to campus. This function is essential to students' success when they migrate from one campus to another. In addition, students shall be guided to gain hands-on experiences, which may require a designated staff to work closely with healthcare organizations in the community.

Though the above lessons (i.e., Points two and three) may be seen as challenges as well, the additional challenges facing the IHIT curriculum model include:

- Students may enter the HiiM program without any experiences, i.e., they are not students with an early exposures as students from ISDs. Then, they need to be advised to make efforts in gaining externships and internships in some health-related organizations during the summer time as early as possible. For now, there are students join the HiiM program, without any experiences, when they are junior at WMU. They will have difficulties in finding jobs at the graduation time.
- There is a competition between community colleges and WMU in terms of getting student enrollments. Our experiences show that many community colleges have health-related programs and have high potential in access to local healthcare providers. Given the difference in tuition charges and early exposures to healthcare, more dialogues and academic cooperation between community colleges and WMU will help HiiM students in gaining hands-on. Similarly, more cooperation between ISDs and community colleges should be pursued as well.
- Lastly, the HiiM Program is truly a blended program that integrates health informatics with information technology from three areas – basic sciences, health and human services, and college of business (computer information systems). Currently, many accreditation organizations (e.g., AHIMA, AMIA) do not have capacity in accrediting programs such as HiiM at WMU. This may slow down the education for training of real capable HIT workforce.

## 6.0 CONCLUSIONS

Healthcare industry is in need of qualified HIT workforce to transform healthcare meeting the Triple-Aim of healthcare – *Improved health, Lower costs, and Better care*. The traditional education approach may not be fast



enough to train college students due to the curriculum is multi-disciplinary and, in particular, the HIT workforce needs extensive hands-on knowledge and skills in health and information technology. This paper presents an Integrated Health Informatics and Technology (IHIT) curriculum model to collapse the campus boundary between regional Intermediate School Districts, Community Colleges, and a Four-Year University in order to support expedited HIT education with sufficient hands-on experiences in health informatics and information technology. This model was pilot tested by a newly developed Health Informatics and Information Management Program at Western Michigan University. Early findings from involved education partners are very positive. More research work and promotion of this curriculum model shall be continued. Challenges to this model are also summarized.

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