Perceptions of Undergraduate Engineering Students on Academic Advising

Youngstown State University

By

Abdulrahman Alsharif

Submitted in Partial Fulfillment of the Requirements

for the Degree of

Master of Science in Engineering

in the

Industrial and System Engineering

Program

YOUNGSTOWN STATE UNIVERSITY

May, 2020

Perceptions of Undergraduate Engineering Students on Academic Advising

Abdulrahman Alsharif

I hereby release this thesis to the public. I understand that this thesis will be made available from the OhioLINK ETD Center and the Maag Library Circulation Desk for public access. I also authorize the University or other individuals to make copies of this thesis as needed for scholarly research.

Signature:

Abdulrahman Alsharif, Student Date

Approvals:

Dr. Cory Brozina, Thesis Advisor Date

Dr. Martin Cala , Committee Member Date

Dr. Nazanin Naderi, Committee Member Date

Dr. Salvatore A. Sanders, Dean of Graduate Studies

ABSTRACT

The research goal was to investigate perceptions of academic advising support system on undergraduate engineering student and to find potential pros and cons that could be improve with in the academic advising provided to engineering students. Engineering programmers have a low retention rate and cannot meet national demand. Academic advising is essential within higher education institutes. Academic advising aims to support and retain students throughout their learning process and experiences. The advisory roles played by faculty or a professional advisor in tandem to support students' education and ensure their progress. A sold academic advising program is very crucial to engineering students because it helps support not only students' goals and success but also determine its attainment. The role of the advisor seems straightforward; however, advisors often assist students with identifying the best major that fits their ability, discuss a potential minor, providing curriculum information, scheduling courses, explaining certificates, internships, and steering students to campus resources. The framework used in this research by Lee and Matusovich, (2016) model of co-curricular support for undergraduate engineering students. Engineering students' perceptions (thought process and experiences) of academic advising support systems considered as a measurement scale within the faculty and staff interactions. This scale contributes to allowing researchers and practitioners a better understanding of academic advising support systems for engineering students. The sample consisted of 79 undergraduate engineering students at Youngstown State University during Fall 2019. Findings reveal regions where engineering students are satisfied with support service provided. College year classification (freshman, sophomore, junior and senior) had significant differences were among engineering students' classification. Juniors and seniors are most satisfied with the academic advising provided. Significant differences found among engineering male students and engineering female students were males are most satisfied with academic advising provided. Advising support delivery systems, descriptive statistical analysis reveals students' most and least selected type of advising delivery system. By utilizing the results of engineering students' perceptions of academic advising, we can establish recommendations for improvements in academic advising for engineering programs. It also suggested further research on academic and social interactions with advisors and peers, both academically and socially; interactions with and involving learning centers; and inclusion within varied program(s).

ACKNOWLEDGEMENTS

I would like appreciation and gratitude to Dr. Cory Brozina, my thesis advisor, for his undivided help and support. During summer of 2018, I start working with Dr. Brozina in conducting a systematic review within academic advising in engineering which tremendously motivated and inspired this thesis. You inspired me and open my eyes to new possibilities in my educational journey. Dr. Brozina, thank you for believing in me.

Dr. Martin Cala, I truly enjoyed every class and conversation I had with you during my two years at YSU. I recognize patient, wisdom, enthusiastic, guidance and encouragement of the thesis committee, Dr. Martin Cala and Dr. Nazanin Naderi. Finally, I wish to thank my parents and siblings especially my sister for their unconditional support and encouragement throughout my study.

DEDICATION

To my parents Mohammed Alsharif and Awatif Alseraihi, my sister Alyaa Alshairf and my aunt Dr. Maha Alseraihi for their love and support.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: Introduction

1.0 Rational

Academic advising is integral within colleges and universities to support and retain students throughout their learning experiences. The advisory roles played by faculty and guidance personnel may work in tandem to support students' educational journeys. Advising advocate for students' success in scheduling, career development, class performance and engagement, and goals. As expected, advising models can vary widely especially for engineering students, and best practices for engineering students, in particular, is instructive.

Furthermore, four-year graduation rates in engineering generally hover between 20-56 percent; approximately 20 percent of engineering students are female, African American and Hispanic have 22 percent graduation rate ("American Society for Engineering Education", 2016). However, "six-year graduation rates were 20 percent to 25 percent higher than the rates for students who attained a degree in four years." ("American Society for Engineering Education", 2016, p.7). Minimal research is available to inform advising diverse populations and are diverse ethnic and socio-economic populations receiving the benefit advisory programs in engineering. Engineering guidance that includes effective communication and collaboration with a supportive culture and data that drives informative paths might be the holistic roadmap that nurtures engineering students. Engineering is a broad area of study encompassing some 40 specialties. Nurturing student needs in academic advising may provide useful guidance in general and specifically secure understandings that lead to insight. Understanding students' perceptions will enhance the holistic knowledge about academic advising across engineering disciplines to improve students' lives. Collaborative support advisory models, for example, may hold potential for improved student outcomes and faculty awareness.

1.1 Purpose of the study

The purpose of this research to examine engineering students' perceptions of academic advising at a mid-size public residential intuition. To accomplish this purpose, the following research questions guide this study:

- 1) What are engineering students' perceptions of academic advising support systems?
- 2) How do males engineering students and females engineering perceptions of advising support systems vary?
- 3) How do freshman/sophomore (group 1) and junior/senior (group 2) engineering students' perception of academic advising support systems vary?
- 4) How do perceptions of academic advising support systems within engineering vary based on the type of advising delivery methods? (e.g., regular advising (faculty and professional advisors) or university resources (support centers) or off university advising (family))

1.2 Background

The term, academic advising generally refers to a process of counseling and discussion between students and counselors where the matters of education, career selection, educational issues, institutional and financial issues are the main subjects of discussion (Gordon, Habley, and Grites 2011). Usually, academic advising is performed in the situation when students need some help with the matters of academic, social, or personal nature. In return, the counselor sometime informs, guides, suggests, counsel, lead, and the other times advisors teach the student (Lowe and Toney, 2000). These activities help the student to flourish and perform better while increasing the institutes' satisfaction level (Krumm, Waddington, Teasley, and Lonn, 2014).

Academic pursuits are a major decision in the life of a student, especially those who choose to get an education despite a difficult financial condition. For other students, the change from the rigid, fixed routine environment of high schools and relaxed environment of homeschooling is difficult to adjust (Woolston, 2002). There is another group who enters back to education after a gap year or a longer period of discontinuity, they find it immensely difficult to meet the requirement of higher education, and they also face a problem with the routine and workload (Razak et al. 2019). Other students are learning with passion, but they must work to meet the financial requirement of education. Similarly, they need to meet the demand for educational courses as well as of the employer, which is a physical workload for them. This type of student keeps on suffering from the double workload, mental stability, and health-related concerns (Braxton, Brier, and Hossler 1988). Although they are the hardest working students, their capability and hard work are not fully reflected in the transcript of their respective educational degrees. All of these students are in a state of change of mind, and they need good advice, support, and care (Sutton and Sankar 2011).

Without academic guidance, students tend to stay longer in colleges than they should be. There are various reasons attributed to this outcome. Students are taking courses that do not help in getting the degree. When they register for an extra course, the workload of their education is increased. This causes them to fatigue and is also known to raise permanent health concerns. The workload is increased, and it finally results in mental and physical fatigue, high-stress level, and two or more of these outcomes in combined form (Fong, Lily, and Por 2012).

1.3 Significance of the study

Some students might delay their graduation to seek extra time for decision making because of their unawareness of their future goals after graduation (Motseke 2016). Guidance from the academic advisor has the potential to solve this issue. This inability or delay in decision making causes delays in the completion of degree programs. Moreover, in engineering, students often get admission to a degree program based on their initial assessment and later on find that their decision is not the best, so they try to change their program. There are many difficulties with transferring to another program such as the new program not accepting the coursework from the previous one. Therefore, students end up needing to enroll in more courses, which results in delays in degree completion. Additionally, there are concerns with students withdrawing from courses as they may induce overload on the student. The courses that they withdraw from results in excess cost to complete a. The decision to withdraw from a course soothes them in the current semester but increases the workload tremendously near the completion of a degree. When a student cannot pass them without compromising on the current semester, he or she adds one or more extra semesters.

Another problem causing trouble for students is adding more than one extracurricular course. When students spend more time in extracurricular activities rather than completing the core courses, the time required for passing the core courses could not be managed. Therefore, their graduation timeline increases. Many students have scheduled a course that does not fit their mind or skill set, and now they find it difficult to complete within the given period (Rungduin and Miranda 2018). In all of the conditions arising due to the reasons mentioned above, the academic advisor can help them. As timely advice can save a future, the advisor can help them make the right decision without wasting any more time and money. There are many benefits that the advisor can offer to students.

Students may be reluctant to share their problems with an advisor at the start, but they begin to become more confident and comfortable with time. Student finds themselves at ease in decision making after they have taken one or more advisory sessions. They feel more comfortable about the selection of the courses and degree programs that can shape their future (Lynch and Lungrin 2018). It is reported that students who get advisory sessions more often, develop an increased awareness about the university, available opportunities, their educational system and merits/demerits of the particular course/program (Lowe and Toney 2000). This self-development and grooming that students attain by attending advising sessions help them get better grades in the degree program and increases the chances of their success in the post-graduation scenario (Baron 1986).

Students taking advisory sessions find themselves more aware of the policies of the university and their operational procedures. This increases their confidence level in university and also increases their working efficiency since they are well known for the processes going on in university (He and Hutson 2016). Many students find a particular part of the program very difficult. They need special care and assistance in developing their skill set to solve their issues. The skillset students find frustrating to attain include presentation skills, languages, mathematics, or the core disciplinary subjects. With academic advisory, students get a chance to discuss their problems and get them solved. In the majority of the cases, they get an appropriate solution to their problems (Donaldson, McKinney, and Pino 2016). Most of the time, teachers offer help to students whenever they need it.

There is a group of students who needs to work to meet the educational, financial requirement. Having their studies completed is particularly difficult for these students. advising makes it easy for such students to find some compensation in their fees requirements, access to the need-based scholarships, some jobs related to education, which can ease their financial needs with minimum hurdles in education. Some students have reached the jobs in university just through the reference of academic advisors, some advisors themselves hire a research assistant for the compensation of their educational expense, and students find this kind of favor very helpful in the success of their educational career (Chan et al. 2019).

1.4 Engineering as a field of study.

In the field of engineering, students face various challenges. Most of the countries around the globe have high merit requirements for engineering programs. Also, the engineering degree programs are costlier than most of the other programs, especially costlier than the programs related to the subjects of social sciences (Bias and Mayhew 1994). Engineering itself is considered a difficult program compared to other programs (Banerjee, Rao, and Ramanathan 2015). The difficulty is illustrated by the meritocracy and high competition in this field. The competition in the field starts from the time of admission and continues from their degree programs to the securing of jobs and sometimes even continues until the bidding of tenders and designs. The definition of engineering itself reflects upon the competence and capability that is required to accomplish its demands.

1.5 Engineering majors and branches

Engineering is a vast discipline of study comprising of several sub-disciplines. Today, most of the engineering is based on the five major branches of engineering, which are often subdivided into other specialized or interdisciplinary branches. The main disciplines of engineering are related to chemical, mechanical, electrical, electronic, industrial, materials, civil, software, computer science, and aerospace works. Chemical engineering comprises the application of the knowledge of chemistry, physics, biology, and engineering to manufacture a chemical product or to carry out a chemical process on a commercial scale. The example of chemical products may include commodity chemical, household chemicals, special chemicals, polymers, elastomers, and medicines while the example of chemical processes may include fermentation, desalination, catalysis, degradation, and digestion. Civil Engineering is the branch of engineering that deals with the design, construction, manufacturing, and study of the buildings and works. This branch is mainly divided into structural engineering, environmental engineering, and surveying. The civil engineering or any of its branch do not consider military construction and designs as its part (Khan and Zubaidy 2016; Rogers et al. 2017). The Mechanical branch of engineering deals with the design and manufacturing of machinal devices, and physical systems including but not limited to machinery, assemblies, aerospace and aircraft products, weapons, vehicles, engines, turbines, moving parts, robots, and other products related to motion and energy (Maleki, Karimpour, and Dizaj 2018). The study of designs and manufacturing of electrical and electronic systems, including the circuits, motors, electromagnetic and electromechanical devices, electronic devices, transistors, processors, telecommunication, signal processing, transmission-related controls, instrumentations and other components (Maciejewski et al. 2017). Materials Engineering is another major and complex branch of engineering that deals with the study, design, development, and testing of various materials that are required by other fields of engineering for the production of their systems (Jr and Rethwisch 2020).

1.6 Importance of Engineering

Engineering is subject to of crucial importance for any nation. For a society, the engineer being countless benefits through innovation in existing products, establishing models, making new resources of production. Individuals bring math, physics, and another number of disciplines together and merge them to make ways that can benefit humanity (Brophy, Klein, Portsmore, and Rogers 2008). The progress of any nation, whether in gross domestic product or any financial indicator, or infrastructure, or transportation, or communication or the mode of education or the field of health and safety, all have the necessary contribution of engineers (Michael 2005).

In time of war, engineer produces the weapons of defense, in the time of peace, engineers work to make the life of people easier. In time of famine, their contribution is in the form of food making processes and pieces of machinery that can bring food. In the times of rain and floods, their part is present in the form of shelters, boats (Kahn 1984; Traas and Office 1993). The forecasting of weather and early warning about seismic activities are all attributed to the hard work of engineers (Cai Ximing, Hejazi Mohamad I., and Wang Dingbao 2011).

In summary, we can safely say that engineering has importance in all the disciplines of life, and the progress of any country's economy is dependent on the quality of the engineer's work

1.7Academic advising in Engineering

Academic advising for engineering students is very important and cannot be overemphasized. It acts as a vital career-shaping force that can protect a person from opting for a field where he or she cannot perform the best. It helps the country build a workforce that is best in their respective professions (Powers, Aaron , Carlstrom, and Hughey 2014). Academic advising in general is very crucial and effective platform in improving the cognitive, psychomotor, and affective domains of students learning (Powers, Aaron, Carlstrom, and Hughey 2014). The counseling is known to benefit students in many ways. It is, however, being evaluated that the course content should be improved and the methodology of learning should be shifted towards a more reasonable type of teaching style, which can foster the counseling and advising requirements within the class activities (Krumm et al. 2014).

1.8 Stakeholders

The academic advising committee may appear to be comprised of a counselor and students to a general person, but there are several people and factors which are constantly contributing to the process of academic advising. All these people are called the stakeholders of the academic advising committee. NACADA identifies some of the stakeholders involved in the process of academic advising. They consider any person who can outline, index or evaluate the ways which can affect the communication of the advising system or the one who can make or affect the decision of the advisory or a person who plays his part in the assessment or distribution of the workload in committee and projects of academic advising or any person who can identify parties, assessment or strategic planning is a stakeholder in academic advising. This is because the outcomes of academic advising can be affected by him or his activities.

NACADA has enabled us to identify the stakeholders in academic advising using this process and the following classification of stakeholders obtained through the use of the same principle. The type of stakeholders is defined based on their importance and role in the academic advising process. The main stakeholders are called Internal and Core Stakeholders-comprises on faculty staff, advisors, students, and administrators. These are the people who either directly affect it or get affected directly. The second most influential and important group of stakeholders are Internal but Indirect Stakeholders- this comprises Institutional Advancement committee or Quality Enhancement cell (QEC), Registrar, Finance, HR department, Office of Academic Affairs, Student Affairs, and Admission department, etc. These influences influence the academic advising process by their policymaking, which can affect the advisors, faculty, and students. The effect of their policy indirectly reaches the outcomes of academic advising. The third group of stakeholders is classified as external and indirect stake holder such as: parents, alumni, employers, accrediting bodies, government, state, and societies. These are the people and organizations that cannot affect the process by their actions but still keep their influence through requesting, checking, and questioning the process and its effectiveness or by addressing the primary or secondary stakeholders. The classification is simplified and explained in Figure 1.

Figure 1.The Stakeholders and Their Classification

1.9 Terminology

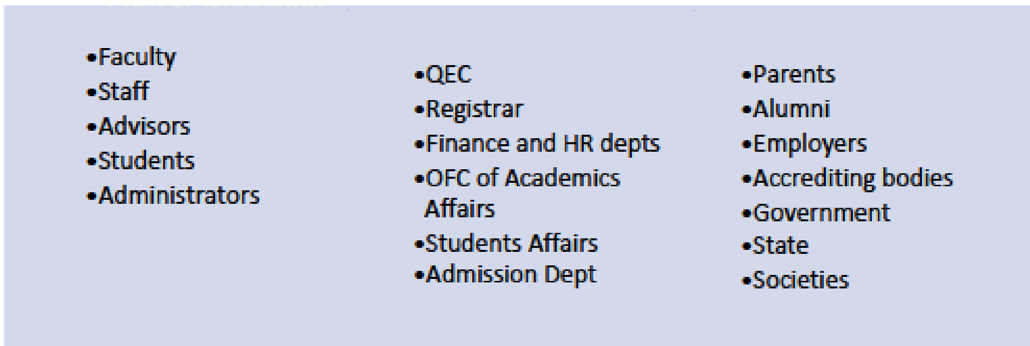

Table 1 will provide definitions of words/phrases used in the subsequent chapters to keep the language consistent.

Table 1. Terminology

vising Delivery Method	e.g., advising sessions with faculty, onl advising sessions, and professional advisors.
SCs	Engineering Students Support Centers
CADA	The National Academic Advising Association.

CHAPTER 2: Review of the literature

2.0 Academic Advising

Academic advisors play a crucial role in students' development and creation of knowledge. This is not an easy task given the significant number of students whose needs and goals rest on advisors' shoulders, as high a ration as 1,200:1, according to Khalil and Williams on (2014), who call for improved advisor-student ratios. A change in ratio appears an even greater need when we consider the depth of diversity among students and the growth of sub-specialties within engineering departments. Grites (2013) pursues a two-dimensional approach to academic advising. The first dimension is developmental academic advising as a practice of strategy, method, technique, and approach, as a way of doing advising. He argues for an advising approach that develops the whole student by pursuing three inseparable goals: education, career, and personal growth. Assisting students' development begins at their point of entry in higher education and seeking successful advising as always moving students positively along a continuum of each of the three dimensions. Students, too, are vital players on the advising team and must be honest while advisors must be tolerant and provocative throughout the journey. In general, engineering students do not graduate at high rates. Only 55% of engineering students complete their program, according to Ricks, Richardson, Stern, Taylor, and Taylor (2014). Guidance practices hold clear implications for students, particularly in their early stages of learning. Following is a discussion of some common problems advisors attempt to overcome as well as useful solutions. In all, many practices, strategies, and programs hold effective promise in assuring the engineering academic advising community to fulfill their interactional guidance with greater efficiency and sagacity.

Framework

2.0 A Model of Co-Curricular Support for Undergraduate Engineering Students

The authors developed a conceptual model with a graphic representation of practices and intentions for engineering students support centers (ESSCs), recently developed programs that work to assist undergraduates. In particular, the research focused on underrepresented students, i.e., women and racially diverse at large public research universities. Typically, the authors report that underrepresented students' retention and persistence have failed to increase appreciably from the mid-1990's to 2015. (Lee & Matusovich, 2016). The trend continues. The study attempts to answer the question, "How do engineering student support centers use interventions to provide undergraduate engineering students with co-curricular support?" (Lee & Matusovich, 2016, p. 407). That is, support in the way of interventions specifically targeted to diverse engineering students' needs; examples are mentoring programs, academic advising, orientation activities, and tutoring services.

Further, despite the student group, the authors attempt to advance the understanding of such practices as ESSCs, operate along with curricula to establish an environment with great support. Though support systems are gaining use, the authors put forth that intentional interventions are not fully understood, purposed, or structured because purpose, intentions, and effects require a framework. The research approach was multi-method, qualitative, and multi-case to include both student-support practitioners and undergraduate students from across several sites (four universities). The instruments used to conduct data open-ended survey, documents and individual interviews (six ESSC cases to represent three ESSC types) did not endeavor to compare, but rather, a manner in which to reveal a holistic synthesis of findings across the studied ESSCs. The Tinto (p.409) model was used to ascertain institutional action(s) that improve student retention or institutional experiences (events) occurring while students are engaged in the university environment, instead of limited facets (non-holistic) of students' experiences. From information gleaned through interviews of 17 administrators, visitations to each of the four ESSCs for 3-5 days, and 538 student questionnaire responses, the authors developed a coding strategy and then a model to help understand each of ESSC. A logic model table was then created:

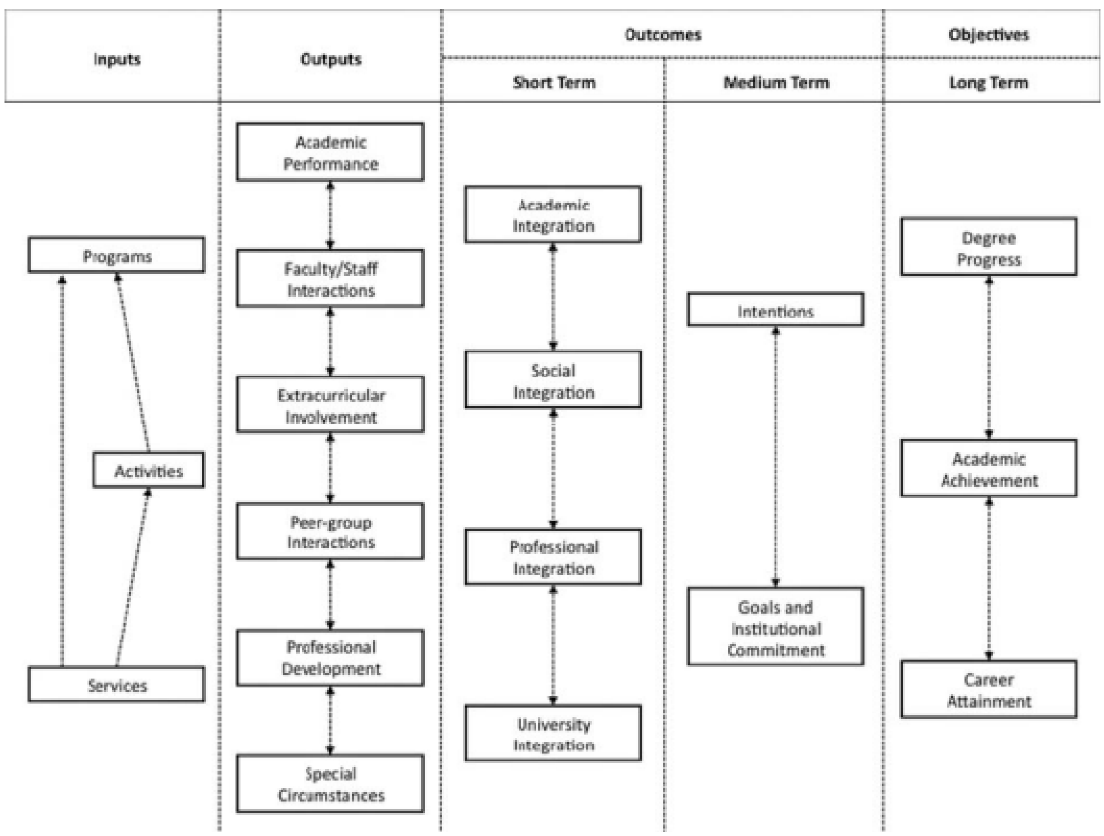

Figure 2. Model of co-curricular support for undergraduate engineering students. (Lee & Matusovich, 2016, p.417)

The model presented attributes, namely these are inputs, outputs, and outcomes. Inputs are interventions: programs, activities, and services provided for students. Outputs include academic performance, faculty and staff interactions, extracurricular involvement, peer-group interactions, professional development (e.g., student communications classes), and special circumstances. Outcomes and objectives were also broken into short-term includes 4 main integration and 2 of them was inspired by Tinto's modes academic integration and social Folsom were in the Tinto's model than they expand the integration to cover professional integration and university integration. Furthermore, the outcomes include medium-term include intentions, and goals and institutional commitment. Lastly, long-term include degree progress, academic achievement, and career attainment. Engineering students usually starts from the first attribute inputs and then if they reacts positively with each outcomes and sub-outcomes students will successful transition to last stage of the model objective and attain their degree, This work provides a qualitative scholarly addition and resource for approaching and understanding processes aimed to support marginalized engineering student populations. In seeking validation of the authors' model for ESSCs, one can turn to repeated use of the instrument as a strong indication that its measurement is successful. With this in mind, one can look to another research that is informed by the model.

2.1 Interactional Causes of Engineering Student Success

The interactional causes of success are many. The effect (success) is somewhat nuanced. However, certain interactions appear empowering and strategically helpful. Because all parties involved often report studies through surveys, success is difficult to ascertain. Nevertheless, perceptions are powerful indicators. Khalid & Williamson (2013) consider the demands and challenges to effectively advise. Students generally perceive advising a minor activity and of low status (e.g., time-consuming) and often merely a prescriptive function when addressing needs. However, satisfying student needs is a critical link to student retention. The authors question whether an automated process of computer-assisted programs should be used. Noting that students generally take availability for granted and that some students come in only when failing, they note advisors must present a warm and welcoming demeanor. Faculty and professional advisors play a vital part in students' success. Though students tend to use both advisors to solve or answer different and separate needs, students might not realize the different perspectives each type of advisor shares, perspectives that students do not recognize as insightful. It is noted that students find faculty advice most helpful in the realm of career.

Promoting engineering students' success through interactions begins early on. Connections often begin before the fall semester. Students should enter college with positive views, skills, and knowledge, the building blocks of their engineering educational experience. This is equally true in the case of women and minorities. Sithole, Kibirige, Mupinga, and Chiyaka (2017) see a need in middle school through high school years. Citing a lack of funding and poor educators' skills, students' disjunction or loss of enthusiasm moves them away from STEM courses. Consequently, skills and knowledge suffer as well. A collaborative bridge between various players is needed. Transfer students also benefit from university interactional practices. Laugerman, Monies, Rover, Mickelson, and Shelley, (2019) point to connected learning communities that deliver a smooth transition for transfer students. Notably, inter-institutional collaboration works to create a community college engineering orientation course that can assist developing an admissions partnership to the engineering program in a 4-years institute for community college students, performed data collection and analysis to guide informed decision-making, and more generally, enhance a transfer-friendly environment.

Khalil & Williamson (2014) suggest providing guidance toward best options, tracking progress, discussing degree requirements, and promoting resources and opportunities as important strategies for early-stage academic planning. Streufert (2019) notes through a case study that non-advancing students benefit from re-engagement, in perceiving failure as hope. In practice, the advisor privately notifies a student of an obstacle to academic progress. Strategically teaching coping mechanisms successfully move students in another direction for greater success. Program tools devised to present graphical representations of student skills and knowledge is another interactional strategy that assists advisors to point incoming students toward their personal (i.e., best fit) program. Macia and Nowlin (2012) describe a graphic tool, based on survey results of aptitude and career preference, that ranks application (e.g., skill) vs theory (e.g., knowledge) in comparative terms. The information gleaned assists advisors plan a four-week intensive semester or summer program than has shown to improve student mindset and their freshman transition. Jones (2009) considers course design as a way to motivate students. Success is design that renders greater cognitive and psychological constructs through courses that motivate through empowerment, usefulness, success, interest, and caring.

A promising trend that appears to benefit students and staff might best be found in capstone projects. Overall, the interactions are remarkably encompassing in their breadth and inclusion. Such projects reach throughout a campus for collective input, and involvement typically reaches outside the institution, as well. Faculty, mentors, advisors, and coaches oversee capstone projects with the inclusion and guidance of business and industry, providing students with real-life mentorship and experiential opportunities. Dixon (2015). Mentoring and interaction cannot be overlooked when both have the potential to better student educational journey in engineering. Further, success appears to follow institutionalize-wide practices. Rabb, Welch, Davis and Ragan (2019) studied the practice of considering the demographic-specific needs of students when organizing advisors. Previously unsupported to such an extent, the six-year program grew to offer and coordinate peer support, leadership experiences, clubs, supplemental training, resume writing, and career experiences. Honors programs, STEM events, industry mentoring, and field trips. Rounding out the year with internships and a week of engineering activities added to the valuable connections between students, while also promoting institutional and career identity.

2.2 Advising is an Effective University Strategy

One theme that runs through much of the research is academic advisors' overwhelming inability to find the time thought necessary to fully and sufficiently provide supportive advice to students. Professional and faculty advisors both feel obliged to support students' many needs, yet often student and advisor ratios simply do not provide the needed time. Consequently, advisors turn to systems, programs, and reconfigurations to help them get the job done. Gardner (2019) points to a coordinated effort for success whereby professional advisors facilitate student/faculty conversations when questions of a learning nature arise. Curriculum, for example, is the purview of faculty, after all, those expertly equipped to guide students through common questions regarding the learning material. The narrower focus enables students to excel and reach their potentials while freeing faculty to enable positive learning outcomes. Further, as former students in the field, it is faculty that can masterfully share their journey of learning, a natural strategy of support.

Institutional strategy is important for first-year engineering students as represented in other programs. ReFresh (Retaining first year engineering students and retraining for success) (Shyminsky and Mak, 2013) share improvement in first to second year average retention rates by 91% over a 4-year study. Students' admission records or academic standing is reviewed term-by-term. If an unsatisfactory standing or aggregated trend is noted, students are obliged to withdraw for the second semester. Withdrawal is mandatory and substituted with an adjusted learning program. With small class sizes and collaborative communities with more instruction time, relearning of important foundational key concepts of calculus, physics, computer programming, chemistry, and linear algebra takes place. It is a systematic do-over. TA study groups and untenured faculty and advisors build skills as well as relationships. Students significantly add to their understanding of core theory and key concepts. Confidence improves and faculty learn common and personal difficulties.

Timely interventions require busy advising staff and faculty have timely student data for timely interventions. New datasets for research and evaluation may solve such problems. (Krumm, Waddington, Teasley, and Lonn, 2014) used a learning management system (LMS) to identify at-risk first-year and second-year engineering students. Gradebook entries, comparisons with peers, and performance were all updated weekly. Data visualization clarified needs. If students were to slide, mentors were contacted, scheduled, and guided by staff using targeted strategies. Engagement was a valued result. Staff and faculty determine actions and guide mentors to encourage, explore and engage.

Rules of engagement: GPA 5% or 10% below average, or below 25^{th} percentile in logins (by students to LMS course site to participate in online discussion and reflections). This organizational capacity improved the engineering school's efforts over a six-year period. Advisors and faculty considered the demographic-specific needs of students when organizing mentors, thought to be helpful. Previously unsupported to such an extent, the six-year program grew to offer and coordinate peer support and multiple inclusive programs. It is through an organizational capacity of resources that enable access to the learning analytic tools and other similar services. This policy is valued on campus; not considered a barrier, but a mechanism that targets and improves student success. It is learning analytics-based interventions. Data visualization merged for various datasets and mathematical functions able assisted mentors, advisors, and staff. In this study, engagement increased when faculty, academic advisors, and mentors were informed, proactive, and engaged. Informal and institutional sanctioned technology-based systems can provide a pragmatic solution to support academic advising. In another form, E-APP online professional network of transfer students can connect with various members of the university to include faculty. The system has been used with some positive responses. Texting and emailing as secondary communication tools for incoming and continuing students (Mattei, Dodson, Guerin, Goldsmith and Mazur 2014) appeared to lack any rational recommendations, however, and students expressed uncertainty as well as any potential long-term positive effects.

Laugerman, Monies, Rover, Mickelson, and Shelley, (2019) found notable increases in graduation rates by pre-engineering admission students transferring to university and participating in learning communities. Graduation rates for transfer students rose by 58% over five years exceeded national gains by 25%. The university system set a goal to graduate 900 engineering students annually by the end of 2012; it was exceeded by 19%. While first-year students found greater comfort with upper-class mentors, informal relationships and organization contexts improved integration and retention. For example, Discovery Engineer Day at a local community college included faculty panel presentations as well as faculty activities. Such interactional programs present faculty to potential students early on, a measure of the overall partnership scheme. This type of inter-institutional collaboration and partnerships include community practice through partnerships that lend to greater awareness about engineering and its many career options. It is student-faculty interactions related to educating and training the engineer that occurs in a presumptive natural setting of merely shared learning.

Low retention and high attrition in general STEM success prompted Sithole et al (2017) to devise methods to attract females and minorities to high school STEM-related courses. Insufficiently skilled and knowledgeable teachers exacerbated the problem of middle and high school disjunction and year-to-year lackluster enthusiasm. The problem was successfully approached with a collaborative model, much like strengthening a bridge between faculty and corporations using feedback and soliciting methods aimed to understand student needs. Student peer mentoring was paired with teacher professional development and incentives, added administrative support. Also, the strategic plan offered early interventions based on student needs, expectations, and academic challenges. The highest college attrition rates are among STEM students who drop out when they feel their success fade. Looking to promote success, an institution-wide collective development of critical policies and practices ensued to enroll and support persistence with early-stage-learning interventions.

Ricks, Richardson, Stern, Taylor, and Taylor (2014) worked with at-risk students: they sought to dedicate faculty advisors for students to encourage sense of community and belonging to improved study behaviors and habits. The study participants had to fulfill a calculus sequence as a required prerequisite filter for scholastic maturity. The results were compared over a five-and-a-half-year period with non-included engineering students. The learning community cohort graduation rate was comparably higher: 50% over the 39.6% non-program participating engineering students (Ricks, Richardson, Stern, Taylor, and Taylor, 2014). Many schools integrate tools of technology as a means to further learning connections. Cyber peer-led team learning is a tool used since 1998 when instructional tech specialists and peer leaders worked collaboratively to develop interactive workshop environments. It offers flexibility for students with work and/or family responsibilities some extra help understanding the learning material. The flexibility allows students to schedule a two-hour face-to-face online peer-led learning session. The peer teachers gain audio/visual presentation skills, increase their knowledge and retention of material through the act of teaching to others, and they can earn extra credit. These student leaders are carefully trained and must possess a thorough familiarity with the course material, performed well in classes, and possess strong communication and leaderships skills. As reported by Mauser (2011), the program, administered by faculty and student leaders, resulted in student learners' exam scores that were of the same caliber as faculty-led face-2-face learning. One might question whether the presentation of the curriculum by a peer helps cement previous learning.

Macia and Nowlin (2012) studied a graphical representation tool that presents application and skill vs. theory and knowledge as an alternate model to assess student abilities. Used for in-depth analysis to assist students to recognize and identify their individual strengths and weaknesses. Theorizing that students need a diverse team of advisors, the model correlates between thinking style and learning style. An implication of the study, while successful when used in a department, points to the need of a high level of involvement. Ricks, Richardson, Stern, Taylor, and Taylor (2014) had an improvement over a five and a half-year period vs. non-included engineering students. The learning community cohort graduation rate of 50% vs. 39.6 % non-program participants points to the need for an institutionally sanctioned widening of the program.

2.3 Factors for Institutional Effectiveness

Troxel (2019) believes scholarly advising must be inward-facing, reflective, and assessed. Colleagues should read and discuss learning and teaching. They should apply the dynamic and ever-evolving theories with intrinsic motivation and external accountability. Some psychological constructs with relevance to engineering education mutable by first-year experiences: creativity and engineering design, self-efficacy). Grit's importance is its prediction educational attainment, GPA, and academic retention. Integration of academic advising into advising design: Control group mostly worked in teams, vs. advising group worked closely with faculty and TAs. Implications from the study revealed greater improvement in all psychometric measures in the control group. Psychometrics barely changed in advising group (Guilford, Blazier and Becker, 2015).

2.4 Institutional Effectiveness

Brooke, McGlothlin (2019) Compares three models of advising programs at large 4-year, primarily residential universities:

1) Dual student-faculty and student-advising office.

2) Total Intake: student-advising office and academic sub-unit.

3) No Best-fit: student academic advisors, office academic sub-unit or student academic sub-unit or advisor office-academic sub-unit.

Three colleges implemented this three-configurations system. Over time, all three institutions transitioned to the use of a professional advising model. It was noted that the transition freed faculty to focus on teaching and provided opportunities for professional advisors to hone their skills. The study highlighted, though, a continued need for services across all models. Also needed is access to support advisors' professional growth to enable professional advisors to affect specific groups with efficiency and coordination. Langley (2017) considers faculty roles in student retention at historically black colleges. It was noted that faculty were using strategies in their own classes. A useful strategy that came to light for further study is institution-wide retention committees with representation from all facets of college communities.

Dixon, (2015) is a focused project typically taken on in the last year(s) of schooling. The growth of Capstone programs has required new faculty to serve as facilitators. Guidance is provided via a handbook that details the expectations of faculty mentors. Depth is provided through vignettes. Such programming offers greater equity for advising.

Rabb, Welch, Davis, and Ragan (2019) sees Qualtrics surveys help with ease of grading. There are more interactions among team members through logbooks detailing progress with comments, in-house meetings to address areas for improvement, industry visits, telecommunication with all entities that may even include sponsors. The overall change in student population from 2011-2018 in engineering jumped 40%-81%, to include minority students increase from18%-22%, and female students from 2%-6%. Undergraduate enrollment increased from 444 to 660+, minority populations increased 4% increase and female enrollment increased 650%. The entire population of engineering student growth was 150% over six years, with retention increasing from 40% to 81%.

2.5 Students Interaction with Faculty

Shyminsky and Mak (2013) note faculty interactions within a program (ReFresh) are reported to be more certain and specific, resulting in deeper understanding by students. Surveys (Mosher, 2017) reveal that faculty advisors are seen as subject matter experts and career experts. Faculties, however, find that hands-on prep takes time away from advising, and further see advising as out of the realm of their teaching and research commitments.

Add to that is the challenge universities face in paying to hire full-time staff. The adjunct faculty is responsible for teaching, yet responses to student needs are unclear. According to Langley (2017), despite coaching by tenured and full-time faculty, the adjunct staff does not follow through with recommendations to encourage and engage students. Further, faculty-meeting conversations did not follow up on the recommendations. Macia and Nowlin (2012) see faculty presents a breadth of knowledge and skill in comparative terms while Jones (2009) looks to a need for designing courses with interactive components to excite and motivate students. The 5-1 and 2-year study by

Ricks, Richardson, Stern, Taylor, and Taylor (2014) saw promise in a dedicated faculty-advising program to encourage both sense of communities and belonging to improve enhanced study habits. As a final step in a program to graphically represent practical and theoretical knowledge of the many engineering program offerings, Macia and Nowlin (2012) applied a strategy to include faculty input as collaborator with student to find a best fit-program of study. Iatrellis, Omiros and Panos (2017) find academic advising to is a combination of both teaching and learning procedures that involves a tutoring, preparation, assistance, and assessment of interactions used in the advising sessions; they note several studies on the academic advising filed which focus on a pedagogically that have meaningful analysis of students' data. Thus, evaluating academic advising as a system for improvement.

Guilford, Blazier and Becker (2015) Designing engineering study teams with more input of advice by faculty resulted in significant improvements in psychoanalytic constructs in fluency, flexibility, originality, creativity, and self-efficacy. Students tend to perceive faculty advising as associated with career plans and academic goals. Part of the academic advisors' job is to present advice on probation students to ascertain which load would be the most fitted load for minimal risk and greater success. (Baloul and Williams, 2013).

Langley (2017), determined that 31 out of 32 faculty believe they should be engaged in ongoing retention efforts and responsibilities of local retention efforts to include advisement, mentoring, experience classes. In a qualitative study to determine the perceived effects of student age differences, adult (25+) students were similarly attracted in their perceptions that class size, and faculty availability hours inhibit connections. It was noted that faculty-teaching styles, for example, organized vs. disorganized, attracted or disinclined younger student engagement. Capstone projects overwhelmingly include a team of collaborators with coordinated interactions. These include logbooks, in house meetings, progress checks and comments, address and note areas for improvement as well as visits to industry, and telecommunication with all entities. Rabb, Welch, Davis and Ragan (2019) Notes using faculty as the student's adviser for freshmen engineering and dividing some sections between two faculty helps spread the burden of time and assists new faculty with a mentor.

2.6 Importance of Student/ faculty Interaction

Learning is a social activity as well as a social contract requiring the interactions between students and faculty be friendly and empathetic, truthful and trusting. Rabb, Welch, Davis and Ragan (2019) suggests hiring advising staff that represents student diversity helps new faculty acclimate with assistance from tenured staff, helping (in a round-about way) student-faculty interaction. Faculty advisors assume the job of engagement with students in spite of their many responsibilities. Occasional dissimilar expectations and the lack of full-time faculty in some institutions can lead to impairments for student success. After all, employing part-time faculty who may not be fully vested in the success of the student body is understandable. Additionally, a lack of systematic programs for advising can add to dissatisfaction by all parties.

In all, while advisors and students tend to agree on advisor responsibilities as well as academic advisors' interest, there do appear to be best practices that emerge. Foremost is a system of institution-wide advising to include mentors and peers, industry, and data systems that quickly and easily provide faculty and others with pertinent student progress.

Including frequent evaluation, research, and discussion groups with all parties should be integral to the advising system. Also, considering Troxel's advice, faculty members who stay abreast of successful practices and engage in roundtable discussions and surveys are placed in a safer position to meet the continuous changing needs of student populations. For example, when we learn that older students use their feelings of vulnerability to their advantage, roundtable discussions provide the avenue for expression. Academic advising could defined as a process within the education , we can look at it as "Viewing academic advising as an educational process moves it from a paradigm of teaching that focuses on information or inputs to a paradigm of learning that focuses on outcomes for student learning" (Campbell & Nutt, 2008, p. 4).

2.7 Relationships of Student and Faculty

Not only curriculum but also testing aside, focusing on students' outcomes is not such a novel concept, but it would tend to change the dynamics of relationships. Faculty advisors tend to look at teaching as a learning process for students. They teach how to process information in various ways. They use varied strategies to help various learners reach a clearer understanding. Supporting the diversity of students in engineering programs can begin with an awareness of the various perspectives of diverse students in the programs. The results of such an endeavor open windows into approach and thinking. Miville & Sedlacek (1994) found that departmental advisors are typically utilized more often but serving walk-ins for registration and signatures might not fully utilize their skills. While many centralized services are underused, freshmen rarely seek faculty and seniors seek faculty advice more than freshmen or juniors. Overall, students seek faculty advisors more often, though first-year students tend to turn to professional advisors.

Ciston,Sehgal, Mikel and Camasciali (2018) concluded older students vs. traditional-age students. First, vulnerability can translate to learning power, and the older group understood this. Traditional-age students can be encouraged to embrace their vulnerability when questioning, which can lead to further engagement, critical thinking, reflection, and connection. While older students find faculty approachable (if schedules permit), their younger peers are often intimidated by faculty. Supporting the diversity of students in engineering programs can begin with awareness of the various perspectives of diverse students in the programs. The results of such an endeavor open windows into a variety of approaches.

2.8 Synthesis of Findings

Like all learning, student success takes a village. This includes students, the users in this (contractual) connection whose job is to achieve skill and knowledge, thus value and wholeness, as they grow and become their best selves. It is clear that institutions are obliged to serve and support students; every effort must be made to offer guidance as students find a major match up with their interests, skills , career goals, and knowledge. Those attributes must be accepted, shaped, and grown with strategies, support, and empathetic guidance. In as much as students vary in attributes, academic advising needs varied research-based tools and models: technological, theoretical, psychological, and sociological, programmatic, informational, etc.

Moreover, structures and systems must be put in place to coordinate and support the professional and faculty advising teams. Otherwise, as proficient, supportive, and well-meaning the professional and faculty advisors, it is systematic and structural foundational resources that appear to tie to effective success significantly. A final consideration, learning takes place at and within all levels of the institution. Self-evaluation and awareness inward looking as a means of growth is an excellent example at all levels of institutional learning. Also, it serves students to treat academic advising as a curriculum of student development.

2.9 Engineering Student Retention

This literature review considers research, both quantitative and qualitative in nature, in an attempt to determine and understand how student-advisor relationships affect student retention and success in engineering programs. For clarity's sake, the notion of success in the education of engineering students might be defined as: engineering students are tomorrow's problem-solvers. As diverse as the problems they may face, engineering students are equally diverse in background, skills, experience, and interests. The successful student ably finds a passion and pathway—despite a myriad of circumstances—and each assumes an identity as a member of the engineering community. Motivated, they move through their chosen program with confidence, a goal always in mind.

Challenges arise, and advice and support are required; this is the intersection where advisors are most needed. Indeed, in day-to-day college and university life, advising is likely working at every turn, orchestrating pathways of least resistance on behalf of the students they serve. If advising appears ad hock, it is typically well meaning. Academic advising practices intertwine through and within the engineering students' experiences in higher education as advisors work, often in diligent concert, to pave success for and among their students. While the above definition is wide in breadth, its ideas flow from best practices within schools and universities reviewed herewith. This is not to say that each setting enjoyed great success or suffered failure. Rather, research may lack findings due to the nature of the research method. For example, interviews of students and academic advisors reveal a great deal about programs and interactions, but psychoanalytic feelings and assumptions are difficult to quantify. Additionally, specific practices that reaped a high percentage of responses yield valuable implications. However, because of design model sans hard facts that might reveal successful retention rates and graduation rates, the breadth of success for our purposes is limited to these rates. Overall, student success appears best supported through institutional level programs, strategies, and practices. At worst, the trickle-down theory will positively affect uninterested key players. More likely all will embrace an institutional level model and assume responsibility to work within an integrated mechanism, like a well-tuned engine, to move students learning and growth in a direction of success

CHAPTER 3: Methodology

3.0 Research Procedures

The research objective is to examine engineering students' perceptions (Patterns thoughts based on engineering students' experiences) on academic advising support systems and determine the connection between advising support systems and engineering students' persistence to help students in their educational. To do this investigation, multiple statistical analysis methods were applied by utilizing the Academic Advising in Engineering Survey. Preliminary statistical analysis methodologies statistical descriptive, regression, and Mann–Whitney U test.

3.1 Theoretical Framework

The Model of-Curricular Support for undergraduate Engineering Students uses both Engineering student support centers (ESSCs) and Tinto's framework Tinto's (1994) model of institutional departure "to define what constituted the undergraduate experience and to theorize our research findings." (Lee and Matusovich, 2016, p. 409). Lee and Matusovich (2016), looking carefully to ensure that engineering students obtain the support associated to academic performance, e.g., professional experience, professional skill development, professional development employment assistance, miscellaneous resources, and discussion will enhance the engineering students academic achievement. As students gain both experience and knowledge to use these support services, their involvement levels become modified.

Furthermore, many program interventions have a large impact on student integration to the university environment, such as first-year seminar, mentoring program, professional seminar, and student leaders. Often, students who did not receive guidance from their academic advisors to use support offices and services, those students are less likely to use those resources. When students arrive at their institution campus, their performance will be influenced by 4 main areas of integrations: academic, social, professional, and university (ASPU). As mentioned by Lee and Matusovich's study by using Tinto's model (1994), students who are affected by positive practices from (ESSCs) gain positive undergraduate experiences. Also, according to Tinto (1975) "the higher the degree of integration of the individual into the college systems, the greater will be his commitment to the specific institution and to the goal of college completion" (p.96). In other words, the higher the quality of student interactions, the better the students' perceptions. These perceptions are often measured by the four areas (ASPU) of integrations. They define to what level the engineering students are integrated into the university's environment.

In short, positive interactions with ASPU will predict good academic achievement and student persistence. However, a negative perception of interactions with ASPU exhibits an absence or deficiency of integration in the collegiate environment, which increases probability of an early departure. This investigation will primarily focus on professional and university, i.e., the integrations that involve academic advising. The model of co-curricular support established five attributes inputs and outputs, outcomes divided into to two outcomes (short-term and medium-term) finally objectives which contribute to (long-term) to complete the engineering degree within the five main scales there are subscales that were constructed to assess support systems and engineering students' interventions. Perception of academic advising in engineering is considered as a sub-scale within the outputs. This scale contributes to allowing researchers and practitioners a better understanding of academic advising support systems for engineering students.

3.2 Satisfaction Survey and Co-Curricular Support

Providing top-notch educational co-curricular support services such as "academic advising" must be a high priority for a higher education institution. It will increase students' successes, class performance, engagement, and personal development to include hard and soft skills, and goals (Fowler & Boylan, 2010). However, to provide a high-quality educational service to students, we must have a deep understanding of students' needs by identifying how cognitive characteristics lead to student satisfaction (Hwang & Choi, 2019). We can recognize these characteristics by using student satisfaction instruments to help quantify the results. Student satisfaction surveys have a huge impact not only on national students but also on students' satisfaction and retention (Sanchez, Bauer, and Paronto, 2006). A study was done by Lent, Singley, Sheu, Schmidt and Schmidt (2007) on 153 engineering students found the higher students' academic satisfaction combined with environmental supports increases the likelihood of predicting goal progress. Students value support systems and perceive great influence of high-quality education (Hill, Lomas and MacGregor, 2003). Charleer Vande, Klerkx, Verbert, and De Laet (2017) look at increasing efficiency in learning and instruments improve awareness to accomplish different methods to predict and identify and support at-risk students by utilizing academic advising.

3.3 Data Collection

In an attempt to evaluate levels of engineering students' satisfaction in academic advising within the collegiate environment the department of Mechanical, Industrial, and

Manufacturing Engineering administered the survey in purpose of this study after the approval of YSU's Human Subjects and Institutional Review Board (IRB). The survey was initially retrieved from Florida State University, "Undergraduate FSU Satisfaction Inventory." Only one section from the satisfaction inventory was utilized in this investigation, which is the academic advising section. It was also modified by adding engineering majors. The academic advising section included 12 questions after modification to evaluate students' satisfaction levels with the academic advising support systems provided at YSU. Further, the academic advising survey was sent to undergraduate engineering students for the intention to complete this investigation to engineering students at YSU in late November 2019 and early December 2019. These dates were chosen because of the different advising systems delivery types to undergraduate engineering students. First-year engineering students utilize professional advisors when sophomores to seniors utilize faculty advisors. The faculty advisors are from the engineering departments. Furthermore, setting up these dates ensures that most of the students attended their advising sessions. The original survey was from FSU satisfaction inventory (Smith, 2004), the academic advising section was used on this investigation's and The Academic Advising Survey is presented in Appendix A.

3.4 Validity of the Instrument

According to Moskal, Leydens, and Pavelich (2002), "Validation is the process of accumulating evidence that supports the appropriateness of the inferences that are made of responses to an assessment instrument for specified assessment uses." (p.351). GoodWin and Leech (2003), define validity as the level of utilization of the information produced by the test for a specific purpose. Validity is considered a crucial source of evidence and should be interpreted in any investigation and should be analyzed (APA, AERA, and NCME, 1999). Contents evidence found helps to break down the construct of interest in the instrument and it puts an accurate explanation of the variance in the scores received (Haynes, Richard and Kubany 1995).

Participants in the investigation answered the survey based on their experiences with academic advising provided. The results of these answers can be analyzed to help conceptually define engineering students' perceptions of academic advising. In other words, the level to which students respond to an assessment instrument, such as surveys reflects student knowledge of the content area of interest. (Moskal, Leydens, and Pavelich, 2002). In order to do this investigation, a valid instrument was needed, therefore, I utilized the FSU satisfaction instrument by using their academic advising section and modify to suit this study. As mentioned earlier, the only section from FSU Student Satisfaction Inventory utilized in this survey is the academic advising section. It was also modified to be suitable for this particular study. The goal of this investigation was to examine the perceptions of undergraduate engineering students on academic advising. Therefore, engineering majors' classification was added to the instrument. The purpose of implementing this classification is to distinguish how engineering students' perceptions differ based on their majors.

3.5 Academic Advising Scoring Scale

The survey included 12 questions that help understand engineering students' perception on academic advising. The scale used in the survey was Likert-type scoring scale The scoring scale from 1 equals strongly disagree to 4 equals strongly agree (4-strongly agree, 3-agree, 2-disagree, 1-strongly disagree, and N/A was not assigned a score).

3.6 Population

Undergraduate engineering students at Youngstown State University during the academic semester Fall 2019. Youngstown State University is a four-year, medium-sized public research university. Students engineering major examined in this study Frist-Year Engineering students categorized as an engineering major with prior going to an engineering discipline, Chemical Engineering, Civil and Environmental Engineering, Electrical engineering, Industrial and System Engineering, Manufacturing Engineering, and Mechanical Engineering.

3.7 Sample Selection

The Department of Mechanical, Industrial, and Manufacturing Engineering at YSU administered the survey in purpose of this study during the Fall 2019 semester. All engineering students from different disciplines were invited to contribute in the research study. Students were communicated via email along with an invitation to the survey an Internet address (link) to open the survey. Students had the freedom to participate in the research study. There were no rewards nor gifts for the students after finishing the survey, i.e. gift cards that hold an amount of money or extra grades to motivate the students to participate in the study. The final combined 2019 Survey on Academic Advising in Engineering sample consisted of 79 cases, which is a response rate of approximately 8%.

3.8 Analysis of Research Questions

The data were obtained through a secured one-drive folder in a secured YSU server and analyzed by using Excel for office 365 and SPSS (statistical package for social sciences).

3.8.1 What are engineering students' perceptions of academic advising support systems?

To evaluate common thoughts of engineering students based on this question. Data were analyzed for the YSU survey on academic advising within engineering (n=79). The 12 questions involving the Academic Advising scale were investigated. Data analyzing involved giving scores for the 4 responses (1-4 scale) and calculating average and variance. Answers were sorted by the mean. By looking at both average and variance, we can distinguish the level of students' satisfaction.

3.8.2 How do males engineering students and females engineering perceptions of advising support systems vary?

- H0: No significant different among males engineering students and females engineering students.
- H1: There is a significant difference in among males engineering students and females engineering students.

Data from males' students (n=57) and females' students were (n=22). A Mann-Whitney U test was applied. Males were coded as 1 and females were coded as 2. The data was analyzed against the 12 questions' scores to find if there is a significant difference among genders.

3.8.3 How do freshman/sophomore (group 1) and junior/senior (group 2) engineering students' perception of academic advising support systems vary?

- H0: No significant different in perceptions among freshman/sophomore (group 1) and junior/senior (group 2) engineering students
- H1: There is a significant difference in perceptions among freshman/sophomore (group 1) and junior/senior (group 2) engineering students

One-way analysis of variance was conducted to distinguish between the type the engineering students' perception based on their class level against the 12 questions. After applying a test of normality that shows the data is normally distributed. The null hypothesis predicted that there are no differences among the groups. This test was completed using YSU's Academic Advising in Engineering Survey (n=79). The independent variables were the engineering students' class (freshman, sophomore, junior and senior). The dependent variables were the survey scores.

3.8.4 How do perceptions of academic advising support systems within engineering vary based on the type of advising delivery methods? (e.g., regular advising (faculty and professional advisors) or university resources (support centers) or off university advising (family))

- H0: No significant different among advising systems delivery methods.
- H1: There is a significant difference in among of academic advising delivery methods

This test has been done in two methods to ensure the validity of the score obtained. The first method, a One-way analysis of variance was conducted to assist between the type the engineering students' perception based on their choices of advising system After applying a test of normality that shows the data is normally distributed. This test was completed using YSU's Academic Advising in Engineering Survey (n=79). The independent variable were the advising methods. The dependent variables were the scores form the survey. The second method, for the independent variable, type of advising delivery methods were divided into combinations. These combinations are the different types of academic advising methods students utilized. The advising systems were assigned to groups, a total of 18 groups, i.e., there are 18 different combinations used by the student who participates in this study. This was the only change for method 2; the other steps remain the same as explained in method 1.

3.9 Advising System Delivery Combinations

This question in the survey asks the participants how many academic advising systems they utilize at YSU. Interpreting students' choices allow us a better understanding of the advising delivery system been utilized by the engineering students. Participants had the freedom to choose more than one option. A total of 79 students participate in this study, a total of 5 advising delivery methods regular advising by faculty and professional advisors. Optional advising by peer advisor. University resources such as support centers and off university advising). Using the following equation, the total combinations of students' choices could be 120.

$$P(n,r) = n!/(n-r)!$$

After analyzing the combinations used form the participants in the stud. Results are 18 combinations of academic advising deliver system utilized by the engineering students at YSU. These 18 combinations were sorted in 18 groups as shown in tab Table 2. A One-Way ANOVA test was applied to the 18 groups to find the different among the academic advising delivery systems; results will be explained in further details in the following chapter

Table 2. Combination of Advising System Delivery

Groups	Faculty advisors	Professional advisors	Peer advisors	Other University resources	Family & friends	Total
Group 1	x					16
Group 2		x				11
Group 3	x	x				2
Group 4	x		x			6
Group 5				x		1
Group 6	x			x		1
Group 7		x	x			1
Group 8					x	1
Group 9	x	x	x			4
Group 10	x				x	8
Group 11	x	x		x		1
Group 12		x			x	4
Group 13	x	x			x	3
Group 14	x		x	x		1
Group 15	x	x	x		x	9
Group 16		x	x		x	4
Group 17	x	x		x	x	1
Group 18	x	x	x	x	x	4
Total						78

CHAPTER 4: Results

4.0 Research Questions

- 1) What are engineering students' perceptions of academic advising support systems?
- 2) How do males engineering students and females engineering perceptions of advising support systems vary?

- 3) How do freshman/sophomore (group 1) and junior/senior (group 2) engineering students' perception of academic advising support systems vary?
- 4) How do perceptions of academic advising support systems within engineering vary based on the type of advising delivery methods? (e.g., regular advising (faculty and professional advisors) or university resources (support centers) or off university advising (family)).

4.1 Demographic Description of the YSU Academic Advising within Engineering Survey

The academic advising survey total sample was 79 engineering students that are consist of 36 freshman students (46%), 11 sophomore students (14%), 14 junior students (18%), 18 senior students (23%) and 0 other or unclassified. This data is presented in Table 3.

Table 3. Students Year Classification

Year	Number	Percentage
Freshman	36	46%
Sophomore	11	14%
Junior	14	18%
Senior	18	23%
Other/Unclassified	0	0%
Total	79	100.0%

Students' major enrollment is a total of 79 engineering students that included 29 Frist-Year Engineering students (37%), 5 Chemical Engineering students (6%), 4 Civil and Environmental Engineering students (5%), Electrical Engineering students(4%), Industrial and System Engineering students (16%), Manufacturing Engineering students

(1%) and Mechanical Engineering students (30%). These are the majors that YSU offers for undergraduate engineering degrees. Table 4 shows the major enrollment for the study.

Table 4. Engineering Major Characteristics

Major	Number	Percentage
Frist-Year Engineering students	29	37%
Chemical Engineering	5	6%
Civil and Environmental Engineering	4	5%
Electrical Engineering	3	4%
Industrial and System Engineering	13	16%
Manufacturing Engineering	1	1%
Mechanical Engineering	24	30%
Total	79	100%

The gender composition of the sample is 57 male engineering students (72%) and 22 female engineering students (28%). The gender data of the YSU academic advising survey is displayed in Table 5.

Table 5. Gender Characteristics

Gender	N	Percentage
Male	57	72%
Female	22	28%
Total	79	100%

The racial/ethnic group composition of the engineering students survey respondents were African American or Black, 2 (3%), Caucasian or White, 61 (77%), Latino or Hispanic, 1 (1%), Native-American,0 (0%), Asian/Asian America,4 (5%), Pacific Islander, 0 (0%), other, 9 (11%), and 2 (3%) engineering students preferred not to respond.

Table 6. Ethnicity Characteristics

Ethnicity	N	Percentage
African American or Black	2	3%
Caucasian or White	61	77%
Latino or Hispanic	1	1%
Native-American	0	0%
Asian/Asian-American	4	5%
Pacific Islander	0	0%
Other	9	11%
I prefer not to respond	2	3%
Total	79	100%

Every engineering department that offers a bachelor's degree in Engineering at Youngstown State University was represented in this sample. The following departments are. Department of Civil/Environmental, and Chemical Engineering, 38 (48%), Department of Electrical and Computer Engineering, 3 (4%) as it only offers a B.E in Electrical Engineering for that reason Computer Engineering was not included in the survey, Department of Mechanical, Industrial and Manufacturing Engineering, 38 (48%) and Frist-Year Engineering Students, 29 (37%). These statistics is demonstrated in Table 7.

Table 7. Departments

Department	N	Percentage of Sample
Civil/Environmental &Chemical Engineering	9	11%
Electrical and Computer Engineering	3	4%
Mechanical, Industrial and Manufacturing Engineering	38	48%
Frist-Year Engineering Students	29	37%
Total	79	100%

4.2 First Analysis

- What are engineering students' perceptions of academic advising support systems?

To evaluate common thoughts of engineering students based on this question. The Data collected from YSU survey on academic advising within engineering (n=79) was analyzed. The 12 questions involving the Academic Advising scale were investigated. Data analyzing involved giving scores for the 4 responses (1-4 scale) and calculating average and variance. Answers were sorted by the mean. By looking at both average and variance, we can distinguish the level of students' satisfaction. Please review Appendix A to view the survey questions. Table 8 shows answer averages and variances from the participants, it also shows where students mostly disagreed on.

Table 8. Average and Standard Deviation for Students response to 12 advising questions

Advising Question	Average	Std Dev	% Of D and SD
1	3.14	0.82	19
2	3.04	0.93	23
3	3.36	0.81	15
4	2.53	0.96	52
5	3.08	0.92	22
6	2.68	0.96	38
7	3.00	0.82	23

Table 8.1 continued

8	2.25	0.98	61
9	2.77	0.90	32
10	2.92	0.84	23
11	3.12	0.87	23
12	3.10	0.85	18

*Scale: Likert-type (1-4)

Mean and standard deviations comparison reveal important information regarding the academic advising system at the YSU campus. Participants in this study were satisfied in most advising criteria except for both questions 4 and questions 8 which are areas of concern requiring institutional attention. Also, the degree to which advisors encourage engineering students to meet with them. Figure 3 is a visual representation of engineering students' percentage.

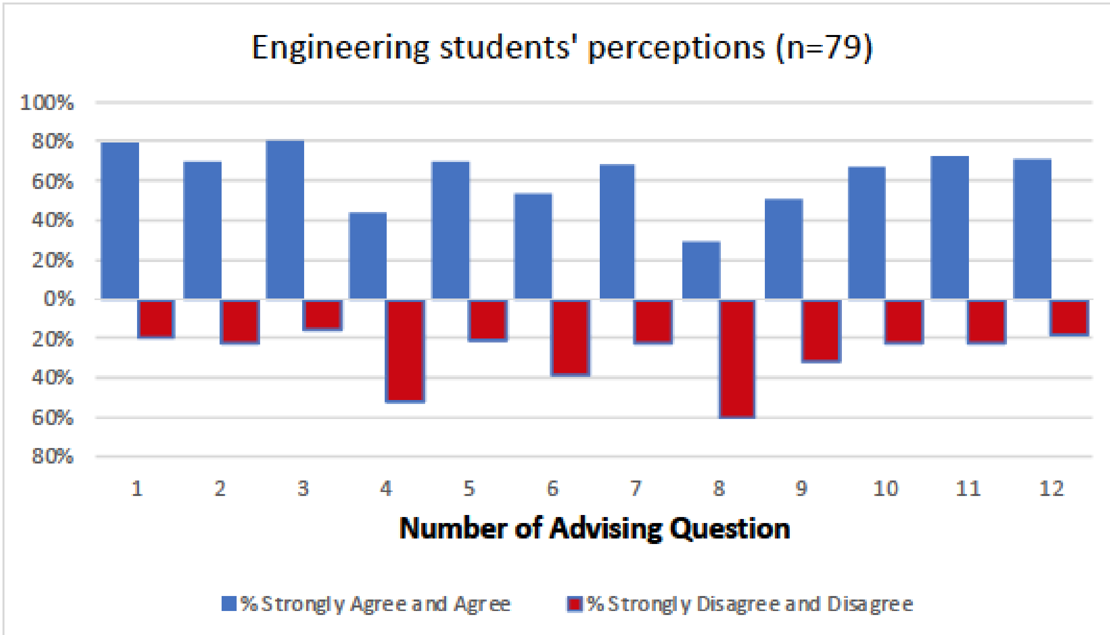

Figure 3. Comparative Histogram of Engineering students' percentage

4.3 Second Analysis

2) How do males engineering students and females engineering perceptions of advising support systems vary?

- H0: No significant different among males engineering students and females engineering students.
- H1: There is a significant difference among males engineering students and females engineering students.

Mann-U Whitney test was calculated to compare differences between two independent groups (Male and Female). Data from males' students (n=57) and females' students were (n=22). A Mann-Whitney U test was applied to both genders. Males were coded as 1 and females were coded as 2. The data was analyzed against the 12 questions' scores to find if there is a significant difference among both genders. Along with a comparison analysis for the mean and standard deviations. This analysis was completed using YSU's Academic Advising in Engineer Survey. The two groups were identified as 1 for male and 2 for female. The scores were ranked and indicated to which sample they came from. Significant differences found using alpha of 0.05 ($p<0.5$). Results listed in Table 9 shows the average answer for each question along with the variance. Figure 3 and Figure 4 show a visual representation of the male and female engineering.

Table 9. Average and Standard for males and females

	Average		Standard Deviation	
Advising Question	Female	Male	Female	Male
1	2.95	3.14	0.90	0.80
2	2.55	3.15	1.05	0.84
3	3.09	3.43	0.92	0.77
4	2.00	2.78	0.87	0.92
5	2.81	3.21	0.81	0.85
6	2.05	2.92	0.83	0.90
7	2.68	3.11	0.89	0.78
8	2.43	2.18	0.81	1.04
9	2.29	2.94	0.77	0.89
10	2.79	2.96	0.85	0.84
11	2.90	3.20	0.83	0.88
12	2.89	3.14	0.88	0.85

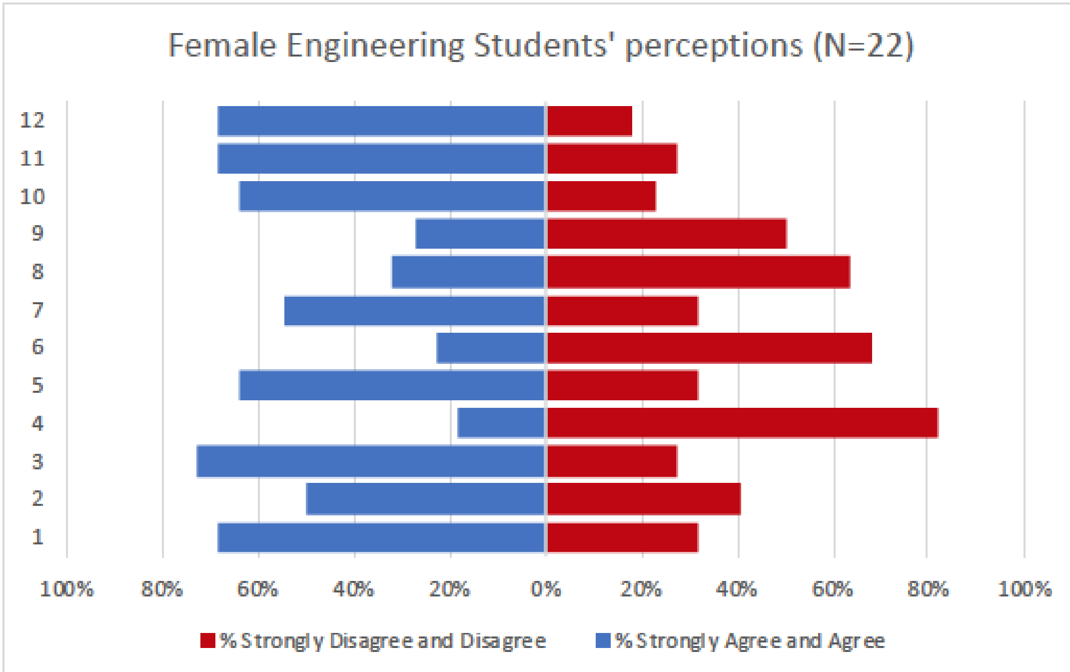

Figure 4. Comparative Histogram of Female Engineering Students' percentage

As we can observe from both Table 9 and figure 4, females engineering students were mostly pleased with advising support systems which indicate satisfaction levels. However, there are four areas requiring institutional attention. Question number 4,6,8 and 9 are areas recognized as requiring enhancement included the extent to which the advisor match female engineering students' academic interests and abilities with potential majors, match academic interests and students' abilities, the misinformation was given by the advisor. We can look closely on Questions 4 and 8 are common areas that need improvement with research question 1.

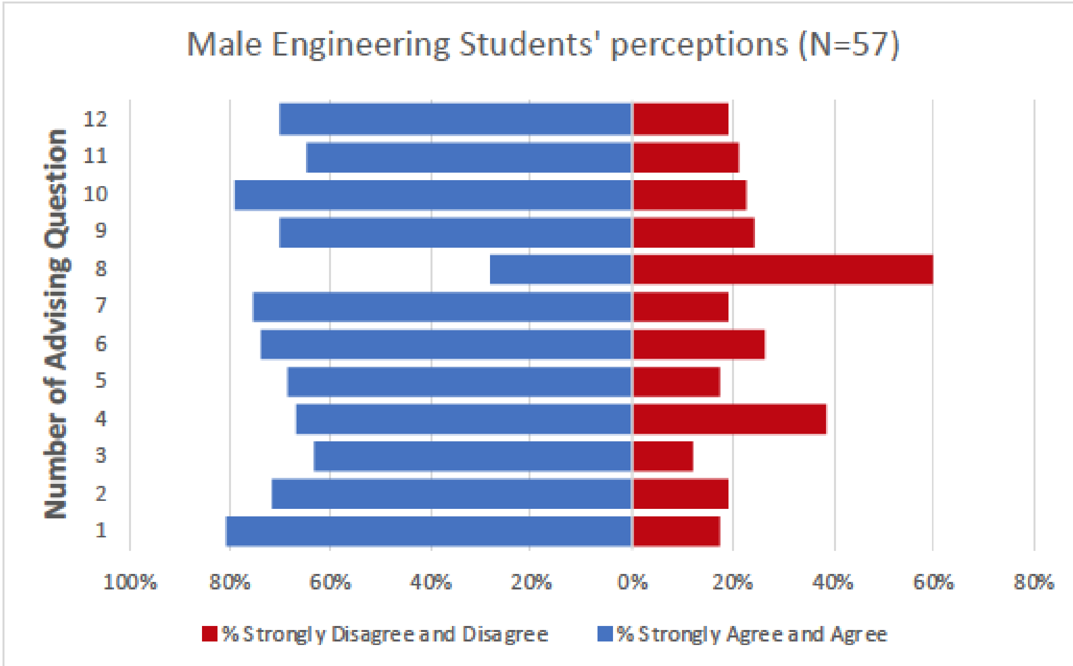

Figure 5. Comparative Histogram of Male Engineering Students' percentage

A comparative analysis of males engineering students' scores shows important data about the strengths and the weakness of the advising support system at YSU. As shown in figure 5 male engineering students were pleased with the advising support system and the advisors' availability, communications, information received, and advisor knowledge.

4.3.1 Test of normality

A normality test was applied to ensure that the data is normally distributed. Results are reported in Table 10.

Table 10. Tests of Normality

Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Statistic	df	Sig.	Statistic	Df	Sig.
.087	57	.200*	.950	57	.019
.093	22	.200*	.984	22	.968

*. This is a lower bound of the true significance.

Thus, there are no normality on males nor females due to our *p*-value is less than significant (Sig=.200>0.05).

4.3.2 Descriptive Statistics Man-U Whitney test.

A total of 78 students knew their academic advisors and one student did not know who his academic advisor is. Therefore, he did not participate in the rest of the survey. A total of 78 observations. 56 males and 22 females participate in the study. The male and female were compared against their survey scores. The results are reported in Table 11.

Table 11. Mann-U Whitney test Ranks

	Gender	N	Mean Rank	Sum of Ranks
Sum	male	56	42.71	2448.00
	female	22	25.64	633.00
	Total	78		

Table 11.1Continued Test Statistics

	Sum
Mann-Whitney U	380.00
Wilcoxon W	633.00
Z	-2.624
Asymp. Sig. (2-tailed)	.009

Hence, the Mann-Whitney test statistic will tell us whether this difference is big enough to reach significant and, the Male group comprises greater than 20 observations. This means we can use the value of Z to derive our *p*-value. Otherwise, the significance value comes from U. SPSS is reporting a Z score of -2.624 and a 2-tailed *p*-value of 0.009. This would normally be considered a significant result (the standard alpha level is .05). Therefore, we can be confident in rejecting the null hypothesis. There are statistically significant differences in favor of males. The Survey results for male respondents (Mdn=34.00) vary significantly from Female respondents (Mdn=29.00), r= 0.29, W=633.00, *p*=0.05, and Z= -2.624

4.3.4 Third Analysis

How do freshman/sophomore (group 1) and junior/senior (group 2) engineering students vary in their perception of academic advising support systems?

One-way analysis of variance was conducted to distinguish between the type the engineering students' perception based on their class level against the 12 questions. The null hypothesis predicted that there are no differences among the groups. This test was completed using YSU's Academic Advising in Engineering Survey (n=79). The independent variables were the engineering students' class (freshman, sophomore, junior and senior). The dependent variables were the survey scores. Results of test stated in Table 12.

Table 12. ANOVA Table Comparing Engineering Student's Year Classification

	N	Mean	SD	Std. Error	Lower Bound	Upper Bound	Min	Max
Freshman	36	30.47	7.51	1.25	27.93	33.01	14.00	45.00
Sophomore	10	31.80	6.26	1.98	27.31	36.28	18.00	42.00
Junior	14	37.42	5.72	1.52	34.12	40.73	30.00	47.00
Senior	18	33.55	10.26	2.41	28.45	38.65	5.00	47.00
Total	78	32.60	8.10	0.91	30.77	34.42	5.00	47.00

Table12.1. *Continued ANOVA Table*

	SS	df	Mean Square	F	Sig.
Between Groups	512.234	3	170.74	2.78	.047
Within Groups	4544.445	75	60.59		
Total	5056.679	78			

Hence, the *p*-value is $0.047 < 0.05$ which means to reject the null hypothesis and to accept the alternative hypothesis there is a significantly different among the groups.

In order to find the differences between and within the group a post hoc least significant difference (LSD) test was applied. The results are reported in Table 13.

Table 13. Multiple Comparisons (Least Significant Difference)

(I) fsjs	(J) fsjs	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Freshman	Sophomore	-1.32	2.80	.637	-5.99	3.33
	Junior	-6.95*	2.46	.006	-11.06	-2.84
	Senior	-3.08	2.26	.177	-6.85	.684
Sophomore	Freshman	1.32	2.80	.637	-3.33	5.99
	Junior	-5.62	3.24	.087	-11.03	-.224
	Senior	-1.75	3.09	.572	-6.90	3.39
Junior	Freshman	6.95*	2.46	.006	2.84	11.06
	Sophomore	5.62	3.24	.087	.224	11.03
	Senior	3.87	2.79	.170	-.778	8.52
Senior	Freshman	3.08	2.26	.177	-.684	6.85
	Sophomore	1.75	3.09	.572	-3.39	6.90
	Junior	-3.87	2.79	.170	-8.52	.778

*. The mean difference is significant at the 0.05 level.

*. fsjs = Freshman, Sophomore, Junior, and Senior

Thus, the results show us that there is a higher mean of 6.95635 difference between Junior and freshman. Juniors have higher mean than sophomores. Therefore, the perception of juniors and seniors differs from freshman.

4.5 Fourth Analysis

How do perceptions of academic advising support systems within engineering vary based on the type of advising delivery methods?

This analysis has been done in two methods to ensure the validity of the score obtained. The first method, a One-way analysis of variance was conducted to assist between the type the engineering students' perception based on their choices of advising system After applying a test of normality that shows the data is normally distributed. This test was completed using YSU's Academic Advising in Engineering Survey (n=79). The independent variable were the advising methods. The dependent variables were the scores form the survey the second method, for the independent variable, type of advising delivery methods were divided into combinations. Method was to look at advising system as whole meaning if a student utilized one system; the type of the system doesn't matter as long as it is one. The same strategy goes from the rest of the systems. Method 2 to find combinations are the different types of academic advising methods students utilized. The advising systems were assigned to groups, a total of 18 groups, i.e., there are 18 different combinations used by the student who participates in this study. This was the only change for method 2; the other steps remain the same as explained in method 1 Table 14.

Table 14. ANOVA TABLE METTHOD 1

Advisor Type	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Min	Max
One system	29	31.71	9.59	1.81	27.99	35.43	5.00	47.00
Two systems	22	32.68	6.19	1.32	29.93	35.42	17.00	47.00
Three systems	22	33.09	8.64	1.84	29.25	36.92	15.00	47.00
Four systems	1	34.00	.	.	.	.	34.00	34.00

Table 14.1. Continued

Five system	4	32.75	4.50	2.25	25.58	39.91	29.00	38.00
Total	78	32.46	8.06	0.91	30.63	34.29	5.00	47.00

Table 14. 2. Continued ANOVA Table

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	28.114	4	7.028	.103	.981
Within Groups	4919.055	74	66.47		
Total	4947.169	78			

Hence, the significant 0.981 > 0.05 (p-value). Therefore, we accept the null hypothesis. There are no significant differences among the advising delivery systems methods.

For the second method, after putting the participants into 18 different groups based on their utilization of the academic advising system delivery. A One-Way ANOVA was applied to test the differences among the 18 groups using an alpha level of 0.05. Table 15 shows the ANOVA test results.

Table 15. ANOVA Table Method 2 (18 groups)

Groups	N	Mean	SD	Std. Error	Lower Bound	Upper Bound	Min	Max
Group 1	16	35.16	8.13	2.34	29.99	40.33	24.00	47.00
Group 2	11	34.44	8.93	2.97	27.57	41.31	18.00	45.00
Group 3	2	35.50	0.70	0.50	29.14	41.85	35.00	36.00
Group 4	6	35.83	2.92	1.19	32.76	38.90	33.00	41.00
Group 5	1	41.00	.	.	.	.	41.00	41.00
Group 6	1	28.00	.	.	.	.	28.00	28.00
Group 7	1	31.00	.	.	.	.	31.00	31.00
Group 8	1	33.00	.	.	.	.	33.00	33.00
Group 9	4	30.37	9.94	3.51	22.06	38.68	14.00	44.00
Group 10	8	32.00	2.64	1.52	25.42	38.57	29.00	34.00
Group 11	1	35.00	6.87	3.43	24.05	45.94	30.00	45.00
Group 13	4	25.33	5.50	3.17	11.65	39.01	20.00	31.00
Group 14	3	47.00	.	.	.	.	47.00	47.00
Group 15	1	32.85	6.14	2.32	27.17	38.54	24.00	43.00
Group 16	9	30.75	2.87	1.43	26.17	35.32	29.00	35.00
Group 17	4	21.00	.	.	.	.	21.00	21.00
Group 18	1	27.25	15.21	7.60	3.03	51.46	5.00	38.00
Total	78	36.88	8.01	0.97	32.92	38.83	5.00	47.00

Table 15 1. Continued ANOVA Table

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	478.545	17	28.15	.372	0.987
Within Groups	4468.623	62	72.06		
Total	4947.169	78			

Hence, The ANOVA table indicates 0. 987 significant value which is higher than the (*p* <.05) that the model applied is not significantly good enough in predicting the outcome variable.

Moreover, utilization of the academic advising delivery systems interprets important information about students' academic advising deliver system selections (i.e., most selected and least selected) as shown in figure 5

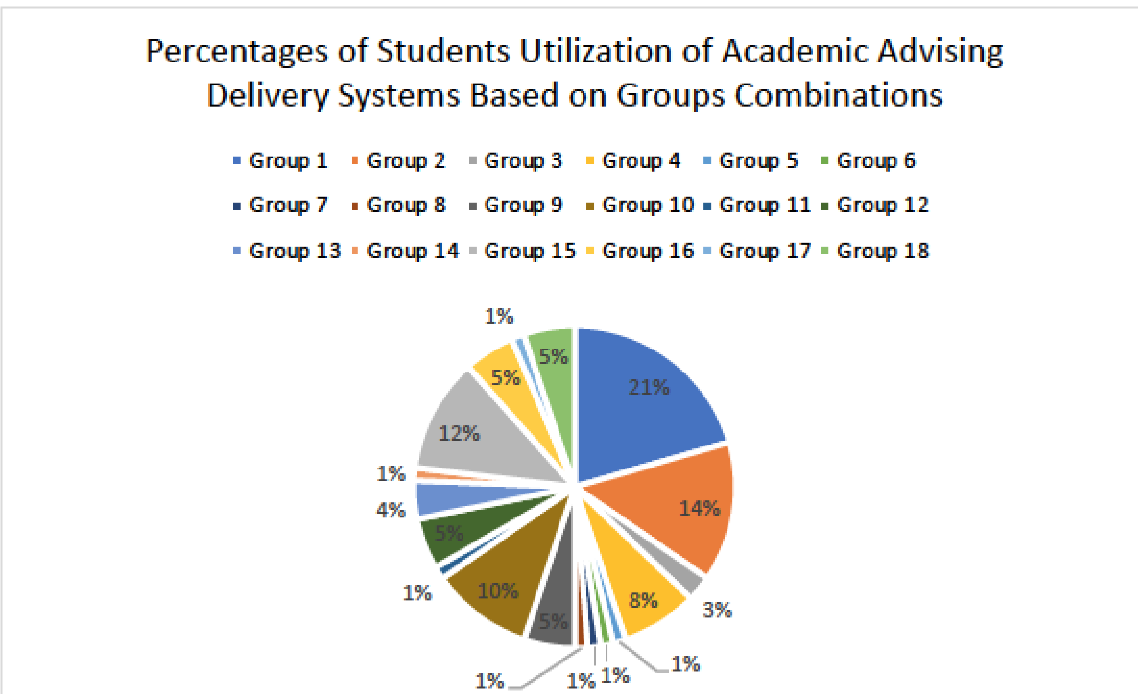

Figure 6. Students percentage utilizing Academic advising delivery systems (N=78).

Figure 6 shows the percentages of students' utilization of academic advising delivery systems based on groups combinations. 78 students by utilizing the academic advising system delivery group 1 (21%), group 2 (14%), group 3 (3%), group 4 (8%), group 5 (1%), group 6 (1%), group 7 (1%), group 8 (1%), group 9 (5%), group 10 (10%), group 11 (1%), group 12 (5%), group 13 (4%), group 14 (1%), group 15 (12%), group 16 (5%), group 17 (1%), and group 18 (5%).

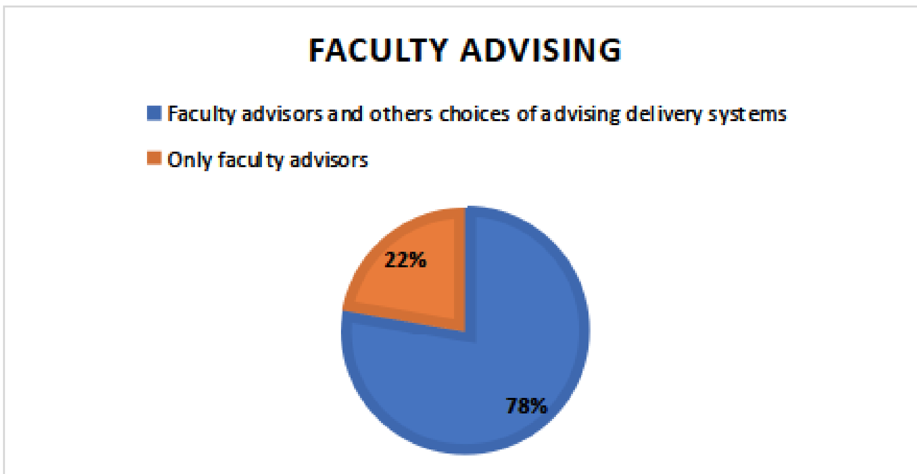

Figure 7. Students percentage utilizing Faculty advising vs Faculty advising and other (n=72).

Figure 7 shows the percentage of students who only utilized faculty advisors versus who utilized faculty advisors and other type of advising systems. Of the 79 participants in the survey only 56 (78%) students who utilized faculty advisors and others type of advising when 22% (16) utilized only faculty advisors.

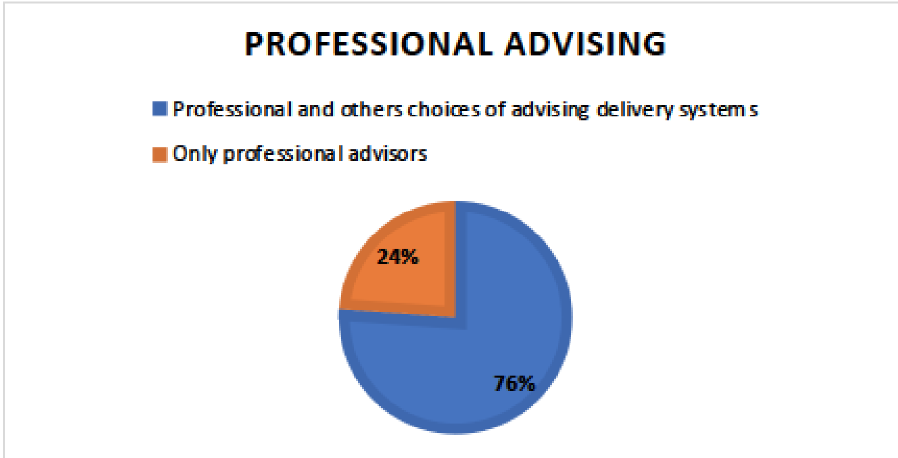

Figure 8. Students percentage utilizing faculty advising vs faculty advising and other (n=46).

Figure 8 shows the percentage of students who only utilized professional advisors versus who utilized professional advisors and other type of advising systems. Of the 46 students who utilized faculty advisors, 35 students which is 76% used professional advisors and other advising system when 24% of students utilized only professional advisors.

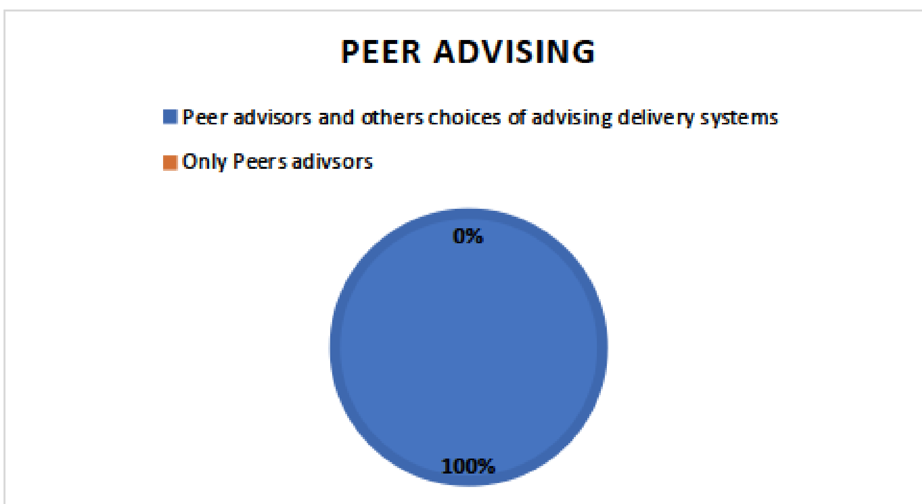

Figure 9.Students percentage utilizing peer advising vs peer advising and other (n=29).

Figure 9 shows the percentage of students who only utilized peer advising versus who utilized peer advising and other type of advising systems. In the survey only 29 (100%) students who utilized peer advising and others type of advising when no students utilized only peer advisors by itself.

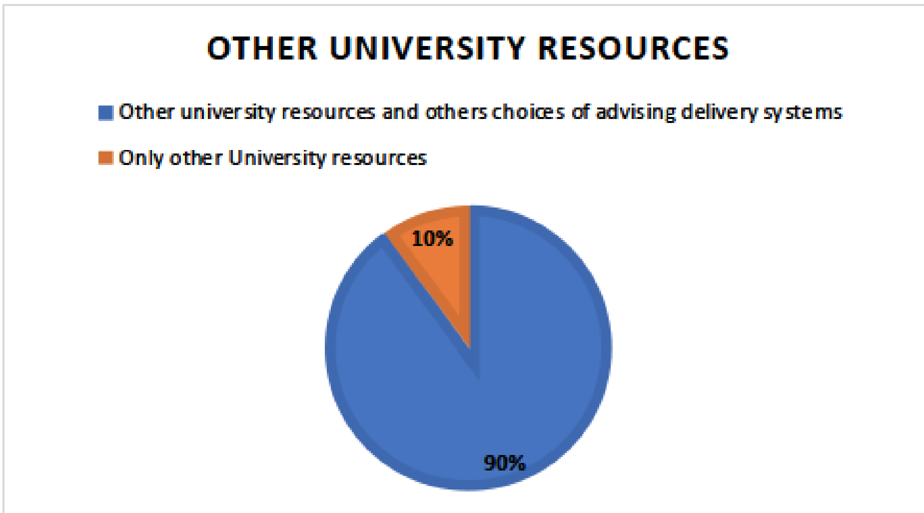

Figure 10. Students percentage utilizing other university resources vs other university resources only (n=10).

Figure 10 presents students' percentage utilizing other university resources versus only other university resources. Examples for other university resources, financial aid, orientation, consultant, and international student office. Of the 78 participants only 10 students choose other university resources where only 9 (90%) students who utilized other university resources and others type of advising when only one student utilized only peer advisors which is 10% (n=1).

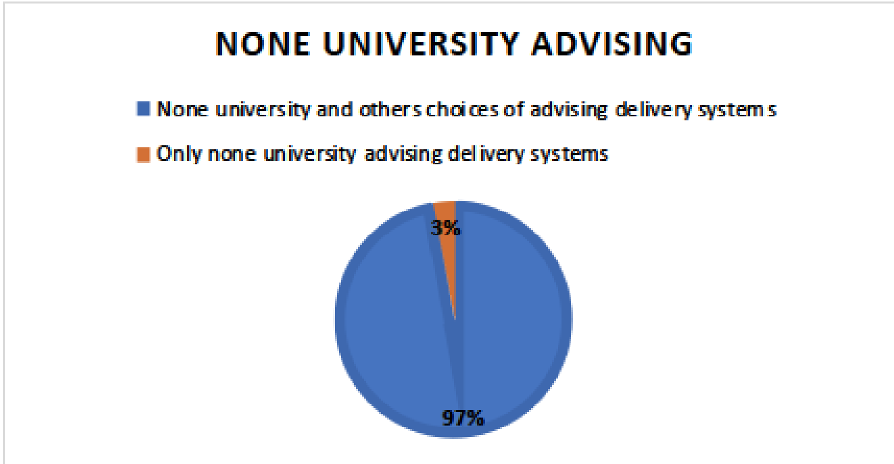

Figure 11. Students percentage utilizing none university resources vs other none university resources only (n=35).

Figure 10 shows students' percentage utilizing none of university resources versus other university resources. Examples for none university resources: family and friends. Of the 78 participants students in the survey, students who pick none university resources and other advising delivery systems are 34 (97%). Only one student utilized none university advising system.

CHAPTER 5: Summary, Recommendations and Conclusions

Summary of results

5.1.0 What are engineering students' perceptions of academic advising support systems?

By applying and utilizing statistical analysis on the 12 questions from the survey of engineering students, the perceptions of engineering students were examined. The conclusions of this analysis shows a variety of opinions regarding to the advising support system provided by YSU. Students had different levels of satisfaction based on the 12 survey questions. Students' pleased can be divided into satisfied and dissatisfied. Categories where students were pleased by the academic advising system provided the level of the knowledge the academic advisor possesses about major requirements and university policies. Also, the level of accessibility of the academic advisors when students are in need of help, the university informing/reminding system about who is each student's academic advisor, and the level of the course planning and scheduling were all deemed satisfactory. Students expressed enormous dissatisfaction with receiving misinformation from their academic advisor and with the level of encouragement by academic advisor to meet with them regularly.

5.1.1 How do males engineering students and females engineering perceptions of advising support systems vary?

Mann-U Whitney test was calculated to compare differences between two independent groups (Male and Female) as well as descriptive statistical analyses on the general perceptions of male engineering students and female engineering students. Test of normality was applied to ensure the normality of the data. The data appeared to be not normal with a significant level of 0.2 > p-value 0.05. Results from the Mann-U Whitney test for Male respondents (Mdn= 34.00) differ significantly from Female respondents (Mdn= 29.00), R=0.04132, W=544.500, p= 0.29, and Z= -2.624. Moreover, both male and female general patterns differ on the level of satisfaction. Females have a great dissatisfaction on the level of encouragement by the academic advisor to meet with them regularly while Male students are satisfied. Also, Females showed enormous dissatisfaction on the level in which academic advisors help them understand university policies and procedures, while males were satisfied. When it comes to the level of receiving misinformation from the academic advisor, Females are dissatisfied while Males are satisfied.

5.1.2 How do freshman/sophomore (group 1) and junior/senior (group 2) engineering students vary in their perception of academic advising support systems

One-way analysis of variance was conducted to distinguish between the type the engineering students' perception based on their class level against the 12 questions. The null hypothesis predicted that there are no differences among the groups. Significant differences were found using alpha level of 0.05 among group 1 and group 2. A post hoc least significant difference (LSD) test was applied to determine the differences. It revealed a higher mean of 6.95635 difference between junior and freshman. Therefore, juniors are more pleased with advising provided.

5.1.3 How do perceptions of academic advising support systems within engineering vary based on the type of advising delivery methods?

By utilizing two methods to answer this question and ensure the validity of the score obtained. The first method, a One-way analysis of variance was conducted to assist between the type the engineering students' perception based on their choices of advising system methods. Participants had the freedom to choose more than one option, which results in two cases. The first case is the sum of the delivery advising systems and the second case is based on combinations of the delivery advising systems. Table 2 illustrates the different combinations. There was no significant difference between the types of advising delivery systems

5.2 Discussion

Developing patterns from the findings within the research on perceptions of undergraduate engineering students on academic advising where the study questions perceptions related to academic advising. The study relies on 12 survey questions utilizing testing normality to ensure the data roughly fits a bell curve preceded running statistical tests and regression. The survey's questions appear closed. Moreover, responses appear to render four answer choices and which choice with its significant 1 to 4: Likert-type scale and N/A was not assigned a score. Likely ranging from "Satisfied" to "Dissatisfied" with 2-3 corresponding midlevel choices of satisfaction.

The survey instrument appears to assess student opinions on the following areas of academic support provided by academic advisors:

- Academic advisor level of knowledge about major requirements
- University-wide requirements and policies
- Level of availability of the academic advisors when students are in need of help
- University informing and reminding system related to whom is a student's academic advisor

- Level of the course planning and scheduling
- Misinformation given to students
- Encouragement by academic advisor to meet with students regularly

Furthermore, advising to undergrad engineering students is considered difficult, and the answers to the questions put forth by engineers are seldom found satisfactory. One of the reasons behind this approach is the overuse of engineering approaches and philosophies in solution to simple human issues. Then there are problems in communication because advisors think it is an information flow problem, but there are other scholars who believe that it is a dynamic interpersonal problem (Woolston, 2002). But none of them are perfect, and both need more work to figure out the exact solution for engineering students' problems.

5.2.1 How do males engineering students and females engineering perceptions of advising support systems vary?

Overall, males are generally satisfied with all areas of academic advising, while females are generally less satisfied. Female dissatisfaction is found in three areas: Encouragement to meet with the female students regularly, level of female understanding in regard to university-wide requirements and policies, and misinformation given to the female students. The results are generally in line with continuous studies targeting possible gender inequality issues facing female engineering students in higher education. Longitudinal studies of gender performance discourage females, which accounts for higher attrition rates and attempts to improve the trend. Statistically, Females have higher graduation rates than men when it comes to obtain a college degree. However, males excessively outnumber females in degrees received from (STEM). To put the growth (or lack of) of women in engineering degree completion in perspective, by the school year 2017-2018, the percentage of bachelor's degrees awarded to women had grown to 21.9% ("American Society for Engineering Education", 2019).

The trend of growth moves slowly upward. Yet, more engineers are needed. For example, The National Science Foundation (2017) spot the light on increasing efforts to raise the number of students that graduate with degrees in STEM. The President's Council forecast that STEM graduates should increase by approximately one million. Statistically, females account for 47% of the US workforce (White and Massiha 2016). However, a study by Verdin and Godwin (2018) that interviewed and surveyed an engineering female student suggests female perceptions of belongingness within the engineering major and her reply to her perception of belongingness:

> "I was more hesitant and that was because when you're growing up you're always being told that the ones who can do that stuff are men…I think that the professors perpetuate that because for one there's not a lot of women who are professors…and also when you talk about like the authors of the books, all of them are males, the people the lab instructors…most of them are males." (p.281)

note various systems that overlook women in engineering education. The characterization, perhaps, goes beyond a perception of feeling overlooked. Females' advancement in engineering is impacted by many factors. Regardless of students' genders, the advisors are familiar with their students and those students who are taking their advice in both thinking and deciding about their academic career and future planning. No matter what type of students are there, what type of background they have, and regardless of what type of courses and concerns they have, they all need assistance and academic advising.

5.2.2 How do freshman/sophomore (group 1) and junior/senior (group 2) engineering students' perception of academic advising support systems vary?

Academic advising by student' year (classification), too, appears to differ in levels of satisfaction. Juniors appear most satisfied, followed by seniors, and then freshman. Sophomores appear least satisfied. When we also consider gender question in this survey, results point to a possible need for other interventions that better support female sophomores who may be attempting to overcome dissatisfying experiences with the academic advising system. Research suggests these perceptions by sophomores and freshmen have merit in that they reveal changes in the students as well as curricular difficulty.

This can be especially true for female engineering students whose freshman year grades reflect their struggles with curriculum. Coll and Draves (2009) found a significant link between first-year students advising satisfaction and developmental stage advising, which comes in the years afterward. He found out that the student who took advising in the first year of the education has performed significantly better than the ones who were not given academic advisory in the initial years (Coll and Draves 2009). A longitudinal study by Brainard & Carlin (1998) reveals a trending drop in self-confidence for females during their freshman year. It can safely be assumed that the sophomore year is more challenging for all students, exacerbated to a greater degree for females who have already lost self-confidence.

Further, deepening the divide, Macia and Nowlin (2012) is the practice of program matching by advisors and others who work to place students into a program that doesn't fit students' dispositions, skill sets or knowledge base. The practice is meant to ease the stress for students, but the results are most positive when they are multi-pronged, according to (Sithole, Kibirige, Mupinga and Chiyaka 2016).

Inasmuch as the outgoing freshman/incoming sophomore is struggling with self-confidence, the added pressure of advice to change one's course further disrupts and diminishes confidence (Verdin and Godwin 2018).

5.2.3 How do perceptions of academic advising support systems within engineering vary based on the type of advising delivery methods?

The result of this portion of the study is of interest. The wording suggests that the student is offered only one system of delivery or a combination of advising delivery systems. Typically, student advising is delivered through more than one system (Sithole, Kibirige, Mupinga and Chiyaka 2016; Lee and Matusovich 2016). Students are more empowered when they are offered choice and supported with their decision. As Macia and Nowlin (2012) discuss, self-esteem, confidence, and grit are diminished when academic advisors try to mold a student to fit a program deemed more appropriate for a student's success and persistence, but doesn't fit the student's disposition, abilities, or aspirations. This fits the notion of lack of choice. It stands to reason that students who are given advising delivery choices are more empowered. In an examination of question 3, a look back at the results of questions 1 and 2 can be considered. Findings from question 3 showed no significant differences between the delivery systems. This is to say student levels of satisfaction among different genders and among the different levels (freshman, sophomore, junior, and senior) was noted to be insignificant. This is telling in that the two preceding questions do not appear to concern choice. Rather, students are provided information, services, encouragement, and availability. These are general and anticipated aspects of advising beyond a student's control; students meet with their advisor in order to gain information and learn about policies. Whether they perceive encouragement or not is beyond the student's choice. Moreover, the interaction of students with their advisor play an important role in developing a positive overall student experience at the college and help a lot in improving the academic performance of the students. Another group of researchers proved that the trust between advisor and advisee ultimately affects the outcomes of advisory (He and Hutson 2016). Another group has noted its positive correlation with competence, care, and trustworthiness of the advisor (Punyanunt-Carter, Nance, and Wrench 2014). Choice of the advising delivery system is within a student's control. This leads one to question whether there is a method by which students can be placed 'in the driver's seat' where they perceive they are the controller of their educational journey.

5.3 Limitations

The responses rate was not high in comparison with the total number of undergraduate engineering students at YSU. The completion of the survey was voluntary and has no awards to encourage the students to participate. The male's participants were significantly higher than the females. Further, freshman students had a higher rate than sophomore students, junior students and senior students. Overall, participants represent the undergraduate engineering students at YSU. Another limitation is the survey was applied for the first time in this study. However, it was sent multiple times to students after their advising sessions during Fall 2019. The final limitation is there was no archive data about engineering students advising sessions to be utilized to enhance this investigation.

5.4 Recommendations

The study seeks to ascertain student opinions regarding their satisfaction with academic advisors at four-year school(s) of engineering, and the results point to greater need for support geared to student needs. We can turn to plentiful research on the subject regarding perceptions of support. Indeed, strategies aimed to improve persistence for engineering students has garnered a great deal of attention over the past years. Moreover, schools of engineering continue to serve greater diversity in students that include gender, race, ethnicity, and a wide spectrum of socio-economic diversity (for example, underrepresented and underserved) student populations. Student, faculty, and advisor interactions appear attributable to improvement in undergraduate engineering students' persistence and success. A lack of targeted interactions may be a key determinant of student persistence and success. Insight into how students perceive interactions might be improved, especially for females and undergraduates require a wide-ranging survey instrument to target needs. Macia and Nowlin (2012) describe a graphic tool, based on survey results of aptitude and career preference, that ranks application skill vs. theory knowledge in comparative terms. The information gleaned assists advisors plan a four-week intensive semester or summer program than has been shown to improve student mindset and their freshman transition.

Program tools devised to present graphical representations of student skills and knowledge is another interactional strategy that assists advisors point incoming students toward their personal 'best fit' program. Lee and Matusovich (2016) offer a model based on previous work by Tinto (1993) who reframed the role of an educational environment (previously considered an independent action taken by a student) to include interactional events of stduents within both academic systems and social systems. Tinto saw the university experience in a larger sense and theorized three stages of membership within the learning context through which successful students moved. In the model of co-curricular support for undergraduate engineering students, Lee and Matusovich (2016) examine and define activities aimed to support diverse engineering students' needs. The authors note that interventions require a framework as interventionists attempt to advance and understand the best practices for Engineering Student Support Centers (ESSCs). The study design was multi-method and qualitative, as well as multi-case to include student-support practitioners. It should be noted that support practitioners included faculty advisors, academic advisors, peer advisors, and more. Surveys and individual interviews were made across four engineering universities to include 538 student questionnaire responses and interviews with 17 administrators. Authors chose the Tinto model and a holistic synthesis to organize and synthesize their findings. A logic model presented the attributes that Lee and Matusovich refer to as inputs, outputs, and outcomes. Inputs are the actions relevant to our study inasmuch as academic advisors perform services (inputs) for students. Services, according to Lee and Matusovich, are informal advising, support centers, tutoring, and course clustering. Other interventions might also be surveyed in order to ascertain a wider view of student perceptions.

Based on model of co-curricular support, these interventions would include programs and activities. For example, program components include undergraduate research program, mentoring, first-year seminar, summer bridge program, and professional seminar these programmers would help the students to integrate to the university environment much smoothly. Lee and Matusovich's Engineering Student Integration Instrument (ESII) regards student integration with a multi-dimensional angle and four integration junctures or constructs to include academic, social, professional, and university. Each, in turn, influences the others within the four constructs. Facilitating positive academic advising systems is challenging. Capturing student empowerment with varied offerings and letting students choose their method of advising might prove to bring greater success (Beekhoven, De Jong and Van Hout 2002). Returning to the questions of perceived satisfaction with academic advising, it such a study that presents an interesting case. This is due to the power of choice as well as an institutional-wide acceptance and promotion of advising as an experience that goes hand-in-hand with learning. Academic and social interactions with advisors and peers, both academically and socially; interactions with and involving learning centers; and inclusion within varied program(s) requires more research. Thus, a wealth of interactive data can usefully target and facilitate improved perceptions of support.

5.5 Conclusion

The research investigates the perceptions of undergraduate engineering student on academic advising. The literature review discussed in this investigation provide special pieces of evidence in understanding, support and bettering academic advising in engineering. Academic advising helps a student to choose a program of study, their future, and in other decision makings, which all assist them in developing their total potential. Overall, males are generally satisfied with all areas of academic advising, while females are generally less satisfied. Another very important factor in which the building of academic advisory bases is the interaction between students and teachers and advisors. The interaction between student and faculty positively affects the academic advising outcomes. The results of this survey point to a possible need for interventions to better support females, freshman and sophomores who may be attempting to overcome dissatisfying experiences with the academic advising community that is trying to support their university experiences.

APPENDIX A
ACADEMIC ADVISING SURVEY

Research Instrument

1. **What is your gender?**

    - o Male
    - o Female

2. **RACIAL/ETHNIC GROUP**

    - o African American or Black
    - o Caucasian or White
    - o Latino or Hispanic
    - o Native-American
    - o Asian/Asian-American
    - o Pacific Islander
    - o Other
    - o I prefer not to respond

3. **What is your current class level?**

    - o Freshman
    - o Sophomore
    - o Junior
    - o Senior
    - o Special Student
    - o Other/Unclassified

4. **What is your engineering major?**

    - o Chemical Engineering.
    - o Civil and Environmental Engineering
    - o Electrical Engineering.
    - o Industrial and systems engineering
    - o Manufacturing Engineering
    - o Mechanical Engineering
    - o Undecided Engineering major

Please select one:

a) I know who my academic advisor is.

b) I do not know who my academic advisor is.

I utilize the following types of advising (please circle): Y= YES, N=No

Y N Faculty member(s)
Y N Professional advisor(s} (departmental or Undergraduate Academic
Advising Center/Center for Advising Undeclared Students)
Y N Peer advisor(s)
Y N Other university resources (publications, Dean's office, Registrar's Office,
or other offices on-campus)
Y N Non-university resources (family. friends, etc.)

The following items relate to your experiences with your primary advisor at (YSU). Using the scale provided, please indicate your level of agreement with each statement. (Selections: strongly agree, agree, disagree, strongly disagree. n/a) (SA A D SD NA)

1) The university keeps me informed about who my academic advisor is.
2) My academic advisor is knowledgeable about liberal studies/university wide requirements.
3) My academic advisor is knowledgeable about my major requirements.
4) My academic advisor encourages me to meet with them regularly.
5) My academic advisor assists me in planning my schedule and selecting my courses.
6) My academic advisor helps me understand university policies and procedures.
7) My academic advisor helps me understand my academic standing (warning, probation, dismissal, good academic standing).
8) I have received misinformation from my academic advisor
9) My academic advisor helps me match my academic interests and abilities with potential majors.
10) My academic advisor is knowledgeable about campus resources that can assist me with my career planning. (My academic advisor refers me to other offices or services when necessary)
11) My academic advisor is easy to talk with.
12) My academic advisor is available when I need help."

APPENDIX B
HUMAN SUBJECTS APPROVAL (IRB)

Karen H Larwin
Sat 11/9/2019 2:35 PM
Cory Brozina; Abdulrahman Alsharif; ckcoy@ysu.edu

Dear Investigators,

Your protocol entitled Perspectives of Undergraduate Engineering Students on Academic Advising has been reviewed and is deemed to meet the criteria of an exempt protocol. You will be collecting responses from the undergraduate students in engineering about advising and available support systems. You will not collect any identifying information.

The research project meets the expectations of 45 CFR 46.104(b)(2) and is therefore approved. You may begin the investigation immediately. Please note that it is the responsibility of the principal investigator to report immediately to the YSU IRB any deviations from the protocol and/or any adverse events that occur. Please reference your protocol number 062-20 in all correspondence about the research associated with this protocol.

Good luck with your research.

Karen

Karen H. Larwin, Ph.D.
Associate Professor, YSU IRB Chair &
Distinguished Professor
Counseling, School Psychology, & Educational Leadership
Beeghly College of Education
Youngstown State University
One University Plaza
Youngstown, Ohio 44555-0001

"If you can't explain it simply, you don't understand it well enough." -Einstein

Leadership is not about titles, positions or flowcharts. It is about one life influencing another."
— John C. Maxwell

REFERENCES

American Psychological Association [APA], American Educational Research Association [AERA], and National Council on Measurement in Education [NCME] (1954, 1999). Standards for educational and psychological tests and manuals. Washington, DC: American Psychological Association

American Society for Engineering Education. (2016). Engineering by the Numbers: ASEE Retention and Time-to-Graduation Benchmarks for Undergraduate Engineering Schools, Departments and Programs. Washington, DC: Brian L. Yoder

American Society for Engineering Education. (2019). Engineering by the Numbers: ASEE Schools, Departments and Programs. Washington, DC: Joseph Roy

Baloul, F. M., & Williams, P. (2013, August). Fuzzy academic advising system for on probation students in colleges of applied sciences—Sultanate of Oman. In Computing, Electrical and Electronics Engineering (ICCEEE), 2013 International Conference on (pp. 372-377). IEEE.

Banerjee, S., Rao, N. J., & Ramanathan, C. (2015). Rubrics for assessment item difficulty in engineering courses. 2015 IEEE Frontiers in Education Conference (FIE), 1.

Baron, R. A. (1986). Self-Presentation in Job Interviews: When There Can Be "Too Much of a Good Thing." Journal of Applied Social Psychology, 16(1), 16.

Beekhoven, S., De Jong, U., & Van Hout, H. (2002). Explaining Academic Progress via Combining Concepts of Integration Theory and Rational Choice Theory. Research in Higher Education, 43(5), 577–600.

Bias, R. G., & Mayhew, D. J. (1994). Cost-justifying usability. Academic Press.

Brainard, S., Carlin, L. (1998) A six-year longitudinal study of undergraduate women in engineering and science. Journal of Engineering Education. 87(4). 369-375.

Braxton, J., Brier, E., & Hossler, D. (1988). The influence of student problems on student withdrawal decisions: An autopsy on "autopsy" studies. Research in Higher Education, 28(3), 241.

Brophy, S., Klein, S., Protsmore, M., & Rogers, C. (2008). Advancing Engineering Education in P-12 Classrooms. *Journal of Engineering Education*, *97*(3), 369 387.

Cai, X., Hejazi, M. I., & Wang, D. (2011). Value of Probabilistic Weather Forecasts: Assessment by Real-Time Optimization of Irrigation Scheduling. Journal of Water Resources Planning & Management, 137(5), 391–403.

Campbell, S. M., & Nutt, C. L. (2008). Academic Advising in the New Global Century: Supporting Student Engagement and Learning Outcomes Achievement. Peer Review, 10(1), 4–7.

Chan, Z. C. Y., et al., (2019). "Academic Advising in Undergraduate Education: A Systematic Review." *Nurse Education Today* 75: 58–74.

Charleer, S., Vande Moere, A., Klerkx, J., Verbert, K., and De Laet, T. (2017). Learning analytics dashboards to support adviser-student dialogue. IEEE Transactions on Learning Technologies, PP,1-1. 10.1109/TLT.2017.2720670.

Ciston, S., Sehgal, S., Mikel, T., & Carnasciali, M.-I. (2018). Differences in Chemical Engineering Student-Faculty Interactions by Student Age and Experience at a Large, Public, Research University. *Chemical Engineering Education*, *52*(2), 136–142.

Clayson, D. E. (2018). Student evaluation of teaching and matters of reliability. Assessment & Evaluation in Higher Education, 43(4), 666–681

Coll, J. E., & Draves, P. (2009). Traditional Age Students: Worldviews and Satisfaction with Advising; a Homogeneous Study of Student and Advisors. *College Student Affairs Journal*, *27*(2), 215.

Dixon, G. (2015), Capstone and Faculty Mentors/Advisors/Coaches Paper presented at 2015 ASEE Annual Conference & Exposition, Seattle, Washington 10.18260/p.23662

Donaldson, P., McKinney, L., Lee, M., and Pino, D. (2016). "First-Year Community College Students' Perceptions of and Attitudes Toward Intrusive Academic Advising." *NACADA Journal* 36(1): 30–42.

Fong, S. F., Lee, P. L. L., and Fei, P. P. (2012). "Reducing Cognitive Overload Among Students of Different Anxiety Levels Using Segmented Animation." *Procedia Social and Behavioral Sciences* 47: 1448–56.

Fowler, P. R., & Boylan, H. R. (2010). Increasing Student Success and Retention: A Multidimensional Approach. Journal of Developmental Education, 34(2), 2–10.

Gardner, R. S. (2019). A Student-Faculty Collaborative Journey toward Transformative Religious and Secular Worldview Literacy. FIRE: Forum for International Research in Education, 5(1), 126–144.

Goodwin, L. D., & Leech, N. L. (2003). The Meaning of Validity in the New Standards for Educational and Psychological Testing: Implications for Measurement Courses. Measurement & Evaluation in Counseling & Development, 36(3), 181 191.

Guilford, W., Blazier, A., & Becker, A. (2015) Integration of academic advising into a first-year engineering design course and its impact on psychological constructs. ASEE Annual Conference and Exposition Proceedings. doi10.18260p.24332

Haynes, S.N., Richard, D.C.S., and Kubany, E.S. (1995). Content validity in psychological assessment: A functional approach to concepts and methods. Psychological Assessment, 7, 238-247

Hill, Y., L. Lomas, and J. MacGregor. (2003). "Students' Perceptions of Quality in Higher Education." Quality Assurance in Education 11 (1): 15–20.

Hwang, Y., & Choi, Y. (2019). Higher education service quality and student satisfaction, institutional image, and behavioral intention. Social Behavior and Personality: An international journal, 47(2), e7622

Iatrellis, O., Kameas, A., and Fitsilis, P. (2017). Academic advising systems: A systematic literature review of empirical evidence. Education Sciences Journal, (7), 90.

Jones, B. D. (2009). Motivating students to engage in learning: The MUSIC model of academic motivation. International Journal of Teaching and Learning in Higher Education, (21),1, p.272-285.

Kahn, D. (1984). "Cryptology and the Origins of Spread Spectrum: Engineers during World War II Developed an Unbreakable Scrambler to Guarantee Secure Communications between Allied Leaders; Actress Hedy Lamarr Played a Role in the Technology." *IEEE Spectrum* 21(9): 70–80.

Khali, A., & Williamson, J. (2014). Role of Academic Advisors in the Success of EngineeringStudents. Universal Journal of Educational Research Vol. 2(1), pp. 73 – 79

Khan, W. Z., and Al Zubaidy. S. (2016) "Engineering Design Approach in Marine Engineering: A Bridge between Training Need Analysis (TNA) and Engineering Education." The International Journal Of Engineering And Science (IJES) Vol .5(3), PP -86-93

Krumm, A. E., Waddington, R. J. Teasley, S. D., & Lonn, S. (2014)."A Learning Management System-Based Early Warning System for Academic Advising in UndergraduateEngineering." In *Learning Analytics: From Research to Practice*, eds. Johann Ari Larusson and Brandon White. New York, NY: Springer, 103–19.

LAUGERMAN, M., MOINES, D., ROVER, D., MICKELSON, S., & SHELLEY, M. (2019). The Middle Years in Engineering: An Effective Transfer Partnership Drives Student Success in STEM. Advances in Engineering Education, 7(3), 1 21.

Lee, W. C., & Matusovich, H. M. (2016). A Model of Co-Curricular Support for UndergraduateEngineering Students. *Journal of Engineering Education*, *105*(3), 406–430.

Lent, R. W., Singley, D., Sheu, H.-B., Schmidt, J. A., & Schmidt, L. C. (2007). Relation of Social-Cognitive Factors to Academic Satisfaction in Engineering Students. Journal of Career Assessment, 15(1), 87–97.

Lowe, A., & Toney, M. (2000). Academic Advising: Views of the Givers and Takers. Journal of College Student Retention: Research, Theory and Practice, 2(2), 93.

Lynch, J., & Lungrin, T. (2018). Integrating Academic and Career Advising toward Student Success. New Directions for Higher Education, 2018(184), 69–79.

Macia, N. F., & Nowlin, R. W. (2012). Advising Engineering Students to the Best Program: Perspective, Approaches, and Tools Paper presented at 2012 ASEE Annual Conference & Exposition, San Antonio, Texas

Maciejewski, Anthony A. et al. (2017). "A Holistic Approach to Transforming UndergraduateElectrical Engineering Education." *IEEE Access* 5: 8148–61.

Maleki, A., Karimpour, A. R., & Dizaj, S. M. (2018). The role of mechanical engineering in the development of nano drug delivery systems; a review. International Journal of Nano Dimension, 9(1), 1.

Mattei, N., Dodson, T., Guerin, J. T., Goldsmith, J., & Mazur, J. M. (2014). Lessons learnedfrom development of a software tool to support academic advising: Proceedings of the 2014 Zone 1 Conference of the American Society for Engineering Education, Bridgeport, CT, 2014, pp. 1-8.

McGlothlin Lester, M. B. (2019). Understanding Academic Advising at Institutions with a First Year Engineering Program. Virginia Tech.

Miville, M. & Sedlacek, M. (1994). An assessment of centralized versus faculty advising in a college of engineering. NACADA Journal: (15), 2, pp. 20 25.

Mosher, G. (2017). Professional advisers in engineering and technology undergraduate programs: Opportunities and challenges. Journal of Technology Studies, 43(1), pp 26-34.

MOSKAL, B. M., LEYDENS, J. A., & PAVELICH, M. J. (2002). Validity, Reliability and theAssessment of Engineering Education. Journal of Engineering Education, 91(3), 351354.

National Science Foundation. (2017). Women, minorities, and persons with disabilities inscience and engineering: 2000. Arlington, VA: National Science Foundation ERIC Clearinghouse.

Powers, K. L., Aaron H. Carlstrom, & Kenneth F. Hughey. (2014). Academic Advising Assessment Practices: Results of a National Study. *NACADA Journal*, *34*(1), 64 77.

Rabb, R. J., Welch, R., Davis, W. J., Ragan, D. D., & Geathers, J. (2019). Small Mentoring Efforts that Make a Big Difference for Retention. *Proceedings of the ASEE Annual Conference & Exposition*, 18627.

Ricks, K. G., Richardson, J. A., Stern, H. P., Taylor, R. P., & Taylor, R. A. (2014). An Engineering Learning Community to Promote Retention and Graduation of At Risk Engineering Students. American Journal of Engineering Education, 5(2), 73 90.

Rogers C.D.F., Hunt D.V.L., Leach J.M., Purnell, P. and Roelich K.E. (2017). Briefing: Resource scarcity and resource security – a suppressed civil engineering challenge. Proceedings of the Institution of Civil Engineers – Waste and Resource Management 166(2): 49–51.

Rungduin, T.T., & Miranda, P.A. (2018). An Exploration of the Factors Affecting Graduate Degree Completion in a Teacher Education Institution (TEI): Inputs for Graduate Program Management and Pedagogy. AsTEN Journal of Teacher Education. Special Issue "Pedagogy" pp 41-54

Sanchez, R. J., T. N. Bauer, and M. E. Paronto. (2006). "Peer-Mentoring Freshmen: Implications for Satisfaction, Commitment, and Retention to Graduation." Academy of Management Learning & Education 5 (1): 25–37

Shyminsky, N., & Mak, L. (2013). ReFresh: Retaining first year engineering students and retraining for success: Proceedings of the Canadian engineering education association. (CEEA)

Sithole, A., Kibirige, J., Mupinga, D. M., & Chiyaka, E. T. (2016). Applying Alternative Teaching Methods to Impart a Rounded, Liberal Arts and Sciences (LAS) Education: Students' Reflections on the Role of Magazines as Instructional Tools. *Journal of Education and Practice*, *7*(33), 176–182.

Smith, K. S. (2004). Perceptions of Academic Advising and Freshman Student Retention: An Application of Tinto's Model. [Doctoral dissertation, Florida State University]. Florida State university.

Streufert, B. (2019) Advising alternatives: A case study. NACADA Review: 2019, Vol. 1, No. 1, pp. 14-29.

Sutton, K. L., & Sankar, C. (2011). Student Satisfaction with Information Provided by Academic Advisors. *Journal of STEM Education: Innovations & Research, 12*(7), 71–85.

Grites . T. (2013) Developmental Academic Advising: A 40-Year Context. NACADA Journal: 2 33(1), 5-15.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. Review of Educational Research, 45, 89-125

Tinto, V. (1994). Cross-ref. Leaving college: Rethinking the causes and cures of student attrition (2nd ed.). Chicago, IL: University of Chicago Press

Michael. T. (2005). "Increasing Engineers' Role in Construction Safety: Opportunities and Barriers." *Journal of Professional Issues in Engineering Education and Practice.* 131(3):199–207.

Troxel, W. G. (2019). Scholarly Advising and the Scholarship of Advising. *NACADA Journal, 39*(2), 52–59

Verdín, D., & Godwin, A. (2018). "EXPLORING LATINA FIRST-GENERATION COLLEGE STUDENTS' MULTIPLE IDENTITIES, SELF-EFFICACY, AND INSTITUTIONAL INTEGRATION TO INFORM ACHIEVEMENT IN ENGINEERING". Journal of Women and Minorities in Science and Engineering. 24(3)

White, J.L., Massiha, G. H. (2016). The retention of women in science, technology, engineering, and mathematics: A framework for persistence. Institute of Advanced Engineering and Science (IJERE) 5(1), 1-8

Woolston, D.C. (2002). Improving undergraduate academic advising in engineering: It's not rocket science. Proceedings of the 32nd ASEE/ISEE Frontiers in Education Conference, November 6-9, (pp. S2C2-S2C4).

Ye He, & Hutson, B. (2016). Appreciative Assessment in Academic Advising. Review of Higher Education, 39(2), 213–240.

Zavadskas, E.K., Antucheviciene, J., Vilutiene, T., Adeli, H., 2018. Sustainable decision making in civil engineering, construction and building technology. Sustainability 10, 14