From Checklist to Lifestyle: Transforming Student IDPs into Growth Habits

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Abstract

Developing an individual development plan (IDP) is a key component in the professional development activities for graduate students. A well-designed IDP supports the student through several steps of professional development planning and goal setting. First, the IDP helps the student articulate career goals. Second, the IDP guides students to identify specific strategies or activities to help make progress toward those goals, including undertaking activities that contribute to academic, professional and personal growth and pursuing focused career explorations to continually refine or change career goals. Third, the IDP supports the students in defining benchmarks with timelines to assess their progress. Finally, the IDP process provides a structure for ongoing evaluation and refinement of career goals, long term and near term plans to develop into well rounded professionals who are successful in entering and navigating their desired careers. Engaging in the IDP process can be a career-long tool for lifelong learning and particularly useful for rapidly changing interdisciplinary fields such as computational science.

Many graduate professional development programs require PhD students to create an IDP, often with annual updates. Creating the IDP is a challenge for beginning graduate students and unless required, students do not evaluate and refine their IDP. We believe that IDP effectiveness is often limited by a lack of institutional support for the IDP creation process. The insufficient understanding of the value of updating the IDP, lack of training in techniques or skills for planning and assessment needed in IDP, and an inability to customize the IDP to each student's specific needs and aspirations, hinders students' voluntary pursuit of IDP revisions. Therefore, the IDP creation activity ends up merely as a one-and-done effort focused on a written product, rather than forming a career-enhancing habit to engage in review and reflection to update a plan with personally meaningful goals.

Under an NSF S-STEM grant we implemented a year-long professional development course for interdisciplinary computational science and engineering students, in which we have experimented and refined the process through which we train our students to develop, refine and update their IDPs. Over the five years of the grant we have continually adapted and iteratively modified the IDP course assignments based on students' feedback and course reflections. This paper discusses the evolution and implementation of our updated IDP process, that includes pre-IDP activities aimed at envisioning a future self, discussions of program timelines and milestones, the hidden curricula and challenges with recent alumni, career exploration activities to inform the IDP, seminar and panel discussions on the pathways and challenges to interdisciplinary careers, developing a network of mentors, near peer advising by students a few years ahead on the IDP, and establishing a scaffolded and iterative process to create, adapt and personalize the IDP.

We performed qualitative analysis of student responses to open ended questions about the course. Using Bandura's agency framework [1], we find the new approach has been successful in eliminating the barriers that graduate students previously faced in the initial creation of the IDP. After changes to the course activities, students were more likely to exhibit self-reflection aspects of agency and discuss their goals, rather than merely evaluating course activities as isolated tasks. Our data shows students adopting the IDP as a career planning tool with indications that some students have transitioned from thinking of IDP as a product to making it a habit.

Introduction and literature review

Mentoring graduate students and providing them with strong professional development is hard. This task is particularly time and labor intensive because students not only enter graduate programs with different sets of skills and knowledge, but they also enter and/or develop different aspirations about their post-graduate professional aims. Thus, one-size-fits-all efforts, which often include workshops, talks, or classes on professional development that focus on general skills are ineffective; strong professional development requires an individualized approach [2]. The Individual Development Plan (IDP) gained popularity for precisely this reason. The IDP provides a structured activity template that helps students think individually about their strengths, areas of needed improvement, and future planning to reach their goals. Mentors and program directors can then ideally provide regular feedback to students' ongoing planning efforts, thus being reflective to students' needs and goals. Studies have widely supported the usefulness of the IDP approach [2], [3], [4], [5], [6], so much so that many institutions encourage and sometimes even require them and many U.S. federal agencies, such as the National Science Foundation (NSF) and National Institutes of Health, require them for training grants and research grants that include funding for students.

Yet, despite the widespread acknowledgement of their value, in practice IDPs are implemented in highly varied ways and their impact varies accordingly [7], [8]. In the context of an interdisciplinary graduate program in Computational Sciences, we investigate whether and how additional supports, particularly those that created social norms around the continued engagement with one's IDP, would improve the benefits of and continued engagement with the IDP for students.

Why are IDPs effective?

The IDP was developed based on research literature on motivation, particularly focused on goal setting, planning, and evaluation of progress toward one's goals, with the aim of providing agency to students in the career planning process, as well as support for this agency [9], [10]. A well-designed IDP supports the student through several steps of professional development planning and goal setting. First, the IDP helps the student articulate career goals. Second, the IDP guides students to identify specific strategies or activities to help make progress toward those goals, including undertaking activities that contribute to academic, professional and personal growth, and pursuing focused career explorations to continually refine or change career goals. Third, the IDP supports students in defining benchmarks with timelines to assess their progress. Finally, the IDP provides a structure for ongoing evaluating and refining, encouraging students to use self-, peer- and mentor-assessments to evaluate, adapt and refine the IDP, and in the process develop into well rounded professionals that are successful in entering and navigating their desired careers. The IDP can be a career-long tool for lifelong learning and particularly useful for rapidly changing interdisciplinary fields such as computational science.

What are barriers to effective IDP implementation?

Engaging in the IDP process is a challenge for beginning graduate students [8], [11]. First, unless required, students do not evaluate and refine their IDP. That is, students (and faculty) often treat the IDP as required busywork rather than a valued exercise, not understanding its value from the start [2]. IDP effectiveness is often limited by a lack of institutional support for the IDP process

[4]. Combined with insufficient understanding of the value of continuous evaluation and updating the IDP, lack of training in techniques or skills for IDP planning and assessment, and the inability to customize the IDP to each student's specific needs and aspirations, hinders students' voluntary pursuit of IDP revisions. Therefore, the IDP activity ends up merely as a one-and-done written product, rather than a career-enhancing habit to engage in review and reflection to continually update a plan with personally meaningful goals.

The present study

Under an NSF S-STEM grant, we implemented a year-long professional development course for interdisciplinary computational science and engineering students, in which we experimented and refined the process through which we train our students to develop, refine and update their IDPs. Over the five years of the grant we have continually adapted and iteratively modified IDP course assignments based on students' feedback and course reflections. This paper discusses the evolution and implementation of our updated IDP process, that includes pre-IDP activities aimed at envisioning a future self, discussions of program timelines and milestones, the hidden curricula and challenges with recent alumni, career exploration activities to inform the IDP, seminar and panel discussions on the pathways and challenges to interdisciplinary careers, developing a network of mentors, near peer advising by students a few years ahead on the IDP, and establishing a scaffolded and iterative process to create, adapt and personalize the IDP. We examine students' work on course activities and their feedback on end of semester reaction assignments to compare differences in IDP engagement and value across cohorts.

IDP implementation within a graduate professional development course

Implementation of IDP creation within our year-long professional development course for graduate students in an interdisciplinary program has evolved from a very prescriptive activity to being the backbone that connects all activities in the course. Two co-authors of this paper have been PI/co-PI on two successive NSF S-STEM grants that required implementing professional development activities for its scholarship recipients. Under the more recent grant (spanning years 2019-2024), the professional development activities were formalized into a yearlong (two semester) 1-credit/semester course and made available to all students in the interdisciplinary STEM graduate program. Details of the professional development course are described in our previous publication [12].

The course participants were first year students (MS or PhD) in the interdisciplinary [name suppressed] Science program. The aim of the course was to help assimilate students coming into the interdisciplinary graduate program, understand challenges and opportunities in becoming an interdisciplinary scientists/engineers, understand academic knowledge, expertise and experiences as well as professional skills needed to succeed as interdisciplinary scientists, use early career exploration and networking activities to identify suitable career choices and plan their studies and activities accordingly to be best positioned for their chosen career paths. It is not surprising that such an endeavor requires students to engage in the IDP process.

Initial IDP implementation attempt

We first attempted to have students develop an IDP using the myIDP tool provided by AAAS. The myIDP tool is a free, online platform designed to help graduate students and postdoctoral researchers assess their skills, interests, and values, identify suitable scientific career paths based on their self-assessment, and set strategic goals for career development by creating a personalized IDP. Student feedback was that

(1) The my IDP was not customized to their needs and
(2) The myIDP tool did not help connect what they had to do as students now to the strategic goals they could formulate.

In general, they did not see the value or purpose of this activity and it was ranked one of the least favorite or least productive activities for that semester.

First IDP implementation with scaffolded activities:

To improve this the following year (for the first cohort in this study) development of IDPs was implemented in scaffolded fashion in stages. First and foremost, a formal lecture was developed and presented on what is an IDP, why do students need an IDP and how to develop an IDP. Students were asked to use IDP form templates (from Stanford University or Rutgers University that were available online) as the starting point. These templates have a self-assessment questionnaire to identify areas of improvement or growth and a scheduling form where they can choose when to pursue these goals. The first activity was to review these templates and identify the challenges they faced and discuss this in a following class meeting. Some of the immediate feedback we heard from students was that

(1) the template forms were still not customized to their needs,
(2) they did not know what their future looks like and planning for something they are not clear yet about made filling out the IDP difficult,
(3) they had difficulty in seeing how to fit all these extra activities in an already busy schedule while taking courses, starting their research and in some cases balancing teaching responsibilities as TA.

To help students with these questions and concerns a series of follow-up activities were implemented in the following weeks.

Career Exploration:

We presented a seminar on career exploration that explained what is career exploration, why students should undertake this early in their studies, why it is an interactive and cyclic process that should be pursued continually and how to use career exploration for the IDP development process. We organized two panel discussions with alumni from the program- one with alumni that graduated within the last five years and another that had graduated more than five years earlier. We chose alumni from industry, government labs and academic careers. We tailored these discussions to help students understand how their graduate studies and experiences prepared panelists for their current job and/or career, what challenges they faced in their transition from being a student to their careers, what they would have done differently knowing what they know now, and how they continue to keep their expertise and skills growing in this constantly changing and evolving field. As a follow-on activity, students were asked to find three jobs that are very different from each other that interest them and parse the job description and requirements to identify technical expertise, skills, experiences, professional skills and personal

traits those job descriptions required. The following class discussion then grouped the requirements that each student had found under academic background, technical expertise, general professional skills. This was to show them that many of these requirements were common for all jobs/career paths and students can prioritize common skills development first. They were given examples of how they can seek more information about specialized career paths through networking, attending conferences, and participating in internships to narrow career choices. This allows students to focus their training or development plans as they narrow choices to pursue relevant activities to develop their technical and professional skills to match their desired career path. We engaged in discussions on what it means to be interdisciplinary scientists/engineers and how one develops knowledge, skills and experiences to succeed in such careers. A more comprehensive discussion of the concerns arising from pursuing interdisciplinary career paths is discussed in our companion paper [13].

Curriculum Vitae/Resume Workshop:

We also presented a short lecture on curriculum vitae and resume. In our class we ask students to update and maintain their curriculum vitae as a portfolio or biographical/chronological description of their professional development, and a resume as a tailored presentation to a specific career opportunity. We asked students to make a list of things they would like to see on their CV at the time they graduate (courses completed, experiences, publications, awards, etc.). The idea was for them to identify things they need to do to add to their IDPs when they start to develop them.

Understanding Academic Requirements Timelines and Milestones:

To help understand how to fit professional development activities into an already busy schedule, we embarked on an activity in developing a detailed academic timeline. The graduate handbook typically listed only the key milestones and when they were due but not when the activities that lead to the milestones were to commence or what preceding goals they had to meet to be ready to achieve each milestone. For this we engaged past participants of the S-STEM program and seniors in the program closer to graduation to work with current first year students enrolled in the course. This activity had two underlying goals. The first was to help students develop a detailed description of the academic requirements, activities, milestones and deadlines for their respective programs, including discussion of the time/effort requirements needed at various times during the program and the challenges their seniors faced and overcame. The latter discussions also led to accomplishing a second goal, developing near peer cohort networking among students.

Engaging research mentors in helping with the IDP:

After these activities, students were asked to complete the IDP template forms. Students were encouraged to discuss this form with their research mentors and get their help and input. We find that students have varying degrees of comfort in approaching their research mentors in the first year to discuss the IDP. Similarly, we find the support provided by mentors asking for such help is also varied. The responses from student mentors varied from “this is too early for this and I will guide you when it is appropriate”, “this is a great idea, lets discuss this and set goals that we can follow up on in future”, to “Okay, what do you want to accomplish as a PhD student and let’s see how we can structure your plan to help you most”. It is needless to say the latter approaches encouraged the students to engage in the IDP activity and revise and update it in future semesters. (To help students whose faculty mentors are not ardent supporters of the IDP

exercise early in their studies, we are now partnering students with near-peer student mentors who are closer to graduation and who had mentors supportive of their IDPs.

Despite these supporting activities to help facilitate an IDP development, feedback from students showed they struggled with the activity and still were not buying into it. Several students expressed they did not like the activity or did not have the information they needed to undertake this task, and did not know how they could possibly form a plan when their direction is still uncertain and changing. Ironically, the IDP is supposed to help navigate such uncertainty and serve as a tool to plan and/or pivot in the face of changing needs and fortunes. One thing that became clear to the instructor was that students were approaching this as an assignment to create a product and not as an ongoing process for development of a lifelong habit. This realization required rethinking the motivation element for the IDP.

Second and Revised IDP implementation with scaffolded activities

In the revised implementation we decided it was important for us to help students develop agency on finding career directions early on, embrace the uncertainty and changes in their choices of career paths as they grow and mature, and use the IDP as a tool to take agency over their development and use it as both as planning tool and as assessment tool.

Envisioning their future self:

The first modification we implemented was a series of activities to envision their future self. The first assignment in the year-long course was to write a recommendation letter as if they were applying for a dream job after graduation (two years in future for MS students and four or five years ahead for PhD students). In the following class meeting, based on their initial drafts, we listed and categorized the various things that should be mentioned in such a recommendation letter (academic background, specialized technical skills and expertise, professional skills and personal traits). The list of things that needed to be included was quite comprehensive, allowing students to realize things they had not thought about or overlooked when they wrote their letters. By categorizing them into individual "buckets" we also could engage in conversations on how they get these skills and experiences (e.g. coursework, research, internships, participation in conferences and networking events, interacting with peers and faculty members beside their main advisor or mentor) We explained to students that a good recommendation letter is based on anecdotal examples provided to support these skill statements, and when there are multiple letters a composite image of the application should be reflected in these letters with some overlap and corroborations. We then posed two questions: who would be the three or four people that they will develop close interactions with during their studies that can get to know them enough to write about them, and what activities or interactions can lead to their referees getting to know them.

A follow-on class activity asked them to imagine everything went according to plan ("of if it were a life on planet Ideal") and they are at the threshold of graduation, describing the person they see (for themselves). The goal for this activity was to teach students to dream and unshackle dreams from reality for a brief moment. But, also at a time (in first year of graduate school) when students are searching for their bearings and looking for paths to help them imagine a destination to which they can plan a path is highly effective.

We revisited this again after several weeks, when students were asked to prepare a self-introduction for themselves. This was to be done in third person, as someone would if they were introducing them to an audience at an event (conference or seminar) five years after their graduation.

Weekly reflections by the students participating in these activities showed these were novel activities for most students and were positively received. Even for the few that found speaking about themselves in future and with some level of flattery uncomfortable, the activity showed them the value of imaging their future in helping them plan for such a future.

The lecture about the IDP process was then presented to students and they were given the IDP template forms (from Rutgers University) as an example, but they were not required to start filling out the IDP form yet.

Making S.M.A.R.T. Plans:

The second major modification to the course was to train students in making good plans. A lecture on how to structure plans using the S.M.A.R.T (specific, measurable, achievable, Relevant and Timebound) plan framework was presented. Students were asked to write two plans, one for the remainder of the current academic year and one for just the next month. In class discussions after submission of this, students shared their plans with peers and this was used to give feedback on this activity and show how they can define the plans to fit the SMART plan framework and how to short term to long term plans. We encouraged students to further breakdown these plans for each week and at the end of the week reflect to see how things went and assess if the plan succeed, if not was it do to not estimating the time or effort, having unanticipated things arise and not having planned any buffer to use to adjust for this, or if they lacked background or ability for tasks undertaken that made it more difficult and longer to complete. Also, we asked students to track their sleep hours and see if the average sleep hours and personal time to relax correlated with their success on their short-term plans.

Time Management:

Another activity we assigned students was to make a detailed list of what they have to do each week and list the hours they need. This list had to be comprehensive, including time sent in lecture, computing time to classes, inactive times between classes, exercise time, grocery shopping, cooking, personal care. Many students exceed the 168 total hours available in a week in their first draft when we added in at least 7 hours of sleep time every day. This was effective to show students that without writing things down it is hard to account for all the things we are doing or expected to do. Also, having success with plans we make also needs allocating the necessary resources to accomplish these plans. Time and rest are key elements of that. Students were asked how they can restructure their activities (allocating a minimum of seven hours of sleep time). We also asked them to categorize their activities into academic work, research, professional development and personal growth and wellbeing. Having seen their current allocation to these categories we also asked students what would be their ideal mix or distribution for activities.

Working with Near Peers to add Academic Requirements into the IDP:

As this was at the mid-point of the semester, where first year graduate students generally get most stressed, we invited near peer seniors to a session to meet with students in the course and allowed students to ask any questions of concerns they had to their fellow students and how they navigated such challenges. This allowed students to get to know their near peers and establish some rapport. We re-invited these near peer seniors the following week to present the Academic Timelines and Planning Document they had developed in the previous year, breaking students into two groups - one for masters students and one for doctoral students, and help answer any questions students may have. We also asked these near peers about how they are using the IDP and what they found worked for them and what they still need to work on.

Students at this stage were asked to start filling out the IDP template form for an initial draft. While they were working in the IDP initial draft (much later in the semester as a result of these envisioning and planning modules introduced) the lecture for modules on career exploration, mentoring and mental health and wellbeing were presented.

Integrating Career Explorations into IDP:

The presentation of career exploration now included direct mentions of the IDP and how this needed to be added to their planning in the IDP. In particular, we asked students on activities and avenues they would like to pursue for networking and career explorations and how they can integrate that into the overall planning in their IDP.

Mentoring and Mentor Network Development as part of IDP:

A module on mentoring was moved earlier in the sequence and use to guide the IDP development. The guest lecture on Mentoring addressed the mentor-mentee relationships, different mentoring styles, the power balance in a mentor -mentee relationship (particularly between students and their research advisor who often is the primary mentor) and the need for having a network for mentors for support the various aspects of their academic, professional and personal growth. We explain to students; this relationship takes time to develop and requires active investment of time and effort and something that needs to be planned. We also emphasized the usefulness of having near peers or alumni as mentors (to complement your research mentor) to ask help with assessment or help on things you would not be comfortable asking your research mentor.

Including Personal Growth and Well Being as part of IDP:

An important emphasis in the professional development courses was to strike a balance and help understand success as a student and professional requires holistic development of the academic, professional and personal aspects. The latter is not emphasized enough in academic advising or programs in general in STEM graduate programs and is often the underlying cause for many of the challenges students face. To help students understand this we invited professional experts on this topic to talk about what are the demands graduate students face and how they need to advocate for their mental health and wellbeing, present to them best practices for achieving good health and maintaining balance between work and life. The intent is to also have students think about their personal wellbeing and growth and make this a part of their IDP. The inclusion of personal growth aspects also brings a closer personalization of the IDP and gets buy into the activity from participants.

Customizing IDP template:

After these scaffolded activities were completed we returned to the IDP again and asked students what their challenges were in completing a draft of the IDP. As expected we heard the usual concern that the rigidity of the template was not something they liked and some of the aspects of the template were not relevant to them. In class discussion we encouraged students to think how they can reformat or redo the template to suit them. We asked students in the final submission to adopt and modify the template format or the items listed to tailor the IDP template to their liking and needs. We expect that showing students the ability to modify IDP templates also will allow them to demonstrate their agency over the IDP process.

The themes we emphasize in all these activities, is to help students discover who they are and become the best versions of who they can be; understand that the IDP is a great tool to use to set goals, assess progress, assess validity of goals, make course corrections and plans based on things learned and lived experiences; and recognize that the IDP is more than just an itinerary or roadmap to graduation, it is an introspective way to look into what you want to accomplish and plan accordingly given the constraints of the real world we live in.

Data Analysis Methods

One coauthor used a qualitative coding approach to analyze course reflection assignments for two academic year cohorts, a total of 4 semesters of artifacts from 18 students in cohort one (Fall 2021-Spring 2022), and 14 students in cohort two (Fall 2022-Spring 2023). See appendix for each semester's assignment prompts. This coauthor is not affiliated with the degree program or university, but is familiar with the course and S-STEM program's goals. The coauthor first used several rounds of thematic coding to identify evidence of Bandura's aspects of agency [1]. This agency framework differs from that used in our earlier work [13], and artifacts were approached without prior annotations visible. Banduras' updated agency framework outlines three aspects of agency, including forethought, self-reactiveness, and self-reflection [1]. Forethought involves making plans or establishing goals in order to achieve some future state. Self-reactiveness involves a self-assessment of an action or participation in an activity using internal standards, and does not include revision of goals or larger plans. Self-reflection combines an assessment of actions and a review of goals or plans, and may include revision of goals or plans.

After thematic coding, the coauthor closely coded the artifacts for any mention of course activities. In our discussion of findings for this paper, we characterize mentions of the IDP document or its creation or revision within the agency framework [1], and whether students connected their IDP creation or updates with related course activities, or if they stated an intent to review and revise their IDP outside of the course activities.

Findings and Discussion

Students expressed a mix of opinions about the IDP and related activities in their end of semester course reflections (herein called *reflections*). Several students in each cohort discussed their IDPs and identified course activities related to creation or update of their IDP documents. Most of the first cohort students who mentioned IDP course activities did not indicate any intention to independently update their plan. We categorize these students as *compliant*. They "checked the

box" for the course activities, but did not integrate the IDP into their personal approach to professional development. Only one student in cohort one described updating their IDP. As described earlier, the instructor revised course activities and lectures/lesson plans for the second cohort to emphasize the value of periodically reviewing and updating IDPs. We hoped to see more statements in the course reflections that described an intent to review and update IDPs outside of the course. Ideally this commitment would expand beyond graduation. In fact, several students in the second cohort mentioned updating their IDP. They indicated that updating their IDP was a helpful and/or planned activity, like the single student in cohort one. Each student who described an intent to update their IDP also exhibited the self-reflection aspect of agency [1]. We call these students *adopters*.

Table 1 presents data on the number of students categorized into the "compliant' versus "adopter" category for the two cohorts. Table 2 presents data on the Evidence of agency with respect to engaging in developing the IDP and the categorization of this agency using Bandura's [1] agency framework.

Table 1. Students with IDP or process statements, categorized as either Compliant or Adopter

	Compliant or Adopter	
	compliant	**adopter**
Cohort One (N=18; student numbers 10-30)	12	1
Cohort Two (N=11; student numbers 40-59)	3	6

Table 2. Students exhibiting one or more of Bandura's agency aspects [1] with IDP statements

	Evidence of Agency Aspect with IDP		
	self-reactiveness	**self-reflection**	**neither**
Cohort One (N=18)	12	3	1
Cohort Two (N=11)	6	7	0

Compliant group for IDP implementation

A few examples from compliant students are provided below in Table 3, with student identifying numbers, and our interpretation of their comments.

Table 3. Comments from students that were compliant in developing an IDP

Student ID	Quote	Observation/ Interpretation
27	"There was not enough guidance given with it [IDP]. I was somewhat lost as to how to approach it."	Wanted more direction or information
18	"The IDP just felt like an administrative task and I didn't personally get much out of it this semester."	IDP activity not valuable to student
19	"...best activities were updating my IDP and contributing to the PhD student timeline. Upon entering this semester, I had a lot more insight into what goals I wanted to achieve before I finish my degree. ... The timeline was obviously less individualized, but working on the two simultaneously allowed me to create a plan for my last two years that hit necessary milestones while also prioritizing professional development."	Connects the degree program timeline activity with IDP update, no stated intention to update IDP in future
14	"felt a bit premature" but important "to fill out for my future" "...it [analyze job postings activity] let me see what skills I already have that would help me when I enter a job in industry as well as realize the skills I still need to acquire before I graduate."	Did not connect supportive course activities to developing their IDP

Some compliant students wanted more direction or information about how to create their IDP. For instance, one (27) stated in their Fall reflection *"there was not enough guidance given with it [IDP]."* They shared, "*I was somewhat lost as to how to approach it".* The instructions, template, and supporting activities provided to the first cohort were not helpful to this student.

Other compliant students also did not connect supportive course activities to their IDP. For instance, a student (14) who in Fall felt the IDP drafting activity *"felt a bit premature"* but important *"to fill out for my future",* in Spring praised the Job Posting activity without connecting it to their IDP revision, indicating that the job postings activity "…let me see what skills I already have that would help me when I enter a job in industry as well as **realize the skills I still need to acquire before I graduate.**" This student has a list of skills they wish to acquire yet did not mention adding new goals to their IDP.

Another student (18) recognized in Fall that an IDP ought to be updated "...at least once a year." However, in Spring this student stated *"The IDP just felt like an administrative task and I didn't personally get much out of it this semester."* This student praised several panel discussions and mentioned growth areas in their reflection. However, they either did not add these to their IDP, or found the process of updating their IDP to include these insights was not worth mentioning in their course reflection.

A more enthusiastic compliant student connected the degree progress timeline to their IDP but applied a time limit to the utility of an IDP. They (19) felt their IDP, revised in Spring, would last through their remaining years in the PhD program. This student found that the

"...best activities were updating my IDP and contributing to the PhD student timeline. Upon entering this semester, I had a lot more insight into what goals I wanted to achieve before I finish my degree. Along with that, I was able to identify areas I struggled in two and make a detailed plan on how to improve. The timeline was obviously less individualized, but working on the two simultaneously allowed me to create a plan for my last two years that hit necessary milestones while also prioritizing professional development." This individual did not entertain the possibility of updates prior to graduation and did not mention maintaining use of their IDP as a working professional.

While many of the compliant students exhibited the self-reactiveness aspect of agency when discussing their IDP, none engaged in self-reflection [1] regarding this course activity. Their self- and course-assessments of IDP related activities were focused on more proximate factors, and did not extend to future use of the techniques learned.

Table 4: Comments from student adopters of the process of developing and updating their IDP

Student ID	Quote	Observation/ Interpretation
13	"I will strive to include future research goals, publications, and conferences in a continuously updated IDP."	Only first cohort student to adopt the IDP
44	"Previously I hadn't known that there was something like an IDP to track progress. I had always thought of professional and personal development as something that kind of just happens and you choose to track your progress or not. It was interesting to see that there's more of a formal framework to self-accountability in professional development that people follow and is something that I will use in the future more regularly as part of my own development."	Values the self-accountability provided by their IDP
45	"...to appreciate my health and well-being as I further my personal goals, constantly updating my IDP keeps my vision clear and within reach."	Student plans to incorporate wellness goals in their IDP
48	"Moving forward, I will use this as a guide as I move through the program, and adapt it as needed, looking over it every semester to see what needs to be changed, updated, or worked on."	Plans to update IDP until graduation

Adopters group for IDP implementation

Only one (13) first cohort student made a connection between their IDP and goal setting, related to a desire to engage in lifelong learning (Table 4). In their Fall reflection they described ambivalent feelings about the IDP drafting activity and expressed that the process was "*somewhat uncomfortable"* but also shared that *"what this class has shown me is this discomfort can be a symptom of uncertainty in my own career goals"*. Compared to continuously updating a CV with accomplishments, they stated an IDP could be *"more important on an internal level to*

keep up to date". In their closing statement about the IDP, they exhibited self reflection [1] by clearly setting a goal to use and update their IDP in the future, *stating* "*I will strive to include future research goals, publications, and conferences in a continuously updated IDP*." Although this student did not complete a course reflection in the Spring semester, their stated adoption of the IDP as a potentially career-length tool demonstrates the desired learning outcome for the IDP activities. As described earlier, the instructor revised course activities and lectures/lesson plans for the second cohort to emphasize the value of periodically reviewing and updating IDPs. We hoped to see more statements in the course reflections that described an intent to review and update IDPs outside of the course. Ideally this commitment would expand beyond graduation. In fact, several students in the second cohort mentioned updating their IDP. They indicated that updating their IDP was a helpful and/or planned activity. Each student who described an intent to update their IDP also exhibited the self-reflection aspect of agency [1]. We call these students *adopters*.

Several adopters appreciated the clarity that their IDP provides them when considering their future. For example, one (44) mentioned the IDP in their Fall reflection in the context of *"my understanding of professional development as a computational scientist"* and mentioned that it *"improved awareness"* to *"think about the future and what we need to do to improve."* and is a *"useful tool for accountability for professional improvement not taught in other classes."* The course activity was the student's introduction to IDPs, and they stated an intention to use them more regularly. This student hadn't been aware of *"... something like an IDP to track progress. I had always thought of professional and personal development as something that kind of just happens and you choose to track your progress or not. It was interesting to see that there's more of a formal framework to self accountability in professional development that people follow and* ***is something that I will use in the future more regularly as part of my own development.***"

Another adopter (45) shared in their Fall reflection that they valued how the IDP activity provided the *"opportunity"* to consider past activities, reflect on their *"past experiences"* and "*draft a reasonable plan of action*" ... *"through an IDP"*. They also stated they would have liked more guidance on how to adapt their own IDP to their areas of interest. They used the IDP samples to make a *"hybrid format of a curriculum vitae and resume"*. In their Spring reflection, they also stated their intention to update their IDP in order "...*to appreciate my health and well-being as I further my personal goals,* ***constantly updating my IDP*** *keeps my vision clear and within reach.*" These students, as well as the sole adopter in the first cohort, do not place an outer time limit on how long they will continue to review and update their IDPs.

Other adopters included a time-limit to their use of IDPs, adopting it for their remaining time in the degree program. For instance, one (48) wrote in their Spring reflection that they were "…"*unaware that resources like the IDP existed for creating development plans, providing guidance on all aspects related to your goals for a well-rounded, detailed plan that is practical and takes everything into account.* ***Moving forward, I will use this as a guide as I move through the program, and adapt it as needed",*** looking over it every semester to see what needs to be changed, updated, or worked on." This student is committed to semesterly updates but not beyond achieving their desired degree.

Another student (44) includes a commitment to update their IDP in their Spring reflection, but also admits they have not "given too much attention to it" this semester. They stated that *"...the implementation of the IDP has helped students and myself plan out the rest of our academics in terms of our long term goals*." This student adds that despite not paying much attention to the IDP, "…***going forward in the future I think I'll keep track of updating it and figuring out where I want to go and what I need to do to get there."*** This student appears to have applied a time limit, "the rest of our academics", for use of their IDP, but it is possible their statement, "going forward in the future" extends their commitment beyond graduation.

Motivation to overcome discomfort

The course activities appear to have motivated some of the adopters to maintain their IDPs (Table 5). Some expressed clear discomfort with the IDP-related activities, and it is thus unlikely they would have opted to create and then pursue updates to an IDP without the course as an external motivator.

Table 5. Statements from students who were motivated to overcome discomfort.

Student ID	Quote	Observations/ Interpretations
46	"...I originally didn't put much effort into but now recognize the significance of..." "After reflecting on the semester and seeing what I accomplished and set for my IDP, I can understand how it can be used more effectively for the short and long term future." "Over the winter break, I plan to revise my IDP with more detail to better plan out my future."	Moves from investing minimal effort at first to adopting IDP updates in the near term.
42	"IDP format of setting short term as well as long term goals, as well as the added motivation of turning a finished plan in as an assignment, made the IDP approachable and pushed me out from my comfort zone."	Course activities helped student move beyond their comfort zone
49	"Even with the hours spent on the IDP and many hours of angst, I still have not managed to plan much further than the next semester away."	Student expresses struggle and angst.

One student (46) recognized in their Fall reflection that they missed an opportunity during the semester to be more "*proactive*" by not recognizing the value of revising their IDP. They reflected that *"...I originally didn't put much effort into but now recognize the significance of...."* They state a goal to be less reactive and more intentional in their plans *"... instead of letting things happen around me."* They connected the IDP to this desire stating, ""*After reflecting on the semester and seeing what I accomplished and set for my IDP, I can understand how it can be used more effectively for the short and long term future*." In fact, the student planned to modify their IDP "*Over the winter break…with more detail to better plan out my future.*"
Other adopters in the second cohort expressed discomfort with the IDP activities. One (49) associated the Fall IDP activities with angst and existential dread, stating that "*Even with the*

hours spent on the IDP and many hours of angst, I still have not managed to plan much further than the next semester away" and that the favorite assignment was presenting a summary on two different academic papers because … "they came with less existential dread as compared to the IDP." In spite of the emotions they associate with their IDP, this student stated *"...one of my few goals this break is to update my IDP to the best of my ability and hopefully create a more solid plan spanning longer than a semester."*
This adopter's motivation to update their IDP is not explicitly stated, but they mention their expectation that the second semester of the course would include a "*consistent emphasis*" on students' IDPs. This may indicate an external motivation, that they see the activity is valued within their degree program. Arnaud and Cahill [11] argued for IDP mandates and showed that requiring IDP creation for entire departments or colleges normalized the activity for graduate students, and despite some students' dislike of a mandated activity, many perceived it as useful and worth prioritizing.

The motivational aspects of the course assignments and in class activities were apparent to non-adopters in the second cohort. For instance, one (42) described creation of the written IDP in Fall as a useful class activity, but didn't make any commitment to update their IDP, stating that the "*IDP format of setting short term as well as long term goals, as well as the added motivation of turning a finished plan in as an assignment, made the IDP approachable and pushed me out from my comfort zone.*"

Table 6. Sample student expressions valuing feedback on goals and plans within IDPs.

Student ID	Quotes	Observations/ Interpretations
27	"My least productive activity was the IDP-related one because I feel the assignment was assigned but there was no real follow-up or feedback given on it."	Lack of feedback decreased the value of the activity
25	"I thought...we'd have more chances to talk about our goals and receive direct feedback on our plans to reach those goals."	Wanted class discussion of plans and goals
15	"This semester I think the IDP was not as productive as last semester. We didn't get a chance to get feedback or peer review which may have been helpful. Last semester it was helpful for me to have my research advisor review it. I got a better idea of what they expected from me and what I needed to learn/improve on more specifically."	Valued and wanted more peer or mentor feedback
41	"Working with an older peer graduate student ([redacted]) was invaluable and by far the most helpful part of this course."	Valued near-peer feedback

They explicitly mention the motivation provided by the assignment to push them through discomfort to produce a written document. While not as expressive as the earlier adopter (49) who expressed a sense of existential dread when creating their IDP, it is unlikely either student

would have created an IDP without the course activities and assignment. This supports Arnaud and Cahill's finding that mandated IDP activities are valuable for students in spite of the likelihood that some will experience or express discomfort with the activity [11].

Individual but not solitary

Students in both cohorts expressed that IDP activities could have been more effective with additional support and feedback. Sample quotes from students expressing the need for more guidance and feedback are listed in Table 6 and discussed in more detail below.

One student (27) in the first cohort noted in their Spring reflection their least productive activity was the IDP, *"…because I feel the assignment was assigned but there was no real follow up or feedback given on it*." For this student, the IDP was not valuable as a solitary activity. Like this student, some expressed a desire for general feedback, while others wanted an opportunity for discussion of their IDPs and goals in the class. One first cohort student (25) *"...thought...we'd have more chances to talk about our goals and receive direct feedback on our plans to reach those goals.*"

Another first cohort student (15) wanted feedback including from peers and their research advisor. They lamented that, "*This semester I think the IDP were not as productive as last semester. We didn't get a chance to get feedback or peer review which may have been helpful. Last semester it was helpful for me to have my research advisor review it. I got a better idea of what they expected from me and what I needed to learn/improve on more specifically*."

A second cohort student (41) found great value in working with a near peer to review their IDP and degree timeline. In their Fall reflection this student described the beneficial social aspects of generating content for both their IDP and degree program timeline. They felt that *"...working with an older peer graduate student ([redacted]) was invaluable and by far the most helpful part of this course.*"

Also, they shared that class discussions related to the IDP content were:*"...helpful for me to voice my goals and plans in the classroom to the other students."* Arnaud and Cahill found that many graduate students appreciated "feedback and interaction with others" while drafting their required IDP [11]. In their case, students were required to conduct an informational interview with an expert before drafting the IDP and to discuss their IDP with their faculty mentor.

Aspects of Bandura's agency framework

Overall, students from both cohorts provided primarily positive comments about the IDP activities, with some expressing discomfort about completing their IDP, and some in the first cohort expressing confusion about the assignment. In the first cohort, students were primarily compliant, completing and assessing the course IDP activities as isolated actions. Their descriptions primarily exhibited the self-reactiveness aspect of agency (Table 2). In contrast, after the instructor implemented several changes in the course content and sequencing of content, the second cohort of students included many more adopters who exhibited self-reflection and set an intention to use their IDP over time. We identified only one such student in the first cohort. We infer that requiring creation of an IDP is insufficient to motivate most students to adopt the

process of IDP updates. Incorporating opportunities for supporting student agency during the IDP process as well as social activity components into IDP development appears to be important to facilitate these changes for some students.

Limitations and Future Work

Our qualitative data that provides a rich description of this course outcome across two academic years cannot be used to infer or predict outcomes for a larger population. Students were not directly prompted to provide their impressions of the IDP; thus, we only have data from students who choose to discuss this assignment as a highlight or least productive course activity. We also do not have comparison data from students in the degree program who did not enroll in the course, or did not enroll in the second semester of the course. A longitudinal study to explore IDP use and revision after completion of one or both semesters of the course could determine if students continue to use this popular tool for lifelong learning. Similar data could be collected for peers who did not take the course, and we could ask about peers' awareness of and adoption of an IDP. Future iterations of the course will also include more deliberate ties to other planning activities the students are familiar with, using an assets-based approach [12] to encourage students to transfer their existing knowledge to the creation and use of their IDPs.

Conclusions & Implications for Practice

The devil is in the details. The literature demonstrates that IDPs have great potential value to students, and that institutional supports are necessary to achieve this value. Our course changes improved students' engagement with their IDP as evidenced by more self-reflection [1] in their descriptions of updating their IDPs. More students in the second cohort also demonstrated an increased perceived value of the IDP supporting course activities, in spite of acknowledging occasional discomfort. We have identified four specific implications for those who want to maximize their IDP effectiveness in their programs:

- Require an IDP draft and at least one update. This signals to students that an IDP is an outcome of an ongoing process and it is not meant to be a singular, static milepost on their journey. Requiring an update encourages the students to move past discomfort and potentially into self-reflection, which may increase their sense of agency and the likelihood of their adopting an IDP update cycle for their career.
- Make the utility of an IDP to career development and lifelong learning obvious. This could include an assets-based approach [14] to tie the IDP creation process to what each student has already experienced in their planning to get into graduate school or achieve other goals.
- Ensure that supporting activities are clearly and explicitly tied to opportunities for students to reflect and consider making IDP updates. This could move students from self-reactiveness to self-reflection, and build a habit of regular goal review and self-assessment.
- Encourage or facilitate discussions of their IDP content, updates, and progress to goals with experts, peers and near-peers, mentors, and faculty advisors. This social interaction will prompt students to engage in both self-reactiveness agency and self-reflection with their mentor network and peers.

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Literature Cited

[1] A. Bandura, Social cognitive theory: An agentic perspective on human nature. John Wiley & Sons, 2023.

[2] B. J. Vincent *et al.*, "Yearly Planning Meetings: Individualized Development Plans Aren't Just More Paperwork," *Molecular Cell*, vol. 58, no. 5, pp. 718–721, Jun. 2015, doi: 10.1016/j.molcel.2015.04.025.

[3] S. Bartolomei-Suarez *et al.*, "Work in Progress: Building Career Goals and Boosting Self-efficacy in Engineering Students," in *2021 ASEE Virtual Annual Conference Content Access Proceedings*, Virtual Conference: ASEE Conferences, Jul. 2021, p. 38126. doi: 10.18260/1-2--38126.

[4] T. M. Hardy, M. J. Hansen, R. E. Bahamonde, and A. C. Kimble-Hill, "Insights Gained into the Use of Individual Development Plans as a Framework for Mentoring NIH Postbaccalaureate Research Education Program (PREP) Trainees," *J. Chem. Educ.*, vol. 99, no. 1, pp. 417–427, Jan. 2022, doi: 10.1021/acs.jchemed.1c00503.

[5] D. Silver and E. Friedman, "Board 334: Master's Individual Development Plans as an Essential Tool in Workforce Development," in *2023 ASEE Annual Conference & Exposition Proceedings*, Baltimore, Maryland: ASEE Conferences, Jun. 2023, p. 42942. doi: 10.18260/1-2--42942.

[6] T. A. Campbell and D. E. Campbell, "Faculty/Student Mentor Program: Effects on Academic Performance and Retention," *Research in Higher Education*, vol. 38, no. 6, pp. 727–742, 1997.

[7] A. H. Flood, S. E. Skrabalak, and Y. Yu, "Individual development plans — experiences made in graduate student training," *Anal Bioanal Chem*, vol. 413, no. 23, pp. 5681–5684, Sep. 2021, doi: 10.1007/s00216-021-03540-z.

[8] J. M. Hunt, N. Langowitz, K. Rollag, and K. Hebert-Maccaro, "Helping students make progress in their careers: An attribute analysis of effective vs ineffective student development plans," *The International Journal of Management Education*, vol. 15, no. 3, pp. 397–408, Nov. 2017, doi: 10.1016/j.ijme.2017.03.017.

[9] E. A. Locke, "Self-Efficacy: The Exercise of Control," *Personnel Psychology*, vol. 50, no. 3, pp. 801–804, Autumn 1997.

[10] A. Bandura, "Social Cognitive Theory of Mass Communication," *Media Psychology*, vol. 3, no. 3, pp. 265–299, Aug. 2001, doi: 10.1207/S1532785XMEP0303_03.

[11] E. Arnaud and S. Cahill, "Graduate Student Perceptions of the Effectiveness of Individual Development Plans," *CJHE*, vol. 54, no. 1, pp. 71–88, Jul. 2024, doi: 10.47678/cjhe.v54i1.189931.

[12] S. Venkataraman, D. B. Thoman, S. Wainscott, and J. E. Castillo, "Board 235: Design and Implementation of a Professional Development Course for Interdisciplinary Computational Science Graduate Students," in *2024 ASEE Annual Conference & Exposition*, 2024.

[13] S. Wainscott, D. B. Thoman, and S. Venkataraman, "Exploring Interdisciplinary Identity Formation in Graduate Students," in *2024 ASEE Annual Conference & Exposition*, 2024.

[14] T. J. Yosso, "Whose culture has capital? A critical race theory discussion of community cultural wealth," *Race Ethnicity and Education*, vol. 8, no. 1, pp. 69–91, Mar. 2005, doi: 10.1080/1361332052000341006.

Appendix

Fall 2021 reflection assignment prompts

1. How did this course increase your awareness or provide you knowledge and/or experiences for professional development as a computational scientist? You can comment along the goals we set for this course, namely provide activities and opportunities for learning and discussion of following topics that contribute to professional development
2. What are things you learned or became aware of that you didn't know previously. As a result, what will you be doing differently going forward?
3. If you were to rank the three best activities or aspects of this course what would they be and why? What were the least productive activities and why?
4. Based on your graduate school experience so far, what are some areas you feel you need to improve or get better?

Spring 2022 reflection assignment prompts

1. How did this course increase your awareness or provide you knowledge and/or experiences for professional development as a computational scientist/engineer? You can comment along the goals we set for this course, namely provide activities and opportunities for learning and discussion of following topics that contribute to professional development
2. What are things you learned or became aware of that you didn't know previously. As a result, what will you be doing differently going forward?
3. If you were to rank the three best activities or aspects of this course what would they be and why? What were the least productive activities and why?
4. Based on your graduate school experience so far, what are some areas you feel you need to improve or get better?
5. Do you have any other general comments, feedback or suggestions for the second part of this two semester course sequence?

Fall 2022 reflection assignment prompts

1. How did this course increase your awareness or provide you knowledge and/or experiences for professional development as a computational scientist/engineer?
2. Did the course activities in the following sub-topics address your specific needs? If so, which aspects were most useful? If not, what are some topics you would like to see addressed better in the future.
    - Academic, Career and Individual Development Planning
    - Career Exploration and Networking

- Exploring Pathways to Interdisciplinary Careers
- Work life balance and personal well being

3. What are things you learned or became aware of that you didn't know previously. As a result, what will you be doing differently going forward?
4. If you were to rank the three best aspects of this course and why? What were the least favorite and why?
5. Based on your graduate school experience so far, what are some areas (academic, professional and personal) you feel you need to improve or get better?
6. Do you have any other general comments, feedback or suggestions for the second part of this two-semester course sequence?

Spring 2023 reflection assignment prompts

1. How did this course increase your awareness or provide you knowledge and/or experiences for professional development as a computational scientist/engineer?
2. What are things you learned or became aware of that you didn't know previously. As a result, what will you be doing differently going forward?
3. If you were to rank the three best aspects of this course and why? What were the least favorite and why?
4. Based on your graduate school experience so far, what are some areas (academic, professional, and personal) you feel you need to improve or get better?
5. Do you have any other general comments, feedback, or suggestions for the second part of this two-semester course sequence?