

Applying a Responsible Innovation Framework in Developing an Equitable Early Alert System: A Case Study

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Abstract

The anticipation, inclusion, responsiveness, and reflexivity (AIRR) framework (Stilgoe et al., 2013) is a novel framework that has helped those in science and technology fields shift their focus from products to the processes used to create those products. However, the framework has not been known to be applied to the development and implementation of data analytics in higher education. In a case study of creating an early-alert retention system at James Madison University, a working group of ~20 faculty, staff, and students creatively utilized the AIRR framework. The present study discusses how the AIRR framework was utilized to observe and enhance group processes, and the outcomes of those enhanced processes.

Notes for Practice

- Process-based action can aid multidisciplinary groups in higher education teams that want to use learning analytics to solve larger institutional equity problems.
- Early alert systems (EASs), although popular, have not always highlighted their creation process, which we aim to do in this paper.
- Our paper maps the anticipation, inclusion, responsiveness, and reflexivity (AIRR) framework onto common higher education values to guide the initial development phase of an EAS.
- Results from the alignment between AIRR and the working group's values through a mixed-methods study highlights how other institutions could use process frameworks like AIRR to create EASs or other initiatives if applicable.

Keywords

Responsible innovation, retention, early alert systems, equity, students as partners

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1. Introduction

Retention of students in higher education is generally an important issue in the United States (Kalsbeek, 2013), but it can more specifically be argued as an equity issue. In the United States, Black, Indigenous, and first-generation students are retained at a lesser rate than their white and continuing education peers (National Center for Education Statistics, 2022). With education being one of the major gateways to economic and social success in the modern world, justice in the form of equitable retention helps to address the marginalization experienced by students of colour and first-generation students. Historically white institutions may possess a retention rate far above the national average, and yet still experience inequity in retention rates across many social identities, including race, gender, socioeconomic status, and first-generation status. Disaggregating the data is an important step forward for an institution to demonstrate its commitment to examining the equities across various segments

of the student body (Brown McNair et al., 2020), but disaggregating data alone is not enough. To address equity-based retention gaps at James Madison University (JMU), an initiative was created in 2021 to research, design, and implement a university-wide system that could foster equity in retention and increase overall retention rates. The initiative, called “Early Alerts: Improving Retention and Closing the Equity Gap,” was identified as the focus of their quality enhancement project (QEP), a critical piece of reaccreditation through the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC). In the fall 2021 semester, the QEP working group (WG) of 20 faculty, staff, and graduate and undergraduate students began meeting formally to create a process for researching and designing an early alert system (EAS) that would close the equity-based retention gaps and increase overall retention rates.

Aware of the possible negative outcomes of creating and implementing a data-analytic system to target social equity (Garcia et al., 2020), as well as the politics that define and drive ideas of equity, retention, and data (Garcia et al., 2018), the working group needed to establish a process that would leverage its members’ diverse knowledge and experiences on data analytics and higher education. To do so, the group needed to navigate the challenges of developing a shared understanding of equity, fairness, responsibility, and harm, as well as garnering a consensus view on design and decision-making. However, the WG recognized that ethical learning analytics as a product required an ethical design process to facilitate collective movement toward our equity-minded goals.

The WG had the extended benefit of time. The report and recommendations for an EAS were not due to SACSCOC until February 2023. With the luxury of time and knowledge of the need for equity mindedness, the WG carefully and intentionally began a process for researching and designing an EAS for equitable retention. The WG began with a set of values and an orientation toward how the design process, and ultimately how an EAS should function. The group approached the design process in phases, working through self-study, research, and design. It was not until well into the loosely guided process that a more formal framework was identified. The evidence-based anticipation, inclusion, responsiveness, and reflexivity (AIRR) framework (Stilgoe et al., 2013) guided and continues to guide group processes.

The AIRR framework has several affordances for supporting ethical design within an institution: it translates easily across the diverse group of actors and stakeholders (e.g., students, faculty, staff, and external bodies such as parents, accreditation agencies, and community partners) involved in such projects, it is broad enough to be tailored to institutional needs, and it aligns with well-established practices for stakeholder-engaged development of projects and programs within a university setting. Engaging in practices of anticipation, inclusion, responsiveness, and reflexivity in an iterative way has facilitated the development of shared values, vocabulary, and sensibilities. This process cannot guarantee ethical outcomes, per se, and it is not mutually exclusive or meant to replace other ethical frameworks, principles, or design processes that can guide implementation and evaluation. Rather, AIRR’s contribution is to provide a framework for upstream design thinking that can facilitate the institutional development of more equitable learning analytics.

1.1. Purpose

The purpose of this paper is to highlight how one institution used the AIRR process as an accountability tool in guiding the group processes to create an EAS. Importantly, this discussion is not about results, outcomes, and features of the EAS proper. Rather, this paper highlights one way in which the AIRR process was used to guide the WG’s work in gathering data, processing results, and initiating next steps in building the EAS. The EAS design process shared here is an example of how the AIRR framework can be adopted — even the benefits of integrating AIRR into a design process after or as design begins. After briefly discussing background literature on higher education retention and learning analytics, we introduce the case. Then, data collection and results of the first phase of EAS design are discussed through the lens of AIRR. After introducing the case, the next sections discuss how an EAS can help address equity in higher education retention, considerations of using such an EAS, and the results of an institutional self-study on retention and the perceived use of an EAS at our institution. Finally, results of the self-study are discussed through the lens of the AIRR framework, centring practical and theoretical implications for using the AIRR framework at other higher education institutions working to implement a similar EAS.

2. Background

Retention in higher education has a robust literature base, where retention is often defined as the persistence of a student from one semester to the next in enrolling for and attending courses (Seidman, 2012; Spady, 1971; Tinto, 1987). When retention first became a concern in higher education, it was attributed in ways that blamed the student for not having the characteristics to succeed in college (Tinto, 2006). Now, student retention is seen through the lens of ecological theory, where a student’s decision to persist depends on the ways they interact with the campus environment, and how the campus environment interacts with them (Tinto, 1987, 2006). Retention is considered a multifaceted global issue (Crosling et al., 2009), as students around the world are choosing to leave higher education for varying reasons.

2.1. Higher Education Retention and Early Alert Systems

Retention today is also seen as a social equity and civil rights issue. Racially marginalized students are retained at a lesser rate than their white peers (National Center for Education Statistics, 2022). Since those with bachelor's degrees earn significantly more money than high school-only graduates over a lifetime (Tamborini et al., 2015), having fewer graduates of colour will continue to perpetuate the current racial differences in lifetime financial earnings (see Carnevale et al., 2013; Jiménez & Glater, 2020). This leads to a cyclic issue of not having the funding to attend higher education (even with loans), which then leads to further racial differences in lifetime earnings. Therefore, to help close gaps and ensure economic success for all people, higher education institutions must do what they can not only to increase retention but to increase retention in ways that allow for equity in graduation rates and lifelong earnings.

With increasing awareness of the potential opportunities afforded by big data and data analytics, higher education institutions across the world are turning to EASs to assist with retention efforts (Sclater et al., 2016; Jayaprakash et al., 2014). Early alert systems are university-wide technological initiatives that use data to seek to identify students at risk of leaving their institution before graduation, including and especially learning analytics (Sclater et al., 2016; Tampke, 2013). Typically, EASs take the form of a complex data analytic structure that collects, stores, and analyzes all relevant data about a student to predict their success (Sclater et al., 2016) within a term and from one term to another. When a student's behavioural, financial, and/or academic-related data suggests that they will not persist to the end of the current semester or into the next semester, typically determined through machine learning methods (also called a predictive analytics approach; Bird et al., 2021), an alert is sent to faculty and staff in the student's support network. As a result, faculty or staff can reach out to the student, discuss the alert, and get the student paired with the resources needed to successfully complete the semester or persist to the next semester or academic year.

Early alert systems have seen many positive outcomes (see Francis et al., 2020), but there is not much research on how EASs can lead to the attainment of equitable outcomes. Becoming aware of this challenge, the WG implemented certain values and processes to work toward the development of an EAS to promote equitable attainment in retention. However, building an EAS for the purposes of equity in retention requires collecting and addressing concerns rooted in both learning analytics and social equity.

2.2. Ethical Considerations of a Data-Driven Early Alert System

The primary ethical considerations of EASs are for individual privacy and security (Jones, 2019). Privacy and security are typically intertwined with a definition surrounding an individual's determination of when, how, and to what extent information about them can be shared or accessed by others, and who has that privileged access (Jones, 2019; Westin, 1967). Predictive systems can amplify existing biases in education, lead to aggressive tracking and surveillance, and lead to decisions that can harm students and/or negatively impact their future choices (Berendt et al., 2020). More specifically, connecting data about a student from different parts of their university experience creates new privacy considerations as compared to disparate data collection. Student data in an EAS is, by design, identifiable, meaning the sensitivity of student data increases the potential harm of a security breach. Whether in the case of normal use (e.g., ways the university legitimately uses the data as part of an EAS) or of a breach, a student's privacy may be infringed upon. Therefore, privacy and security should be addressed in relation to both student rights and to outcomes that include data breaches.

Beyond questions of privacy and security, learning analytics systems build in values and biases, even when this is unintentional. As a technology designed and implemented by humans and deployed within an institution, it reflects the assumptions, values, biases, and power relations within which it is designed, implemented, and deployed (Lang et al., 2017; Prinsloo & Slade, 2018). While design, implementation, and evaluation should strive to embody institutional values, be transparent about assumptions, root out biases, and mitigate the harms of power dynamics, a human-designed system is a social product imbued with values and politics that can have enormous social and political governing power.

Embodying the wrong values can lead to actions and interventions based on false interpretations of data, resulting in harm (Slade & Prinsloo, 2013). False interpretations may be based on deficit models of student success and retention that shape data collection and interpretation (Bensimon, 2005; Broughan & Prinsloo, 2020). Such harm can be individual (e.g., decreasing a student's sense of belonging or making recommendations that negatively impact their learning and career trajectory), or aggregate (e.g., deficit-based interpretations toward a student population that furthers inequity). Whether individual or aggregate, such harm can also adversely affect the university by negatively impacting stakeholder trust in the EAS, resulting in reputational harm or legal liability for the university.

Aside from concerns of privacy, security, and enacting deficit-based values, a last concern is deciding what data is used in the system. Generating alerts based on demographic data (e.g., race, gender) may be ineffective (Foster & Siddle, 2020). By using data for only individual student success and interventions, an EAS may not be able to address institution-wide behaviours and characteristics that negatively affect retention of marginalized students (Prinsloo & Slade, 2018), especially students whose

identities are intersectionally marginalized. Therefore, data regarding students’ social identities should not be collected on its own. An EAS should collect data about a student’s identities, experiences, and other information to get a more comprehensive view of both the student and the institution.

In summary, a system with good intentions, such as the goal of closing equity-based retention gaps, can be designed and implemented in ways that bring negative consequences. Consequences range from damaging a student’s sense of belonging to increasing the likelihood and impact of a privacy violation or security breach. These consequences ultimately go against the initial goals of the system, as well as the values of equity, inclusion, and justice.

2.3. AIRR Framework

To help those in science and technology fields shift their thinking from the end-product to the process used to create the product, the anticipation, inclusion, responsiveness, and reflexivity (AIRR) framework for responsible innovation was created (Stilgoe et al., 2013). The attention to the group process responds to two issues of ethics and responsibility in innovation. First, it recognizes that while group members individually may not be irresponsible, the coupled systems of science and innovation can create irresponsible groups (Beck, 2000). Second, a greater engagement with the intrinsic uncertainty of innovation can help groups better recognize the values that become imbued into their products and the potential for negative consequences (Stilgoe et al., 2013).

Table 1. AIRR Tenets, Definitions, and Guiding Questions

Tenet	Definition	Guiding Question(s)
Anticipation	Foreseeing consequences to design and implementation decisions.	What could go wrong with implementing this design?
Inclusion	Engaging with all relevant stakeholders. Allowing stakeholders to question innovation design and implementation, as well as group processes.	Who are the relevant stakeholders?
		How can we find and include those with the least power in this situation?
Responsiveness	Addressing stakeholder concerns and integrating stakeholder ideas into group processes, product design, and implementation.	How can design and implementation best incorporate input from relevant stakeholders?
		How can design and implementation be improved by anticipating diverse scenarios?
Reflexivity	Positioning one’s social identities and values with the project, and realizing that each singular positioning is limited.	How can innovators make visible and transparent the assumptions and values that shape design and implementation?

Note: AIRR = Anticipation, inclusion, responsiveness, and reflexivity.

Anticipation recognizes that there is always the possibility of an unintended consequence. A robust anticipatory practice should make visible a variety of plausible use cases and analyze these in relation to different stakeholders. Anticipation helps to determine whether design decisions in the innovation process can better maximize benefits and minimize harm, and for whom. Inclusion refers to authentic engagement with all relevant stakeholders to guide decision-making with stakeholder input. Importantly, this should occur early in the process, when input still has the potential to shape outcomes. Participants are invited to question 1) the design and implementation of the innovation, and 2) participatory processes (Stilgoe et al.; 2013). Responsiveness requires that innovators genuinely work to integrate concerns noted by participants. It implies a “capacity to change shape or direction in response to stakeholder and public values and changing circumstances” (Stilgoe et al., 2013, p. 1572). This does not necessitate acceding to every demand, but does imply addressing legitimate concerns in a robust way. In being responsive, groups are acting out their responsibility, defined as “not only the need to be answerable and accountable, but also to being respons-able and having an obligation to act” (Prinsloo & Slade, 2014, as cited in Prinsloo & Slade, 2018, p. 64, italics in original). Reflexivity signals the willingness of innovators to recognize the limits of their own perspectives, and to update their thinking in relation to the other three principles identified in AIRR. Institutional reflexivity means “holding a mirror up to one’s own activities, commitments, and assumptions, being aware of the limits of knowledge and being mindful that a particular framing of an issue may not be universally held” (Stilgoe et al., 2013, p. 1571). Displaying reflexivity usually

entails documenting decisions and rationale. Table 1 summarizes the four tenets, their definitions, and example guiding questions that groups can use to heighten the quality of their process.

Together, the four tenets work to increase the quality of group processes when designing projects (Stilgoe et al., 2013). By asking the questions in Table 1 during project design, group members can reflect on the relationship between themselves, the project, and the intended audience. In doing so, group members can practise 1) personal ways of being through reflecting on how each member perceives the project; 2) relational ways of being through using others' comments to further reflect and expand upon the worldviews of themselves and others, and 3) community ways of being through normalizing pauses for reflection and thought (Watt et al., 2022). By practising these ways of being together, the group process becomes stronger and asserts a more equitable quality, which helps to increase the product's quality (Stilgoe et al., 2013; Watt et al., 2022).

3. The Case

The central component to a case study analysis is noting the case in which the results appear (Yin, 2014). This section outlines the case, including the institution, the WG members, and the mapping of the WG values with the AIRR framework. The latter is described as a grounding framework for how the results are discussed below.

3.1. Institution

James Madison University is a large, research-intensive university located in the mid-Atlantic region of the United States. Approximately 20,000 undergraduate and 2,000 graduate students attend the institution, where the student body is primarily white (75%) and female (59%). Of the approximately 4,000 faculty and staff who work at the institution, 92% are white and 56% are female. Our institution is also considered a predominantly white institution, as more than 50% of the students who attend are racially white. JMU publicly reports an average first-year retention rate of approximately 89% over the past five years. Although this rate is higher than the national average and median rates, reports show that this is primarily driven by the retention rate of socially privileged students, such as white and continuing generation students. The retention rate and equity-based retention gaps were identified as the QEP topic and the WG was formed to help design and implement an EAS to ensure intersectional equity in first-year retention.

3.2. Working Group

The WG was formed through an intentional process to identify and leverage the interest and expertise of local students, staff, and faculty. The director of the QEP was hired through an open internal search and members of the WG were selected based on an open call to the university community and nominations by leaders across campus. As the WG was formed, it consisted of 19 members, including undergraduate (n=2) and graduate (n=2) students, faculty (n=6), student affairs staff (n=6), and administrators (n=3). It is important to note that these are the primary classifications for each WG member, but many members have dual roles. For example, two of the faculty have dual roles in student affairs, and one faculty is also an administrator. The WG also identifies as primarily white (79%) and female (58%), and range in their length of time at the institution (between five and 30 years for staff). Disciplinary diversity is also present in this group, as disciplinary homes were considered when the WG was conceived. For example, the authors bring expertise and credibility to the working group through their respective backgrounds in the following areas:

- Quantitative and qualitative research methodology; helping to lead research projects and report writing

- Learning analytics and ethics, providing subject-matter expertise in guiding EAS creation

- Academic advising and education technology, providing insight to how front-line faculty and staff would realistically utilize the EAS when implemented

- Administration and relationships across the university, providing insight into how administrators and other faculty/staff/administrators may perceive the EAS

- Teaching, administration, and social justice, providing insight as a faculty member and supervisor to both student and professional staff, as well as the opportunity to guide the reflection of EAS development through the lens of social justice

Other WG members bring knowledge and expertise in areas such as multiculturalism, higher education and student development, retention, and teaching and learning.

3.3. Values

The primary goals of the EAS are to close equity-based gaps in retention and reverse declining retention rates. In preparation to lead and kick-off the working group, the QEP director drafted a charge document that included purpose, goals, objectives, timeline, and guiding values. The guiding values were drafted based on the student success and equity literature and experience within higher education as a faculty member, administrator, and higher education scholar (Culver et al., 2021; Kezar, 2019). After discussion at the opening meeting, the WG adopted these four core values to guide both internal reflection (e.g., WG

meetings), and external showcasing (e.g., interacting with campus stakeholders): student-centred, equitable, transparent, and improvement-minded (SETI).

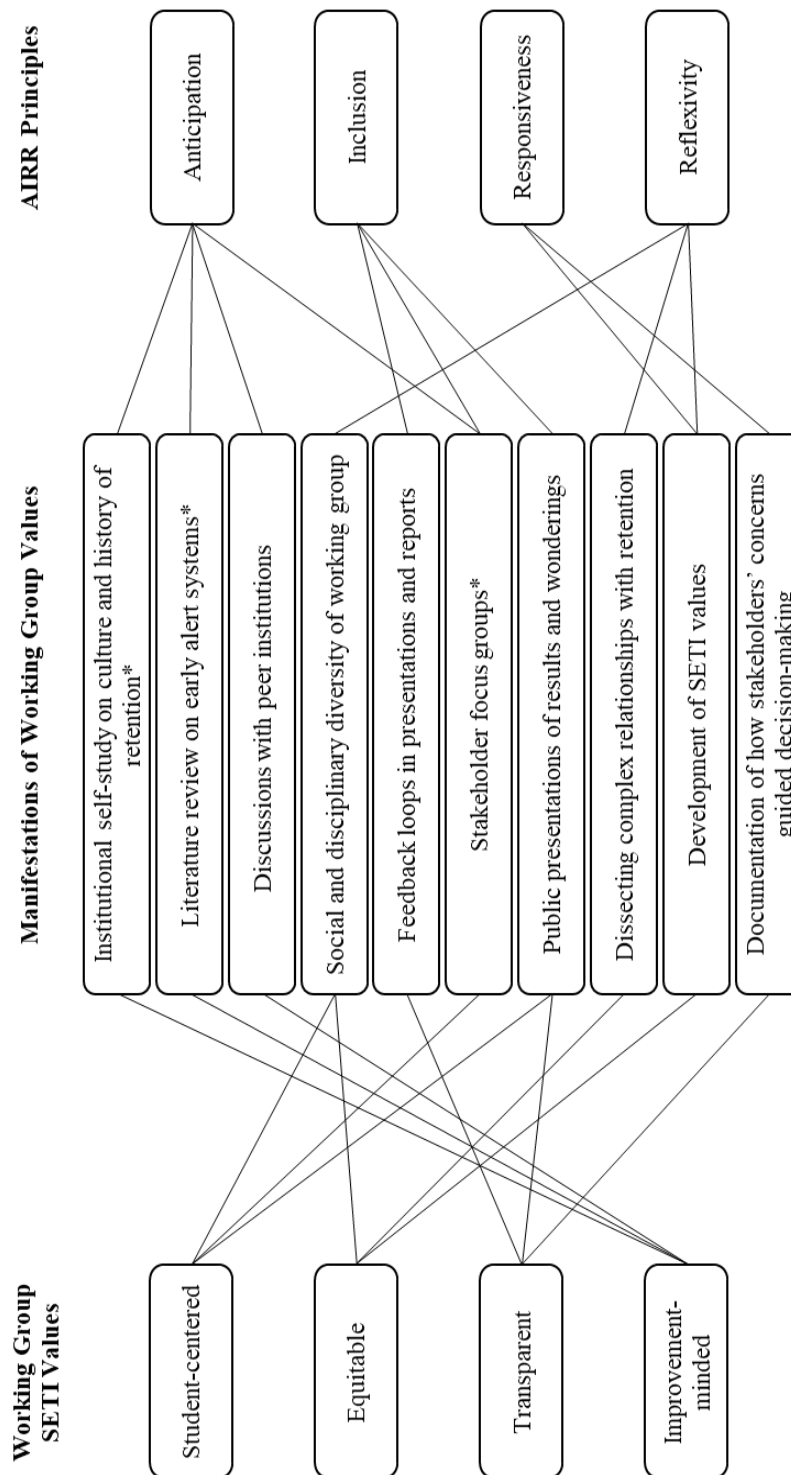


Figure 1. Mapping of AIRR principles to SETI values
*Manifestations involved in this study.

Note: AIRR = anticipation, inclusion, responsiveness, and reflexivity;
SETI = student-centred, equitable, transparent, and improvement-oriented.

Student centredness is the value that because students are the beneficiaries of educational interventions, students should be included in their creation process (Brown Wright, 2011). This value was created before the inception of the WG, but named during the first WG meeting, since both undergraduate and graduate students were invited into the WG itself. The value of equity acknowledges the presence of complex and nebulous systems of power and oppression (e.g., racism, sexism; Watt et al., 2022) that must be actively critiqued and opposed in our work to pursue social justice. As the QEP's primary task is to create equity in retention, equity was a quickly agreed-upon value among members of the WG. In other words, creating a product that addresses equity was deemed impossible if equity did not exist in the process of creating the EAS. The value of equity also implies that no one source of knowledge (literature, analytic method, etc.) serves as an authority. Rather, it is recognized that data and equity are two politically driven concepts that have rendered many social consequences (Garcia et al., 2018). The third value, transparency, acknowledges that the public must be kept informed of conversations and decisions made within the WG. Members of the WG acknowledged that in both product-design and institutional initiatives, not keeping the client and other relevant stakeholders informed may lead to resentment of the product via misunderstanding. It is also noted that transparency of processes can lead to higher stakeholder engagement and acceptance in higher education assessment (Montenegro & Jankowski, 2020), community planning (Casadevall, 2016), and marketing (Gregory, 2007). Finally, improvement mindedness transforms the three steps of learning improvement in higher education (assess, intervene, reassess; Fulcher & Prendergast, 2021; Fulcher et al., 2014) to the institution-wide initiative of creating an EAS. The WG realized that the success of the EAS is not in its completion and deployment; instead, the EAS must be directly linked to improved equity in retention rates across student populations. Therefore, the process used to measure improvement should take a similar three-phase approach: 1) measure retention rates across student populations and gain initial perceptions and attitudes toward retention and equity in retention; 2) design and build the EAS; and 3) repeat part 1).

Upholding these values, the WG split into four groups to enact phase 1 of the process. The institutional data group compared the retention rates across certain student populations, performing a quantitative analysis. The literature review group created a report outlining how to construct, perceptions of, and ethics in implementing an EAS in higher education institutions. The focus group collected qualitative data and created the qualitative report from the focus groups with students, faculty, and staff. Finally, the peer institution group interviewed other higher education institutions using learning analytics and EASs for student retention. This group gained further advice on building and ethical considerations of EASs. During and after data collection, the WG was asked to present in-progress findings and updates to various stakeholders. Enacting the value of transparency, the WG used presentations as another avenue of data collection, where feedback and comments were recorded and considered alongside the other data collected and analyzed in the WG. The qualitative and quantitative analysis, as well as the literature review, are the objects of the analysis explained in the next section.

During this phase, the WG found the AIRR framework (Stilgoe et al., 2013), of which the WG decided to adopt it as a form of accountability in enacting the group's SETI values. In checking the relationship between SETI and AIRR, it was found that the values aligned well. For example, the SETI value of transparency was enacted through presenting to external stakeholders and collecting feedback from stakeholders to consider in further development of the EAS. The act of presenting to stakeholders and welcoming feedback falls into the inclusion tenet of AIRR, whereas addressing and considering feedback is the tenet of responsiveness. Other examples of WG processes, as well as how those processes connect the WG's SETI values and the AIRR framework is outlined in Figure 1. As a result of finding AIRR, the WG had a form of accountability in holding an intentional process for creating a product.

4. Methods

Case studies are a unique approach to research that explores phenomena in a certain context, often called a bounded system (Yin, 2014). Often, case studies are used when there are certain contexts bound to the phenomenon of interest, or where the boundary between context and phenomenon is unclear (Yin, 2014). This section outlines a piece of the WG's initial phase process, which was a mixed-methods institutional self-study on retention and perceptions of an EAS among students, faculty, and staff. In doing so, the study described here is one piece of the larger WG process. In total, we aim to write a narrative on 1) how retention is perceived at our institution; and 2) the perceptions of how an EAS could help with retention.

4.1. Design

The institutional self-study takes a convergent/parallel mixed-methods approach through a transformative paradigm (Creswell, 2014). In this design, a quantitative and qualitative study are done concurrently and separate from one another; the process of one study does not directly affect the other, like in other mixed-methods designs. The transformative paradigm acknowledges the presence of power and oppression in society, where the purpose of research is to include members of the community in order to create an agenda for change (Creswell, 2014). As members of the community for which we want to create change, both the authors and the WG are leading drivers of both the study and the larger EAS initiative.

4.2. Sample

There are two samples for this study. The quantitative sample was all first-year students at the institution over the past five years (N=18,106). Sample characteristics are noted in Table 2. The sample for the qualitative study consisted of students (n=15), faculty (n=51), student affairs staff (n=30), and administrative staff (n=36) for a total of 132 participants. For complete confidentiality, sample characteristics are not described for the qualitative study.

Table 2. Sample Characteristics for Quantitative Study

Race	n	Gender	n	Generation Status	n	Residency	n
Asian/Asian-American	924	Female	10,764	Continuing Generation	15,333	In-State	13,391
Black/African American	860	Male	7,340	First Generation	2,468	Out-of-State	4,715
Hispanic/Latinx	330	Other	2	Unsure	305		
Multiracial (two or more racial identities)	1,778						
White	14,214						
Total	18,106						

4.3. Data Collection

Data for the quantitative study was collected through the university’s office of institutional research since the data is historical in nature. Data collected included year of entry, racial and ethnic identity, gender, generation status (first generation vs. continuing generation), and residency status (in-state vs. out-of-state). Data also noted whether each student was retained in their first year, noted as fall-to-fall retention (attended classes in both year 1 and 2).

Qualitative data was collected via semi-structured focus groups. Specifically, 37 focus groups occurred, where the number of participants ranged from one to five. In the case of having only one participant, the focus group was conducted as a semi-structured interview, utilizing the same topics and questions as the focus group. The focus group consisted of four themes of exploration: 1) perceived barriers of retention; 2) perception of campus community; 3) thoughts on implementing an EAS; and 4) the role of an EAS at the institution. Focus groups occurred over the Fall 2021 and Spring 2022 semesters via Zoom.

4.4. Analysis

4.4.1. Quantitative Analysis

A chi-square analysis was used to answer one research question: Controlling for a second social identity, is there independence in retention rate across each social identity? Specifically, a three-way interaction of retention and two social identities (e.g., retention rate across race while controlling for gender) was done via a Breslow-Day test for homogenous association. If the Breslow-Day test is not statistically significant, a Cochran-Mantel-Haenzel test of conditional independence is used to determine the nature of the three-way relationship. This process was done for each combination of social identities in the data set (race, gender, generation status, and residency).

4.4.2. Qualitative Analysis

Thematic analysis via consensus coding was done via an emergent process to answer one research question: What role does an EAS play in preventing students from leaving the institution? Throughout the coding process, an audit trail was documented, and member-checking was done to ensure credibility. Three WG members participated in the coding process, where coders went through each transcript individually, then came together to discuss codes, create consensus, and arrange codes into themes.

Combining the two analyses together in a convergent pattern, constant comparison was also used to align quantitative and qualitative results to literature in retention, equity, and ethics in constructing an EAS.

5. Results

The results below represent primary themes. However, this does not represent the full set of results.¹ These are also framed within how the WG processed results to give the reader further insight into interpretation.

¹ Readers looking to find detailed results of each individual analysis and the combined analysis can go to https://www.jmu.edu/sacscoc/qep_meetings.shtml or contact the authors for supplemental materials.

5.1. Equity

Although equity was a guiding value of the WG, equity was a theme that emerged as a concern from stakeholders and the WG. At times during the initial research and self-study phase, conflict arose between members of the WG, the WG and stakeholders, or among stakeholders. As conflict arose, people came together to discuss where and why dissonance arose, and how we can increase the quality of the WG's process through exploring dissonance. Exiting the research phase and entering the design phase, this outcome serves as a reminder that data is not representative of a student's full experience.

As an example found in the study, there are differences in retention rates among racial identity groups on their own ($\chi^2(4) = 16.89, p < .01$), where white, Asian, and Hispanic students were retained at higher rates than Black and multiracial students. However, in the Breslow-Day analysis, race was not significant when explaining any three-way analysis when it was the control variable. In the focus groups, it was found that students, particularly students of colour and female students of colour, lacked a sense of belonging on campus, which led them to think about leaving college.

Reflecting on the tensions within this theme, the WG understood that although quantitative analysis is heavily relied upon in higher education (Garcia et al., 2018), it is only one piece of information and can support or conflict with any other information found via other analyses or literature reviews. Therefore, statistics were one tool used to help with the self-study, but statistics and numerical data alone should not stand as a value alongside equity.

5.2. Student Agency

Any system that uses data should allow those whose data is being collected to have agency over how their data is used. With the EAS being implemented, the WG found that student knowledge of data ownership would be a priority. Therefore, a grounding piece of the design phase focuses on encouraging student control or agency over their data. To encourage data agency, the awareness of data practices and ways to exert user control must be communicated (Reidenberg & Schaub, 2018). If students are given ways to exert that agency, then students will not perceive the university as seeing students as mere data points, but rather as co-collaborators in the EAS initiative (Prinsloo & Slade, 2018). The theme of student agency emerged from both literature (e.g., Prinsloo & Slade, 2018) and from focus groups with students.

As an example of student agency, both WG experts and the focus groups suggested enacting informed consent. With informed consent, students have direct access to their rights and responsibilities with data they generate and can give explicit permission for their data to be used by a second or third party (Jones, 2019). Although informed consent has its own set of ethical considerations (Berendt et al., 2020; Jones, 2019), it is a common example of how student agency is enacted. Going further, stakeholders in focus groups used informed consent as a springboard to reimagine the role of the entire EAS. More specifically, stakeholders imagined the EAS to take an atypical approach; instead of putting the onus completely on faculty and staff to act on behalf of students, students should also be given an opportunity to act on an EAS alert given to them. As the WG enters the design phase, we ground ourselves in the idea that students need to be in control of their data, and therefore of their college experience.

5.3. Framing

Through living in the AIRR framework, the WG found ways to collaborate with stakeholders that resulted in how to frame the EAS in ways that will encourage all campus stakeholders to use the EAS to its fullest potential. As a result, a theme that emerged from the initial research and self-study phase is framing, where framing the EAS took the form of language used within the EAS as well as when talking about the EAS.

Through involving stakeholders (e.g., other students, faculty, staff, administrators, and community partners) in our process, the WG found that the way we were talking about retention, equity, and the EAS evolved over time, which has garnered more interest in how the EAS should be mentioned. Stakeholders voiced many opinions and concerns about identifying and replacing biased language that may hold negative perceptions about success on campus. Some examples included changing the term "early alert system" to "student success system," to foster student perception that they are not only important when an "alert" comes up for them, but rather that the EAS is in place to encourage student development throughout their entire college career. Second, changing the term "alert" to "insight" allows faculty and staff to start conversations with students rooted in care and curiosity rather than a deficit perspective. These small changes inspired by stakeholders are not just about semantics or perception, but a fundamental reconceptualization of what and who the EAS is for; moving from a system designed for faculty and staff to a system designed for students and their success.

In summary, stakeholder input has fostered a theme of framing the EAS in ways that led the WG to change its approach to the design of the EAS. As a result of the new framing, the WG keeps itself grounded in acknowledging the power of stakeholders and transparency in the success of the EAS.

6. Discussion

After a year of working aligned with the SETI values, and connecting it to the AIRR framework, an institutional self-study resulted in themes of equity, student agency, and framing of the EAS. As the WG goes into the design phase of the EAS initiative, the three emergent themes work together to form a design outcomes framework. The tenets of this design framework are ease of use, accountability, data-informed, student agency, student empowerment, and human empowerment. Table 3 shows the definitions of these tenets.

Reflecting on how the AIRR framework overlaps with the WG’s SETI values in creating an EAS in higher education, there are both practical and theoretical implications for AIRR and EASs in higher education.

Table 3. QEP Working Group Framework Guiding the Design Phase

Principle	Definition
Ease of Use	Prioritize ease of use, management, and workflow for users.
Accountability	Clear expectations and policies should guide the design and use of the system, including user and institutional responsibility.
Data-Informed	The system should provide actionable insights informed by data, rather than be driven by the data.
Student Agency	Students are not data objects, but subjects and owners of data who have agency.
Student Empowerment	The system should be asset-based, agency-oriented, and supportive of student development.
Human Empowerment	The system itself is not a solution, it is a supplement that enhances the experience and practice of the users.

Note: QEP = Quality Enhancement Plan

6.1. Practical Implications

The AIRR is a practical framework that allows groups to form a strong process (Stilgoe et al., 2013). The WG did not come across AIRR right away, but rather used it as an accountability measure to ensure that SETI values were being properly enacted. In doing so, the WG was able to live within values of higher education, justice, and science and technology.

The five tenets shown above lead into ideas for how the EAS will be built and marketed at JMU. For example, “ease of use” notes that all users should have no difficulty navigating the system. The WG currently imagines this as faculty and staff being able to find their student(s) easily in the EAS, or being able to compile reports quickly for a group of students (e.g., a class or cohort). As another example, student agency is framed as students being informed as to how their data is being used, and determining if students want their data to be used in the EAS. Therefore, an opt-out option will be available for students at any point in their college career, along with an explanation of the consequences of “opting out.”

In a broader discussion, the AIRR framework assisted the WG primarily in dealing with conflicting concerns from different stakeholders. Throughout the self-study, there were conflicting concerns and ideas from existing research, WG members’ expertise, literature, and the larger campus community and stakeholders. Although the SETI values were helpful in establishing what we as a WG thought was right, the AIRR framework helped to ensure that the WG kept the scope of the project in mind. The SETI values were great for navigating equity at the individual level, but the AIRR framework helped the WG remember that the scope of the project was at the institutional level. As such, other institutions seeking to implement a framework for creating or modifying an EAS may look to the AIRR framework to create an intentional process.

6.2. Theoretical Implications

The application of AIRR to a higher education process is, to our knowledge, relatively new. In doing so, there may be further implications for the application of the AIRR framework outside of science and technology itself.

The use of AIRR in the process of developing an equity-minded EAS has several theoretical implications that call for further exploration. First, the SETI values made by the WG aligned well with the AIRR framework. If other higher education institutions or WG’s hold values like SETI, the AIRR framework could already be used outside of science and technology, but under possibly different names or frameworks. Further work would need to be done to connect these possible values and frameworks. Another area of further exploration is the political outcomes of using AIRR. The AIRR framework is a developmental outgrowth of responsible innovation (Stilgoe et al., 2013). This type of responsible innovation is talked about primarily in intergovernmental industry and sector fields. Higher education is considered a highly diverse sector, consisting of multidisciplinary, multigovernmental bodies that may look at the same problem differently. If AIRR is further explored in higher education, the relationship between AIRR and higher education policy, governance, and accreditation should be

explored. Finally, the WG realizes that an EAS is one piece of retention initiatives in higher education. Although the values of SETI can be used to connect the EAS to other parts of the retention initiative, there could be the possibility for AIRR to govern more than just data analytics groups; AIRR could be used as a framework to guide initiatives where data analytics is one piece of a more complex puzzle. In summary, the theoretical implications for AIRR wonder about its possibility to exist outside or past its original intention of science and technology.

7. Conclusions

Frameworks like AIRR are essential when creating products used to target complex social inequities (Buckingham Shum et al., 2019), such as an EAS targeting higher education retention. By adopting the AIRR framework and mapping it onto SETI values, we saw outcomes emerge that provided further guidance on how to ensure equity in the design and implementation of an EAS. The application of the AIRR framework in a higher education context now leads to wonderings about the applicability of AIRR to other institutions in the same position as us, or generally in the higher education space.

In our case study, the alignment of the AIRR and SETI frameworks produced an institutional self-study revealing what the WG should consider when building the EAS. Through the themes found in this mixed-methods study, the WG will ground the EAS design in five tenets. Ideas for the EAS's physical features have just begun, with discussions of informed consent, the integration of drag-and-drop tables for the user interface, and sending text reminders or alerts to students at specific times in their first year. However, these ideas will continue to develop as JMU develops the EAS for the purpose of equity in retention.

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