Designing a Database to Facilitate Efficient Information Management at the Health Mentors Program Office

by

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Although she has retired, she still gives her students much encouragement and support. I am truly grateful to **Dr. Grace Patterson** for the direction and professional connections.

Executive Summary

This report describes the internship work performed at the Health Mentors program (HMP) office at Dalhousie University. HMP is an inter-professional education program under Dalhousie's Faculties of Medicine, Health Professions and Dentistry. It is an experiential learning process that is compliant with the National Interprofessional Competency Framework. The students are prepared to be collaborative practitioners who keep the goals of the patients at the centre of care.

The HMP director's office is the administrative hub of the program. It holds information pertaining to the students, mentors and faculty members. The information changes each academic year when new students are enrolled, new mentors recruited and faculty members take up varying responsibilities.

The internship project was to design a database that captures and stores data that is generated through an academic year in order to facilitate HMP program governance and coordination.

The existing data and information was analyzed to understand stakeholder requirements, information requirements and information flow. Recommendations were made to improve data quality and prevent human errors while transcribing the data to the database. The recommendations were limited to data collection. The recommendations were, to specify required attributes, to have a standardized data collection form and to introduce measures to keep the data up to date or timely.

Information models and diagrammatic representation of the information acquired will be used to guide the final implementation of the database.

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Introduction

Interprofessional education is a training program through which professionals from various disciplines are trained to work collaboratively. Educational institutions associated with Medicine, Nursing and Health professions are incorporating this training as a part of their curriculum. Collaborative practice occurs when healthcare providers from various professions pool their knowledge and expertise together to render optimum care for their patients and their families in a manner that meets the goals and needs of the patient. This type of practice requires teamwork and trust.

Another facet of interprofessional education in healthcare is the emphasis on patient-centric care. It means that the patients are at the centre of their own healthcare. The patients and their families are empowered to make informed decisions about their care. The expert care delivered is a balance of professional expertise and patient goals or care needs.

Dalhousie's HMP inculcates these principles into the students from the various health professions during the course of their program.

The internship project is to design a database that will store historical information, information that will be generated through the coming years and that which will facilitate easy retrieval of the stored information for HMP program governance and coordination.

1. INTERPROFESSIONAL EDUCATION (IPE)

1.1 DEFINITION OF INTERPROFESSIONAL EDUCATION

According to Reeves, Perrier, Goldman, Freeth, and Zwarenstein, (2013) interprofessional education is defined as "Interprofessional education occurs when members of more than one health or social care (or both) profession learn interactively together, for the explicit purpose of improving interprofessional collaboration or the health/wellbeing (or both) of patients/ clients" (p.2).

1.2 DEFINITION OF COLLABORATIVE PRACTICE

According to Bridges, Davidson, Odegard, Maki, and Tomkowiak (2011), collaborative practice is defined as "a process which includes communication and decision-making, enabling a synergistic influence of grouped knowledge and skills" (p.2).

1.3 RELEVANCE OF INTERPROFESSIONAL EDUCATION

The current practice of healthcare delivery as silo structures is being rethought. The fundamental drawback of healthcare delivery as silo structures is the lack of communication and teamwork between healthcare professionals. Poor communication between healthcare professionals increases the possibility of incoordination between the healthcare team. The lack of coordination between healthcare teams has an adverse effect on patient outcomes. The patient safety can be compromised, especially in environments like an emergency department.

The healthcare delivery of the future should make provisions to manage chronic conditions with co-morbidities that is expected from a population that will be mainly seniors. The healthcare delivery system that meets this requirement is collaborative practice. The IPE prepares the future healthcare professionals for a practice that is collaborative in nature.

1.4 INTERPROFESSIONAL EDUCATION IMPLEMENTATION

Currently IPE is not an established and routine part of education in many institutions. It is slowly gaining acceptance and being integrated into the curriculum. There are various factors that play a role in establishing IPE (Barker, Keegan, Carmela & Ivy, 2005). Some are considered enablers and other barriers.

The enablers of the program are listed as champions, finances and support of dedicated staff. The barriers are lack of consensus around issues; for example, an apt period to introduce the program to the students or the methods of teaching or putting interprofessional education into practice.

The task of introducing IPE into a well-accepted, time-tested curriculum requires champions. Champions are people who are motivated and are convinced about the benefits of the program. They are able to promote the program and motivate others because they are well respected and are known across programs. They are well established in their professions and held in high regard within their professional community. These personality qualities give them credibility and people trust them. They are the beginners of change.

Finances are another factor that play a crucial role in the actual implementation and sustainability of the program. The funding of the program and the continuity of the program are dependent upon the level of support for the program from within the organizational structures. The continuity of the program requires faculty development and staff commitment. Thus, the factors that determine the implementation, continuation and effectiveness of the program are all overlapping and interlinked factors.

According to George Thibault, Institute of Medicine-IOM, (2013), the barriers of IPE implementation are classified into logistical, curricular and cultural.

Logistical: Finding the right timing for IPE and the right group of learners among the professions.

Curricular: Finding appropriate curricular content and the suitable topics to teach.

Incorporating the curricular content meaningfully into clinical and community.

Cultural: Currently the predominant culture in education and practice is that which reinforces separation. It is manifested through inadequate collaborative space, lack of time for interprofessional work and the lack of earnestness for new models of education.

1.5 OUTCOMES OF INTERPROFESSIONAL EDUCATION

A study done by Mann, Sargeant and Hill (2009) into the impact of the program upon health professionals' knowledge, skills and attitudes drew the following conclusions:

- In clinical practice, positive changes were noted with patient interactions, treatment and care of the patients and with practices of using team resources.
- The changes in interprofessional interaction were, improved communications and interactions with other professions, respect for other health professionals, sharing resources and a sense of increased confidence in one's own ability.

The predisposing factors that enabled changes were:

- Participation in IPE sessions with other team members
- Respect for the roles of other health professionals
- Confidence to interact with other team members
- Understanding of professional roles of other team members
- Understanding of the importance of interacting with other team members

The factors that enabled changes were:

- Receptivity and support of other team members
- Support of decision-makers
- Open channels of communication
- The awareness of the need to change and reinforcing that need

In conclusion, to introduce IPE into an established curriculum requires the effort and dedication of people that champion the program. It requires dedicated and trained staff to administer the program and educate future healthcare professionals. It needs organizational buy-in and financial support. IPE has the potential to make difference in healthcare practice, interprofessional communication and improve patient satisfaction.

2. DESCRIPTION OF THE ORGANIZATION

2.1 OBJECTIVES

The HMP at Dalhousie University is an interprofessional education program that educates students in health professions on the importance of collaborative and patient-centric care. The objectives of the program are to develop competencies in:

a) Interprofessional collaboration: Interprofessional collaboration requires communication and collective decision-making by leveraging the collective knowledge of the various disciplines.

b) Team functioning: In order to have an interprofessional collaboration, it is necessary that the professionals should function as a team. The participants of the program develop set guidelines that respect the ethical values of the members, facilitate discussion and participation among the members, and establish healthy relationships between all stakeholders.

c) Client-centredness: It means that the goals and healthcare decisions of a patient are the foundations of the healthcare provided to the patient.

d) Understanding the impact of chronic conditions: It is an experiential learning process that gives the students an understanding of what it is like to live with a chronic condition and how their collaborative professional expertise can provide quality care.

2.2 HMP PROGRAM DESCRIPTION

The HMP is sponsored by the Faculties of Medicine, Dentistry, Health Professions, Science and Computer Science. The centres are in Halifax, Nova Scotia and Saint John, New Brunswick. These five faculties incorporate 18 programs between the two sites and various institutions. One of the participating programs from New Brunswick is the Faculty of Medicine affiliated with Dalhousie – Dalhousie Medicine New Brunswick. The other programs that participate from New Brunswick are affiliated with the University of New Brunswick (UNB), New Brunswick Community College and Horizon Health NB.

The students from these various programs form interprofessional teams. Each team has four students from any four professional programs. They are supervised by a faculty member. In Halifax one supervisor is responsible for four teams while at Saint John each supervisor is responsible three teams.

2.2.1 Patients as teachers

The team interacts with a mentor assigned to their team. A mentor is an adult volunteer with a chronic condition or disability who are recruited from the community. The mentors willingly share with the students the impact of living with chronic conditions or disabilities and their journey though the healthcare system.

The students meet with their mentor twice during the course of the program. They listen and record the mentor's experiences. The students share with their mentor what they have learned from them. The mentor's story, student's personal reflections and peer assessment are the student's graded assignments. A final grade of pass or fail is given.

The program is designed in accordance to the National Inter-Professional Competency framework. The framework focuses on the ability to incorporate knowledge, skills, attitudes and values in decision making processes.

2.3 ORGANIZATIONAL STRUCTURE OF HMP

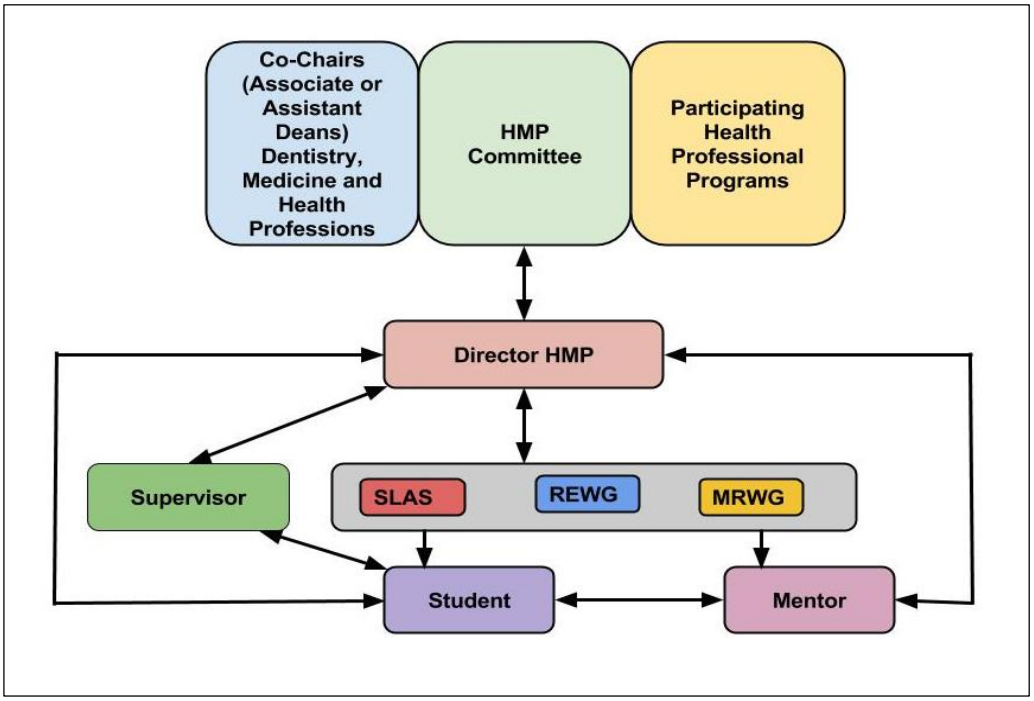

Figure 1: Organizational structure of HMP

Co-chairs: They are Assistant/Associate Deans from the Faculty of Medicine, Faculty of Health Professions and Dentistry.

HMP committee members: They are members appointed from participating programs.

Three working groups

- Student Learning Assessment and Supervision working group (SLAS) -- This working group faculty oversee aspects of the program that relate to Student learning. They work closely with The Mentor Relation Working Group faculty that address Mentor issues.
- The Mentor Relation Working Group (MRWG) -- MRWG oversee aspects of the program that relate to Mentor recruitment, screening and support.
- Research and Evaluation Working Group (REWG) -- REWG supports and participates in program evaluation and research activities related to the HMP, with the HMP staff, on behalf of the Health Mentors Program Committee.

Supervisors: They coordinate and supervise student learning.

The organizational structure is collaborative in nature. The faculty representation in the program is proportional to the number of participating students.

3. DESCRIPTION OF THE PROJECT

3.1 SCOPE

Design a database that will effectively capture all information obtained or generated and facilitate easy retrieval of the stored information for HMP program governance and coordination.

3.2 REQUIREMENT COLLECTION

3.2.1 Understanding stakeholder requirements

The historical data present at the HMP office was inspected to understand the data types, attributes and entities and the information requirements of the program. The authorized manuals and

documents available at the office were studied to understand the business rules associated with the organization.

3.2.2 Information sources

The main information sources are from the participating programs. The information content is that of the students enrolled in the program each academic year and the faculty members who hold various positions of leadership within the program. The other important information source are the mentors volunteering in the program. The information content is their demographics. All information attributed to these three entities and the information generated each academic year through the course of the program are stored at the HMP office.

Input: Demographic or personal identification attributes related to the participating faculty members, mentors and students enrolled in the HMP program from the various programs each academic year.

Throughput: The information obtained on the students, supervisors and mentor are used to allocated the teams. The team allocation is emailed to the supervisors.

3.2.1 Information purposes

The information at the HMP office is used by the stakeholders for communication, administration, reporting, evaluation and research.

3.2.2 Information stewards

The director and the manager at the HMP office maintain, manage and ensure the information security at the HMP office. The database designed will be used in-house, only by them to for the HMP program governance and coordination.

3.2.3 Information flow

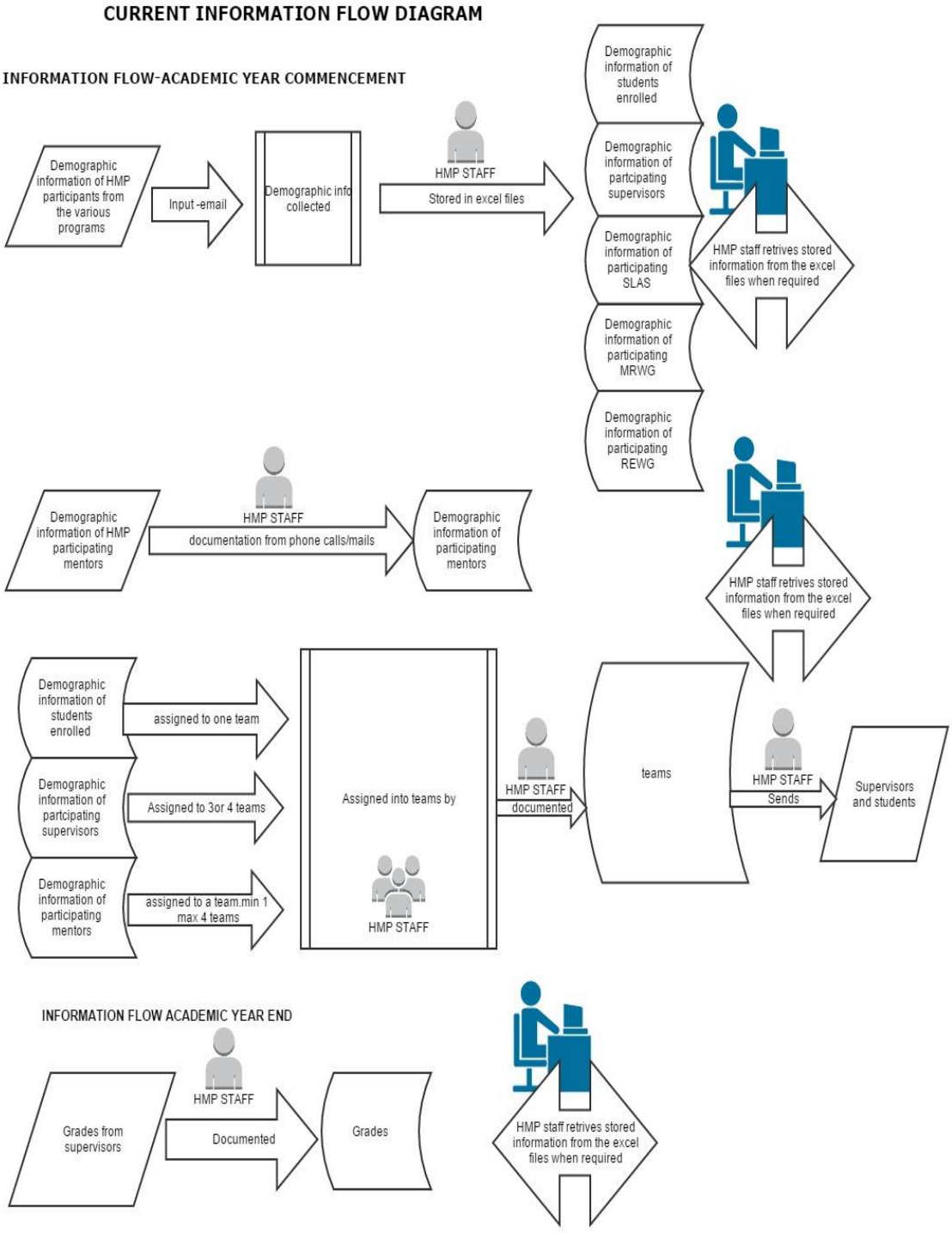

Figure 2: Current information flow

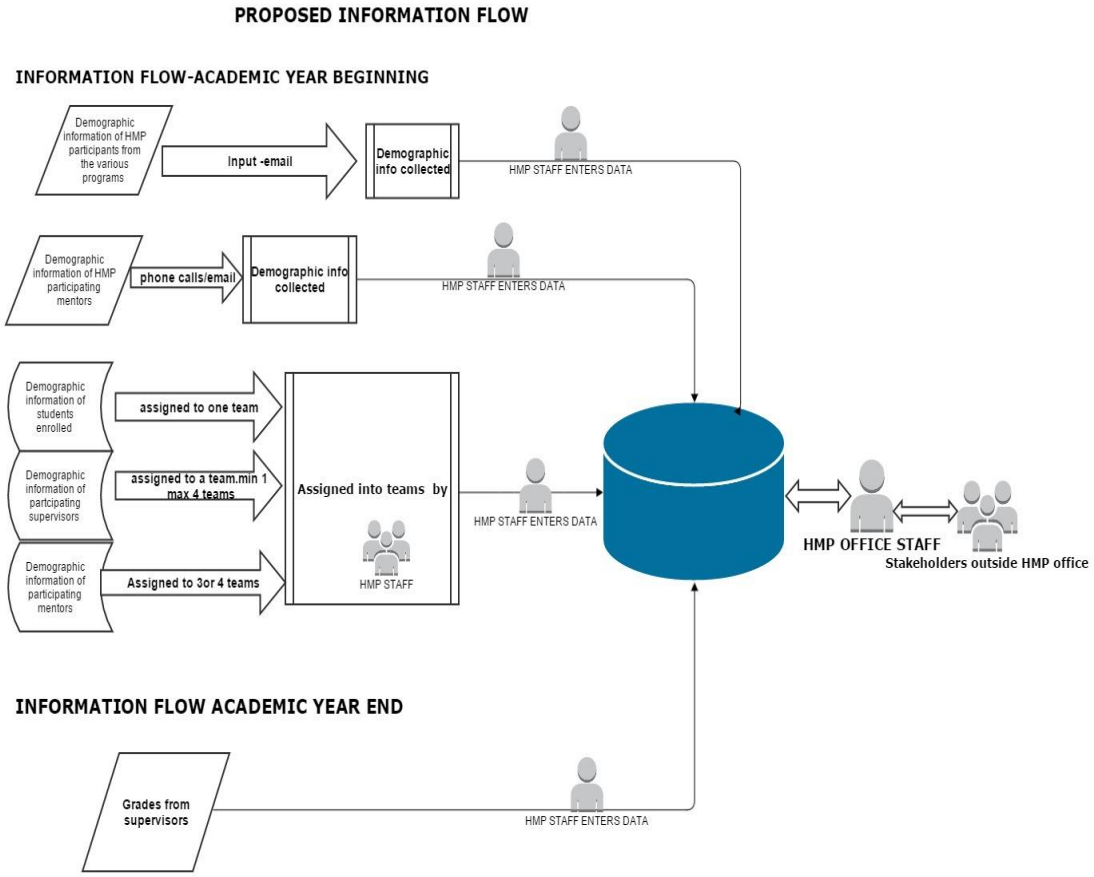

Figure 3: Proposed information flow

3.3 CONCEPTUAL DESIGN

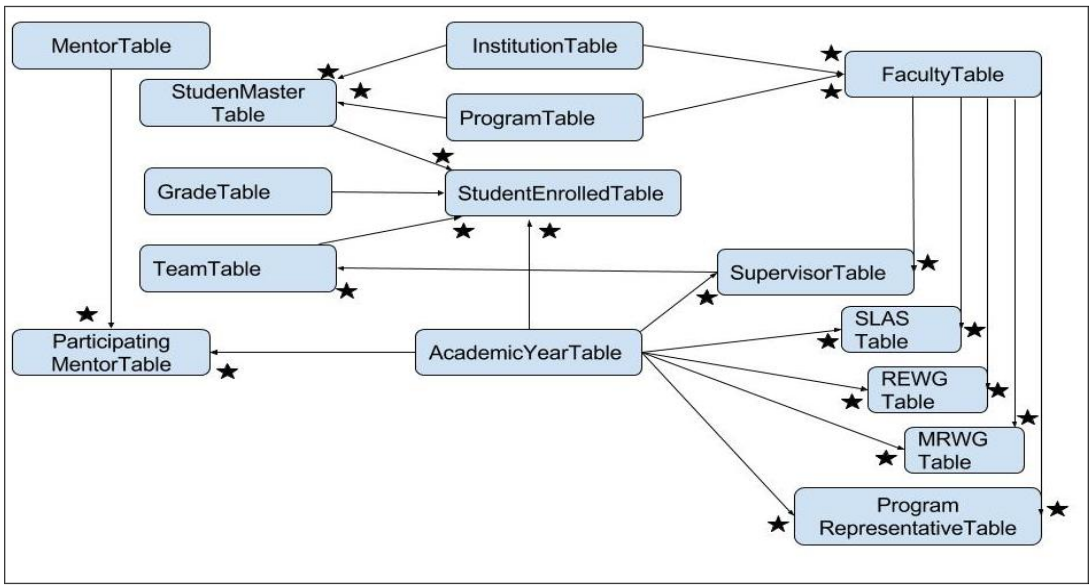

Figure 4: Conceptual design. ★ = one to many relationships

4. HEALTH INFORMATICS PRINCIPLES AND INTERNSHIP WORK

The concepts from health informatics that were relevant to this project were those pertaining to information flow and use, the importance of data quality, and concepts that form the foundations of database creation and its design.

4.1 DATA QUALITY

The foundation of informatics lies in data. The quality of data is fundamental for the data to evolve into information, knowledge and wisdom that is trustworthy, relevant and useful. Data quality translates into the fitness of use of the data for the purposes of the user. This is a concept that was emphasized throughout the program irrespective of the course.

4.2 FUNDAMENTALS OF A DATABASE CREATION

The approach undertaken to build this database is a top down approach that consists of the following steps:

1. The scope
2. Requirements collection and analysis
3. Conceptual design
4. Logical design

A relational database was proposed for this project. The data management system is Microsoft Access™. The version available at the HMP office is Access 2013™.

A relational database is a collection of tables with a set of attributes whose values are stored in tuples or rows. Each table is identified by a unique name and each row is represented as an object identified by a unique key. The data model used to describe the database is an Entity-Relationship diagram. The data stored can be retrieved through queries.

1. The scope: The scope defines the deliverables at the end of the project. It defines the work that will be completed. The scope for this project is a database design. The data base designed will store and retrieve information for various activities that facilitate the governance of the program.

2. Requirements collection and analysis: It is the process that determines the client requirements and expectations of the end product. It is obtained through understanding the current routine work practices and the outlier events that may occur during the process of meeting given goals. The author was made familiar with all these variables during the course of her additional responsibilities as manager at the HMP office. The process of understanding the routine work and outlier events, modeling the flow and the use of that information, was the knowledge translation of the information flow and use course.

3. Conceptual design: It describes the entities and the relationships between the entities. The relationship between the tables should be either a "one to one" relationship or a "one to many" relationship (Figure 5).

4. Logical design: It describes the attributes associated with each entity. The design is in conformance to a specific database. The database for this project is in conformance with the Access Database™. The various tables were uniquely identified by meaningful names. The tables and their attributes are documented in the Appendices 1- 3.

5. Physical Implementation: It is the final step of the database creation.

5. A CRITICAL ANALYSIS OF DATA QUALITY

Data quality is fundamental for informatics. It is imperative that the data stored is accurate, complete and consistent. Generally, information technology is a means to improve data quality and usability. However, it may have a paradoxical effect when there is big data. The features of big data

are volume, velocity, variety and value or veracity. (Cai & Zhu, 2015). Volume refers to data bytes which are usually in terabyte range when referring to big data. Velocity refers to the rate at which the data is formed and the speed at which the data has to be dealt, variety references the data types which are namely structured data or unstructured data and the value of data is the data quality. In the context of the HMP project, data can be categorized as small data.

5.1 DATA QUALITY DIMENSIONS

Data quality dimensions are used to describe characteristics of data that can be assessed against set standards in order to determine the quality of data, DAMA UK Working Group (2013). DAMA UK Working Group has described six core data quality dimensions: completeness, validity, accuracy, consistency, integrity/uniqueness, timeliness.

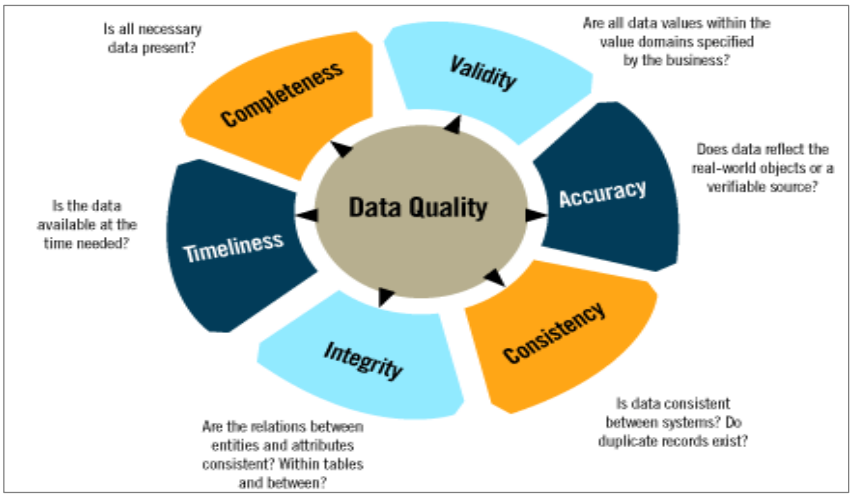

Figure 5: Data quality Dimensions (REALISE DATA SYSTEMS)

5.1.1 Completeness

It is a measure of the presence of non-blank values. It has dimensionality of validity and accuracy. It means that even though data values are completely documented, the data values entered should be accurate and valid.

5.1.2 Consistency

It means that there is no discrepancy on comparison with a standard. Data values or data patterns are measured for consistency. It is measured as a percentage. The dimensions of this characteristic are validity, accuracy and uniqueness/integrity.

5.1.3 Timeliness

It is the degree to which data represent reality from the required point in time. It means how up-to-date the data is from a given time. The significant dimension of this feature is accuracy. The accuracy of data decreases with time.

5.1.4 Integrity / uniqueness

This characteristic stresses that data value should not be repeated. Every record is a unique record, like the tuple of a relational database. Duplicity is introduced when related records are not linked together appropriately. It impedes analysis. Uniqueness is measured against all records in a dataset. The related dimension is consistency.

5.1.5 Accuracy

The degree of actuality to which the data describes an object or event. The dimension associated with accuracy is validity. In order for the values to be accurate the values must be valid.

5.1.6 Validity

A data value is valid if it obeys the format, type or range attributed to its definition. The related dimensions are accuracy, completeness, consistency and uniqueness.

5.2 INACCURATE DATA SOURCES -RELAVANT FOR HMP OFFICE ENVIRONMENT

The origins of inaccurate data within a database lie in different sources, Olson JE. (2003). Each of them contributes to the decrease in data quality. It is essential to understand these vulnerabilities in order to maintain an information repository that is accurate, reliable and useful.

5.2.1 Errors at data creation

A potential source of data inaccuracies is during the initial data creation. If the error is not detected it gets carried down with the data flow. The issues during data creation are due to various factors like human error or a flawed data entry process or system error.

5.2.2 Flawed data entry processes

5.2.2.1 Form design and data entry

The design of data entry form plays an important role in reducing data entry errors.
Forms that are paper based do not have error reduction features of an electronic form like a drop-down list. The likelihood of missing values, incorrect entry, or misspelling is reduced when choosing from a list of valid values on a drop-down list. However, incorporating fields that are clear and easily understood is independent of the nature of the form. The field names should be easily understood by the user. The positioning of the field name and text box all play important roles in bringing clarity to the form. If there are options to fields like “not applicable” check boxes, there is clarity for the user that the information required is not applicable and mandatory for all users. In the absence of such options individuals may fill in inaccurate data so as not to leave a field empty.

Another source of data inaccuracies is untrained individuals who do not understand the nature and process of the activities that support the database are tasked to fill the forms. This is particularly relevant with paper based forms.

Illegible entries are common sources of inaccurate data. They are characteristics of handwritten forms.

5.2.3 Data collection period

The data collection should be done when all the required information is available at the source. It should be collected ideally during the period when information obtained at the source is final and least likely to change.

5.2.4 Systems issues

Data error due to computing systems is a very unlikely event. It can occur due to some human factor or due to a poorly designed transaction system.

6. RECOMMENDATIONS TO HMP TO ENSURE DATA QUALITY

The records at the HMP were stored in various Excel™ files. The information from the various programs were sent to the program office via email. It was then copied into the system.
The files had a high degree of data completeness, validity, accuracy, consistency and timeliness. However, there was redundancy of information, inconsistency in the order of the attributes and occurrence of various records pertaining to the same entity to reflect the changing information, like when a student withdraws from the program or there is a change in team configuration.

6.1 DATA COLLECTION RECOMMENDATIONS

6.1.1 Specifying data elements

A data collection instrument that specifies exclusively the data elements required by the HMP office. It eliminates unwanted information like the B00 number, the identifying tool of Dalhousie students. According to the current work practices, the B00 number is not used for reference anywhere during information retrieval; however, there are scattered instances where they present as data elements.

6.1.2 A standardized data collection form

The current practice of data collection is through Excel™ files. Participating programs send information regarding the students enrolled or information regarding faculty representatives and the roles taken up by the faculty representatives through such files. Excel™ files have proved to be efficient systems of data collection for the program. The data recorded have exhibited a high degree of accuracy.

However, there is no uniformity in the sequence of attributes. Some programs send the information in a manner that has “Last Name” as an attribute that precedes “First Name” while in others “First Name” precedes “Last Name”. It is recommended that an Excel™ sheet with attributes sequenced in a standardized manner be send to the participating programs. The attributes and the sequence of the attributes on the Excel™ file should match the database columns and its sequence. This will make transcribing to the database easier for the HMP staff.

6.1.3 Data collection period

In an academic environment it is not possible to determine a time beyond which the data available is constant. Data modifications are required when students withdraw from the program. In some cases, the change in status of the student was reported long after the student left the program.
It is recommended that measures should be taken in terms of policy that any student enrolled in the HMP program, should inform the HMP office or the supervisors when the student leaves the HMP program or leaves the parent program. This helps to maintain the timeliness of the records.

6.2 ENSURING DATA QUALITY THROUGH DATABASE

Database design facilitates data accuracy, validity, completeness, uniqueness, consistency through the inherent mechanisms in place. Database constraints are set to prevent missing values or redundancy.

The database is designed in such a manner that is as close as possible with the existing manner of governance. This ensures ease of use.

It is designed with the flexibility to capture all possible changes in data that can occur during the course of the program each academic year and thus ensure completeness of information.

7. CONCLUSIONS

This internship project applied the fundamentals of database creation through the application of the principles associated with requirement gathering, information flow and information modeling. A database that is in conformance with the client objectives and requirements was designed. Diagrammatic representations of the conceptual and a logical model of the database were done to

facilitate the final implementation of the database. The database will be capable of collecting storing and retrieving HMP program relevant data to facilitate governance and coordination.

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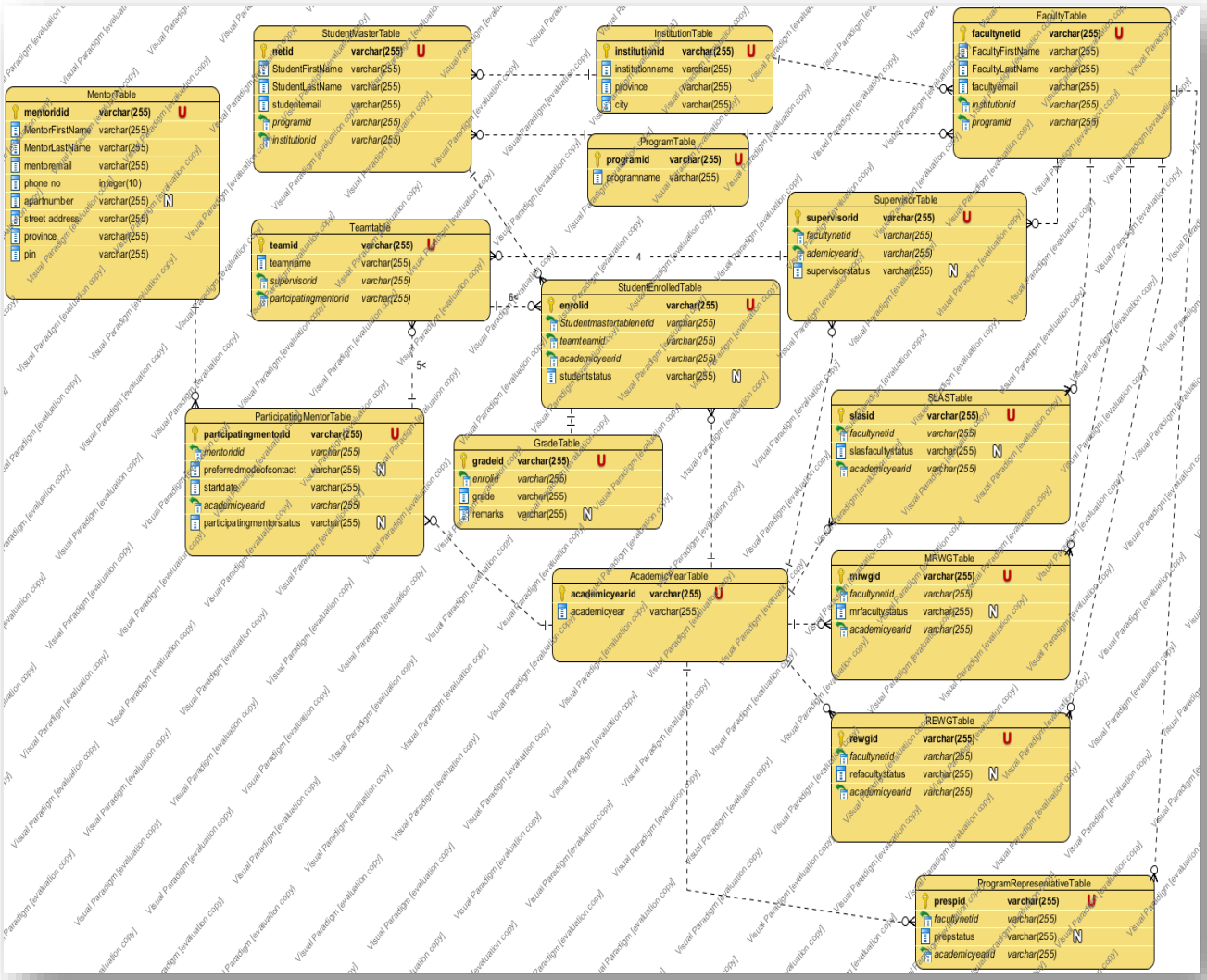
9. APPENDIX

Appendix 1. **LOGICAL MODEL OF THE HMP DATABASE (**Designed by author on Visual Paradigm™ software)



Appendix 2. THE TABLES (Visual Paradigm™ software)

Database Tables

Name
ProgramRepresentativeTable : Entity
AcademicYearTable : Entity
ProgramTable : Entity
InstitutionTable : Entity
REWGTable : Entity
SLASTable : Entity
MRWGTable : Entity
ParticipatingMentorTable : Entity
SupervisorTable : Entity
GradeTable : Entity
Teamtable : Entity
StudentEnrolledTable : Entity
MentorTable : Entity
FacultyTable : Entity
StudentMasterTable : Entity

Appendix 3. THE TABLES WITH THEIR ATTRIBUTES (Visual Paradigm ™software**)**

ProgramRepresentativeTable Table

Column Name	Data Type	PK / FK	Nullable
prespid	varchar(255)	PK	No
facultynetid	varchar(255)	FK	No
prepstatus	varchar(255)		Yes
academicyearid	varchar(255)	FK	No

AcademicYearTable Table

Column Name	Data Type	PK / FK	Nullable
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academicyear	varchar(255)		No

ProgramTable Table

Column Name	Data Type	PK / FK	Nullable
programid	varchar(255)	PK	No
programname	varchar(255)		No

InstitutionTable Table

Column Name	Data Type	PK / FK	Nullable
institutionid	varchar(255)	PK	No
institutionname	varchar(255)		No
province	varchar(255)		No
city	varchar(255)		No

REWGTable Table

Column Name	Data Type	PK / FK	Nullable
rewgid	varchar(255)	PK	No
facultynetid	varchar(255)	FK	No
refacultystatus	varchar(255)		Yes
academicyearid	varchar(255)	FK	No

SLASTable Table

Column Name	Data Type	PK / FK	Nullable
slasid	varchar(255)	PK	No
facultynetid	varchar(255)	FK	No
slasfacultystatus	varchar(255)		Yes
academicyearid	varchar(255)	FK	No

MRWGTable Table

Column Name	Data Type	PK / FK	Nullable
mrwgid	varchar(255)	PK	No
facultynetid	varchar(255)	FK	No
mrfacultystatus	varchar(255)		Yes
academicyearid	varchar(255)	FK	No

ParticipatingMentorTable Table

Column Name	Data Type	PK / FK	Nullable
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mentoridid	varchar(255)	FK	No
preferredmodeofcontact	varchar(255)		Yes
startdate	varchar(255)		No
academicyearid	varchar(255)	FK	No
participatingmentorstatus	varchar(255)		Yes

SupervisorTable Table

Column Name	Data Type	PK / FK	Nullable
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facultynetid	varchar(255)	FK	No
ademicyearid	varchar(255)	FK	No
supervisorstatus	varchar(255)		Yes

GradeTable Table

Column Name	Data Type	PK / FK	Nullable
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enrolid	varchar(255)	FK	No
grade	varchar(255)		No
remarks	varchar(255)		Yes

Teamtable Table

Column Name	Data Type	PK / FK	Nullable
teamid	varchar(255)	PK	No
teamname	varchar(255)		No
supervisorid	varchar(255)	FK	No
partcipatingmentorid	varchar(255)	FK	No

StudentEnrolledTable Table

Column Name	Data Type	PK / FK	Nullable
enrolid	varchar(255)	PK	No
Studentmastertablenetid	varchar(255)	FK	No
teamteamid	varchar(255)	FK	No
academicyearid	varchar(255)	FK	No
studentstatus	varchar(255)		Yes

FacultyTable Table

Column Name	Data Type	PK / FK	Nullable
facultynetid	varchar(255)	PK	No
FacultyFirstName	varchar(255)		No
FacultyLastName	varchar(255)		No
facultyemail	varchar(255)		No
institutionid	varchar(255)	FK	No
programid	varchar(255)	FK	No

MentorTable Table

Column Name	Data Type	PK / FK	Nullable
mentoridid	varchar(255)	PK	No
MentorFirstName	varchar(255)		No
MentorLastName	varchar(255)		No
mentoremail	varchar(255)		Yes
phoneno	integer(10)		Yes
apartnumber	varchar(255)		Yes
street address	varchar(255)		Yes
province	varchar(255)		Yes
pin	varchar(255)		Yes

StudentMasterTable Table

Column Name	Data Type	PK / FK	Nullable
netid	varchar(255)	PK	No
StudentFirstName	varchar(255)		No
StudentLastName	varchar(255)		No
studentemail	varchar(255)		No
programid	varchar(255)	FK	No
institutionid	varchar(255)	FK	No

FIGURES

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Figure 5: http://www.realisedatasystems.com/tag/data-quality/